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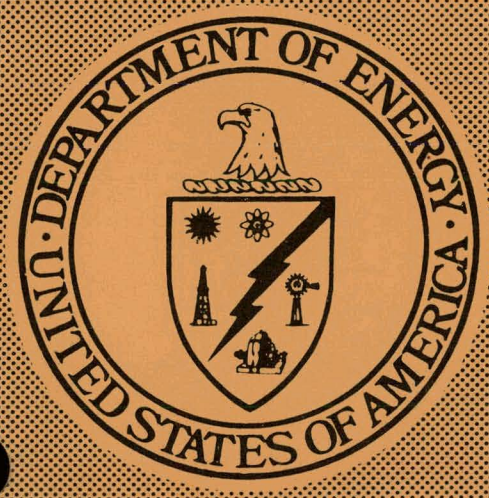

COST & SCHEDULE CONTROL SYSTEMS CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENT

CONTRACTOR REPORTING/DATA ANALYSIS GUIDE

OFFICE OF THE CONTROLLER
DEPARTMENT OF ENERGY

NOVEMBER 1980

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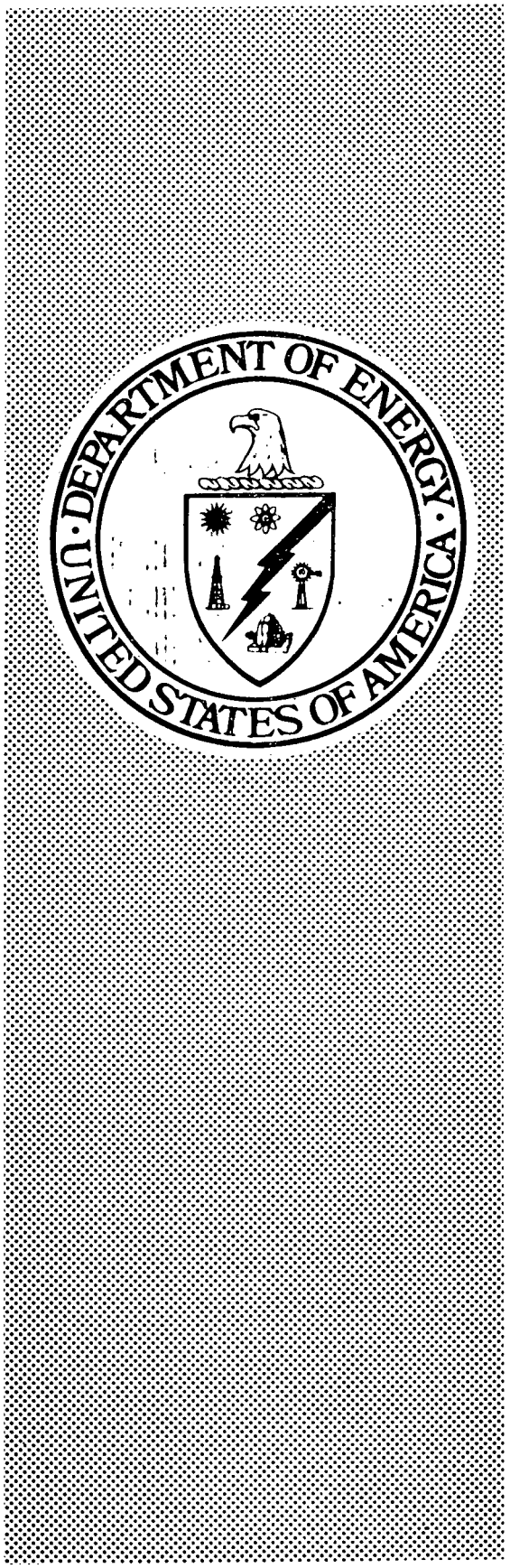

COST & SCHEDULE CONTROL SYSTEMS CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENT

CONTRACTOR REPORTING/DATA ANALYSIS GUIDE

OFFICE OF THE CONTROLLER
DEPARTMENT OF ENERGY

NOVEMBER 1980

Foreword

The Contractor Reporting/Data Analysis Guide has been prepared to aid both DOE and industry personnel in the effective use of contract performance measurement data. It provides suggested techniques for analyzing contractor cost and schedule data which should give insight into the current contract performance status and help forecast future contract performance. The techniques contained herein should be modified and tailored to fit particular project and special needs. This Guide is not all inclusive - other techniques known to users of this Guide should be submitted for inclusion in future revisions (see Attachment 2).

Users of this guide should be thoroughly familiar with DOE policy for applying and using the Cost and Schedule Control Systems Criteria (CSCSC) contained in DOE Order 2250.1. Guidance for implementing the CSCSC is provided in the Implementation Guide, DOE/CR-0015.

P. Marshall Ryan
Controller

COST AND SCHEDULE CONTROL SYSTEMS CRITERIA

FOR CONTRACT PERFORMANCE MEASUREMENT

CONTRACTOR REPORTING/DATA ANALYSIS GUIDE

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CHAPTER I - INTRODUCTION

A. PURPOSE

The DOE Cost and Schedule Control Systems Criteria (CSCSC) require that a contractor's management control systems include methods and procedures designed to ensure that they will accomplish, in addition to other requirements, a summarization of data elements to the level of reporting to DOE specified in the contract under separate clause. Reports provided to DOE must relate contract cost, schedule and technical accomplishment to a baseline plan, within the framework of both the contract Work Breakdown Structure (WBS) and the contractor's organizational structure. This Guide describes the reports available from contractors, with emphasis on the Cost Performance Report (CPR), and provides a framework for using the reported data as a basis for decision making. This Guide was developed to assist DOE Project Managers in assessing contractor performance through proper use of the CPR and supporting reports.

B. SCOPE

Cost and schedule information is an integral part of the CSCSC. This information is used to track contract progress, to highlight areas (e.g., technical problems) that merit closer investigation and management attention, and to aid in complying with the DOE Project Manager's reporting requirements. The definitions and terminology used in this Guide reflect CSCSC validated or accepted management control systems and the associated data elements. These data elements, their acronyms, and their report sources are depicted in Figure 1. The report forms, the instructions for their accomplishment, and the sample clause for placing them on contract, are contained in the DOE Uniform Contractor Reporting System (UCRS) Guidelines, Volume I (DOE/CR-0001/2). In accordance with the UCRS Guidelines, the Project Manager prepares a Reporting Requirements Checklist (Form DOE 537),documenting the reporting requirements of the project office and other concerned DOE activities. Only minimum essential reports required for effective project and contract management should be selected. In accordance with DOE Order 5700.4, Project Management System Handbook, the Project Manager will use these reports to the maximum degree in meeting requirements for reporting to higher echelons, integrating cost, schedule, and technical performance data along with an assessment of the total project.

C. CRITERIA APPROACH

DOE defines its requirements for contractor management control systems in terms of Criteria rather than a specific or rigid framework (e.g., PERT Cost, Line of Balance, etc.). The policy for applying and using the DOE Criteria are contained in DOE Order 2250.1, "Department of Energy (DOE) Cost and Schedule Control Systems Criteria for Contract Performance Measurement". Guidance for

DATA ELEMENT	ACRONYM	SOURCE
Work Planned (Budgeted Cost for Work Scheduled)	BCWS	Cost Performance Report (CPR) Formats 1&2, Cols 2,7
Work Accomplished (Budgeted Cost for Work Performed)	BCWP	CPR Formats 1&2 Cols 3,8
Cost of Work Accomplished (Actual Cost of Work Performed)	ACWP	CPR Formats 1&2 Cols 4,9
Schedule Variance (BCWP - BCWS)	SV	CPR Formats 1&2 Cols 5,10
Cost Variance (BCWP - ACWP)	CV	CPR Formats 1&2 Cols 6,11
Budgeted at Completion (Total Allocated Budget)	BAC	CPR Formats 1&2 Col 12 & Format 3, Col 6
Estimated Cost at Completion	EAC	CPR Formats 1&2, Col 13
At Completion Variance (BAC - EAC)	ACV	CPR Formats 1&2 Col 14
Performance Measurement Baseline	PMB	CPR, Format 3
Management Reserve	MR	CPR Formats 1&2 Col 12 & Format 3 Col 14
Manpower Baseline	—	Manpower Plan, Item 14
Manpower Status	—	Manpower Management Report Item 17
Problem Analysis	—	Project Status Report
Variance Analysis	—	Project Status Report

FIGURE 1: DATA ELEMENTS

implementation of this policy and a detailed discussion of the Criteria, organizational relationships, procedures and definitions are provided in DOE/CR-0015, "Cost and Schedule Control Systems Criteria for Contract Performance Measurement - Implementation Guide". Under the Criteria approach, contractors' management control systems are recognized to vary because of differences in product lines, organizational structures, management philosophies, and involved key personnel. Although the systems do vary, the information furnished to DOE is obtained from the same data base as that used by the contractor's managers on all levels. The application of the CSCSC establishes this common source for data. In addition, a confidence level in the reported data is established because the data are generated by management control systems that assure:

- Work is Identified and Organized. Management control points, i.e., cost accounts, are established such that work is identified to the lowest level WBS element at which organizational responsibility is assigned to a functional manager.

- Baselines are Established. All authorized work is scheduled and budgets are assigned to identifiable and manageable units of work. The time-phased summation of budgets (BCWS) establishes the performance measurement baseline.

- Current Status is Measured. Work accomplished is compared to the cost of the completed work and to the original plan for its completion. In Criteria terms, this is the BCWP compared to the ACWP (Cost Variance), the BCWP compared to the BCWS (Schedule Variance), and the BAC compared to the EAC (At Completion Variance).

- Trends are Identified. Historical data are used to identify trends to determine whether the data (i.e., variances) are increasing, decreasing, or remaining stable.

- Forecasting is Performed. Current trends are evaluated as a basis for forecasting future positions.

- Management Action is Taken. Based on the variances, trends and forecasts, the contractor is required to evaluate the situation, assign responsibilities for corrective actions, and monitor the results.

Since the Criteria approach facilitates communication with contractor management, CPR analysis can assist in promoting better working relationships, as well as improved contract performance. The appropriate use of this Guide will supply a common framework for communicating trends, changes, and facts, as well as analytical results.

D. OVERVIEW OF GUIDE CONTENTS

The Guide is structured to follow a logical sequence from the identification of the contractor reporting requirements to the use of the data. To assist the user of this Guide, an overview of the contents are presented below.

Chapter	Guide Contents Overview
I. Introduction	Outlines the DOE CSCSC approach to contract performance measurement, and identifies the fundamental data elements generated by validated or accepted contractor's management control systems.
II. Contractor Reporting	Describes the three formats of the CPR and associated formats for the earned value baseline plans, status reports, and exception reports. Relates the salient features of these reports to the CPR.
III. Preparing for Analysis	Provides guidance with respect to variances, thresholds, and data validation activities, as well as suggestions for linking narrative reporting to quantitative information.
IV. Performing the Analysis	Covers both current status determination and trend analysis. Examples of specific calculations and techniques, using twelve monthly CPRs as the data base, illustrate basic variance analyses, use of performance indices, including examples of smoothing and regression techniques, and corrected trend data combined with a narrative interpretation.
V. Forecasting Future Performance	Provides detailed examples and techniques for forecasting which are related to the sample CPR data base; presents forecasting under two main categories, point projection, and trend extrapolation; emphasizes establishing and validating both Estimates At Completion (EAC's) and Budgets At Completion (BAC's); discusses management reserve budget usage, schedule performance, and cost performance.

CHAPTER II. CONTRACTOR REPORTING

A. GENERAL

The DOE Project Manager should require from a contractor the minimum reporting essential for effective project and contract management. After determining which reports are required and when and to whom they are to be submitted, the Reporting Requirements Checklist should be completed by the DOE Project Manager. This Checklist will be included in the procurement solicitation package and will be made part of the contract so that specific reporting requirements will be known to the contractor. The Checklist must be specific in each of the following areas: reports selected, report content (reporting categories and level of detail), frequency of reporting, delivery schedule, distribution list, and special instructions (e.g., tailoring of a form, dates for submission, or unique reporting requirements).

To assure valid contractor reporting, the data base that supports the detail data requirements of day-to-day contractor management must be used for reporting summary level data to DOE. Thus, the data reported must consist of traceable accumulations which account for work performed and resources expended at lower levels. The detail data available at the contractors may be requested for tracing a problem to its source. At DOE, the data are required for contract management, for project management, and for reporting to upper DOE management.

B. REPORTS

1. Report Selection. The reports that may be obtained from contractors may be categorized into baseline plans, status reports, and exception reports. Figure 2 suggests the reports to accompany the CSCSC related Cost Performance Report (CPR). The cost, schedule, and manpower data reported in the baseline plans and status reports should be consistent and reconcilable with those reported in the CPR. Following the discussion of the CPR, the supporting reports, their contents, and their relationships are described below to provide an overview of the data available.

2. The Cost Performance Report (CPR). The CPR depicts the output of contractors' management control systems. It is emphasized and is discussed in greater detail here and in subsequent chapters because its earned value and its variance data provide the basis for contract cost and schedule performance measurement and control. The CPR is required on all contracts which require compliance with the DOE CSCSC. It consists of three formats, containing integrated cost and schedule data for measuring contractor's cost and schedule performance. It is both a baseline and status report and is specifically designed to be used with implementation of the Criteria approach and reporting of earned value (Budgeted Cost for Work Performed, BCWP). The unique feature of the CPR is that it compares the BCWP with the Budgeted Cost for Work Scheduled (BCWS) and with the Actual Cost of Work Performed (ACWP) to provide

PLANS AND REPORTS	FORM NO.	RESEARCH SUPPORT OR ADVANCED DEVELOPMENT		CONSTRUCTION OR DEMONSTRATION	
		$2M-50M MODIFIED	OVER $50M FULL	$2M-50M MODIFIED	OVER $50M FULL
Cost Performance Report					
a. Format 1 — WBS	144	M	M	M	M
b. Format 2 — Functional Categories	144A	A	M	A	M
c. Format 3 — Baseline	144B	A	M	A	M
BASELINE PLANS					
Management Plan	None	XOA	XOA	XOA	XOA
a. Management Control System Description	None	XOA	XOA	XOA	XOA
b. WBS Dictionary					
I. Index	142A	XOA	XOA	XOA	XOA
II. Element Definition	142B	XOA	XOA	XOA	XOA
Cost Plan	533P	XOYC	XOYC	XOYC	XOYC
Milestone Schedule and Status Report (Plan)	535	XOYC	XOYC	XOYC	XOYC
Manpower Plan	534P	XOYC	XOYC	XOYC	XOYC
STATUS REPORTS					
Project Status Report	None	M	M	M	M
Cost Management Report	533M	M	M	M	M
Milestone Schedule and Status Report	535	M	M	M	M
Manpower Management Report	534M	M	M	M	M
EXCEPTION REPORTS					
Conference Record	None	A	A	A	A
Hot Line Report	None	A	A	A	A

Legend:

- A As Required
- C Contract Change
- M Monthly
- O Contract Award
- Q Quarterly
- S Semiannually
- X With Proposal/Bid
- Y Yearly or Upon Contract Renewal

FIGURE 2: REPORT SELECTION GUIDE

Schedule and Cost Variances and the Budget at Completion (BAC) with the Estimate at Completion (EAC) to provide an At Completion Variance (ACV), all expressed in dollars. For reporting under full Criteria implementation, BCWS and BCWP are direct summations of work package budgets, whereas under modified implementation these values may be generated at the cost account level on the basis of reasonable and consistent methodology as agreed to between the DOE Project Manager and the contractor. Variances which exceed the agreed to threshold values (percentages and/or dollars) should be addressed in the Project Status Report. The following subparagraphs describe the three CPR formats:

a. Format 1 - Work Breakdown Structure (WBS). Format 1 (Figure 3) is used to report cost and schedule performance by contract WBS element. The WBS levels of detail to be reported is left to the discretion of the DOE Project Manager and should be negotiated during the contract award. Normally, this is to level 3 of the contract WBS; however, reporting to lower levels may be required for critical activities.

b. Format 2 - Functional Categories. Format 2 (Figure 4) is used to report cost and schedule performance in accordance with the contractor's organization. Format 2, in conjunction with Format 1, provides a two-dimensional view of the contractor's cost and schedule performance.

c. Format 3 - Baseline. Format 3 (Figure 5) assists DOE Project Managers in monitoring baseline changes which result from contract changes or internal replanning (including the use of management reserve budget). The format provides a monthly update of the performance measurement baseline to reflect the overall effects of changes made during the month. It also provides a summary track from the original negotiated contract cost to the current authorized cost.

3. Baseline Plans. The baseline plans identify the contractor's plan for accomplishing the authorized work. They consist of the Management Plan, the Cost Plan, the Milestone Schedule and Status Report, and the Manpower Plan.

a. The Management Plan describes the management methodologies, control systems, and procedures that the contractor will use to perform the work identified in the contract and the method for data accumulation. When the Criteria approach is applied, the Management Plan includes:

(1) The Systems Description, describing the internal management control systems the contractor will or plans to use in the conduct of the contract. Under full Criteria implementation this description is detailed, whereas under modified implementation the description is less detailed. The Systems

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2) (2222)	Energistic	12-1-XX to 12-31-XX	J. S. Browning
LOCATION: Germantown, Maryland				TITLE: Project Director
				DATE: 1-8-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292,420 1/	-0- 1/	$8773/3%	$301,193	$290,419	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	4140	3901	4134	(239)	(233)	29775	25348	32235	(4427)	(6887)	76234	76584	(350)
SITE AND BLDGS.	5076	5064	5147	(12)	(83)	24772	23506	26008	(1266)	(2502)	82494	83255	(761)
BALANCE OF PLANT	1080	1076	1055	(4)	21	6399	6185	6496	(214)	(311)	23026	23239	(213)
TRAINING	72	75	80	3	(5)	274	271	285	(3)	(14)	1930	1930	0
SUPPORT EQUIP.	24	23	23	(1)	0	119	115	114	(4)	1	2386	2386	0
SYS. TEST & EVAL.	760	685	788	(75)	(103)	6487	5655	6975	(832)	(1320)	26681	26995	(314)
PROJ. MGT.	630	642	624	12	18	7570	7380	7470	(190)	(90)	18836	18836	0
DATA	136	147	140	11	7	886	911	911	25	0	8362	8062	300
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	11918	11613	11991	(305)	(378)	76282	69371	80494	(6911)	(11123)	246648	247986	(1338)
GENERAL AND ADMINISTRATIVE	1632	1591	1643	(41)	(52)	10451	9504	11028	(947)	(1524)	33790	33974	(184)
UNDISTRIBUTED BUDGET											0	0	
SUBTOTAL	13550	13204	13634	(346)	(430)	86733	78875	91522	(7858)	(12647)	280438 2/	281960	(1522)
MANAGEMENT RESERVE											11982		11982
TOTAL	13550	13204	13634	(346)	(430)	86733	78875	91522	(7858)	(12647)	292420 1/	281960	10460

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

FIGURE 3: CPR FORMAT 1 – WBS ELEMENTS

1/ Contract Budget Base = Negotiated Cost + Est. Cost of Auth. Unpriced Work = BAC = Total Allocated Budget (Format 3) = 292,420

2/ Performance Measurement Baseline (PMB) = $280,438.

COST PERFORMANCE REPORT–FUNCTIONAL CATEGORIES (Format 2)

CONTRACTOR:	CONTRACT TYPE/NUMBER	PROJECT NAME/NUMBER	REPORT PERIOD
A.U.S. Inc.	CPFF/(10-10-10-2) (2222)	Energistic	12-1-XX to 12-31-XX
LOCATION: Germantown, Maryland			

ORGANIZATIONAL OR FUNCTIONAL CATEGORY	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARI-ANCE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Engineering	6351	6173	6664	(178)	(491)	37249	33493	40455	(3756)	(6962)	108798	109536	(738)
Tooling	12	11	13	(1)	(2)	88	76	83	(12)	(7)	4257	4257	0
Quality Control	15	15	16	0	(1)	162	162	170	0	(8)	876	876	0
Construction	526	524	532	(2)	(8)	3005	2997	3119	(8)	(122)	27463	27463	0
Procurement	231	230	232	(1)	(2)	1874	1870	1901	(4)	(31)	13729	13729	0
Material Overhead	12	12	12	0	0	94	94	95	0	(1)	686	686	0
Subcontract	3933	3784	3678	(149)	106	25080	22117	26005	(2963)	(3888)	63418	64018	(600)
Project Management	838	864	844	26	20	8730	8562	8666	(168)	(104)	27421	27421	0
Functional Subtotal	11918	11613	11991	(305)	(308)	76282	69371	80494	(6911)	(11123)	246648	247986	(1338)
Mgment Reserve											11982		11982
GENERAL AND ADMINISTRATIVE	1632	1591	1643	(41)	(52)	10451	9504	11028	(947)	(1524)	33790	33974	(184)
UNDISTRIBUTED BUDGET											0	0	
TOTAL	13550	13204	13634	(346)	(430)	86733	78875	91522	(7858)	(12647)	292420	281960	10460

FIGURE 4 CPR FORMAT 2 — FUNCTIONAL CATEGORIES

COST PERFORMANCE REPORT–BASELINE (Format 3) Page 3 of 7

CONTRACTOR:	CONTRACT TYPE/NUMBER	PROJECT NAME/NUMBER	REPORT PERIOD
A.U.S., Inc. LOCATION: Germantown, Md.	CPFF/(10-10-10-2) (2222)	Energistic	12-1-XX to 12-31-XX

(1) ORIGINAL CONTRACT TARGET COST	(2) NEGOTIATED CONTRACT CHANGES	(3) CURRENT TARGET COST (1) + (2)	(4) ESTIMATED COST OF AUTHORIZED, UNPRICED WORK	(5) CONTRACT BUDGET BASELINE (3) + (4)	(6) TOTAL ALLOCATED BUDGET	(7) DIFFERENCE (5) - (6) (See Project Status Report)
$228900	$63520	$292420	- 0 -	$292420	$292420	- 0 -

ITEM	BCWS CUMULATIVE TO DATE	BUDGETED COST FOR WORK SCHEDULED (NON-CUMULATIVE) SIX MONTH FORECAST +1	+2	+3	+4	+5	+6	(ENTER SPECIFIED PERIOD) 3 Q	4 Q	2 Y	3 Y		TOTAL BUDGET
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PM BASELINE (BEGINNING OF PERIOD)	76282	11095	11461	11461	11461	11461	11461	17192	17192	45027	12555		236648
(LIST BASELINE CHANGES AUTHORIZED DURING REPORT PERIOD) None													- 0 -
MR Applied to WBS Elements in PMB 1/		100	1000	2000	2000	2000	2000	900	--	--	--		10000
GENERAL AND ADMINISTRATIVE 2/	10451	1534	1707	1844	1844	1844	1844	2479	2355	6169	1720		33790
UNDISTRIBUTED BUDGET													0
PM BASELINE (END OF PERIOD)	86733	12729	14168	15305	15305	15305	15305	20571	19547	51196	14275		280438
MANAGEMENT RESERVE													11982
TOTAL	86733	12728	14168	15305	15305	15305	15305	20571	19547	51196	14275		292420

FIGURE 5 CPR FORMAT 3 – BASELINE

1/ Application of MR to be discussed in Project Status Report
2/ Includes $1380 MR applied to G&A by PMB

Description should describe the contractor's policies, procedures, and methods for work authorization, work planning, budgeting, scheduling, cost accumulation, work measurement, internal reporting, variance analysis, estimating, and performance measurement baseline control, and must describe the techniques for measuring earned value in detail.

(2) The WBS Dictionary, used to document and update the WBS for the contract, consists of two parts - an index and element definitions.

b. The Cost Plan establishes the time-phasing for the planned rate of cost accruals (sometimes referred to as the "spend plan") for the WBS reporting categories on the CPR. These Planned Costs will not necessarily be identical to the time-phased performance budgets, i.e., the BCWS reported in the CPR. While the BCWS is similar to a spend plan, there is one significant difference. The BCWS is directly based on the schedule for resource assignment and work performance rather than simply on when money is to be spent. Therefore, BCWS is not only time-phased, but is also work-phased to represent the planned schedule (in dollars) for accomplishing the contractual effort. When the Cost Plan and CPR cover the same reporting period, the Total Planned Cost, less Fee, reported on the Cost Plan should be equal to the EAC reported in the CPR.

c. The Milestone Schedule and Status Report serves as the time-phased schedule baseline plan in that it establishes the contractor's schedule for the achievement of objectives for reporting categories identified in the contract. Under Criteria implementation, the schedule information on this report is based on the same data that are used to establish the time-phased performance budgets reported in the CPR.

d. The Manpower Plan provides the time-phased baseline for the planned rate of direct labor utilization for specified reporting categories. The initial plan is based on the manpower resources used to establish the time-phased performance budgets reported in the CPR. As the contract progresses, if actual performance deviates from that planned, the planned future fiscal year manpower resources should reflect those used to develop the estimated cost at completion (EAC) reported in the CPR.

4. Status Reports. The status reports provide additional information (e.g., cost and manpower accruals, schedule progress, and contract status narrative) needed to monitor the contract's progress. They consist of the Cost Management Report, the Milestone Schedule and Status Report, the Manpower Management Report, and the Project Status Report.

a. The Cost Management Report (CMR) is a monthly report of the actual and estimated accrued costs and their variances from the spend plan identified in the Cost Plan. Variances from the Cost Plan which are

identified in the CMR and which exceed thresholds specified in the contract, should be addressed in the Project Status Report.

(1) As noted in the discussion of the Cost Plan (see 3.b., above) the Planned Accrued Costs reported in the CMR will not necessarily be identical to the CPR's BCWS. Because of this situation, the Actual Accrued Costs of the CMR may also vary from the CPR's ACWP. This situation occurs because the Cost Management Report is used to plan and track authorized fund expenditures rather than to measure performance, as is the CPR. On a material intensive contract, for example, a major material item may be planned for receipt in March and for installation in June. The CMR would show the items's Planned Accrued Cost (i.e., the spend plan) as a March entry. If it is received and paid for in March, it would be shown also as an Actual Accrued Cost during that month. On the other hand, for performance measurement and CPR purposes, the item's budget would be included along with the labor budget for its installation in June. If the item is installed as scheduled, its BCWP and ACWP also would be reported in the June CPR. At the end of June, the two reports would be in agreement with respect to this item. Consequently, the DOE Project Manager, as part of CSCSC surveillance should periodically require the contractor to reconcile the Accrued Actual Costs and Estimated Accrued Costs shown in the CMR with ACWP and EAC reported in the CPR to assure consistency and comparability of reporting.

(2) The Total Contract Value reported in the Cost Management Report also may differ from the CPR's BAC. Differences may occur because of the costs included. As an example, the total contract value reported on the CMR includes fee whereas the totals reported in the body of the CPR do not. The CPR totals, for purpose of performance measurement, represent cost, rather than price. However, the target profit, the percent of fee, and the target price are shown in separate blocks of the CPR. If the Estimated Accrued Costs, Total Contract, reported in the CMR exceed the CPR's EAC by more than the Fee, reasons for the difference should be detailed in the Project Status Report. The CMR serves also to identify all of the contractor's proposed funding requirements. Since the EAC shown in the CPR is generated with respect to the authorized contract work, i.e., the BAC, such a situation implies that forecasts for funding requirements shown in the CMR include changes not yet authorized.

b. The Milestone Schedule and Status Report, in addition to its submittal as a baseline plan (discussed in paragraph 3c above), is used to report periodically the status and progress of the contract as measured against the baseline schedule. The data reported and the variance analysis explanations should cover the same period as the CPR. The variances identified should be addressed in the Project Status Report.

c. The Manpower Management Report (Figure 6) compares the actual manpower expended through the reporting period versus the planned manpower as stated in the Manpower Plan. It also forecasts manpower

FORM DOE 5MM
(1/78)

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MANPOWER MANAGEMENT REPORT

PAGE OF

1. Contract Identification	2. Reporting Period	3. Contract Number
ENERGISTICS	12-1-XX through 12-31-XX	CPFF (10-10-10-2) (2222)
4. Contractor (name and address)	**5. Manpower Plan Date**	**6. Contract Start Date**
A.U.S. Inc., Germantown, Md.	1-15-XW	1-5-XW
		7. Contract Completion Date 1-5-XZ

8.	9	10	11.	12.	13.	14

15. Identification Number	16. Reporting Category (e.g., contract line item or work breakdown structure element)	17. Manpower Expended				18. Estimated Manpower Expenditures			19. Total Contract Manpower	20. Variance	21.
		During Reporting Period		Cumulative to Date		a. Subsequent Reporting Period	b. Balance of Fiscal Year	c. Total Contract			
		a. Actual	b. Planned	c. Actual	d. Planned						
	Engineering	2,680	2,658	15,086	14,799	2,714	14,987	47,852	46,942		
	Tooling	12	12	42	50	15	967	2,152	2,562		
	Quality Control	15	15	96	97	17	84	492	507		
	Construction	426	440	2,754	2,649	608	3,145	17,301	16,641		
	Project Management	240	243	2,237	2,192	290	1,650	11,536	11,302		
	Subtotal Direct	3,373	3,368	20,215	19,787	3,664	20,833	79,331	77,954		
	Indirect	680	672	4,043	3,772	733	4,350	15,864	14,801		
22	Total	4,053	4,040	24,258	23,559	4,397	25,183	95,195	92,755		

23. Remarks	24. Manpower Expressed in:
Figures are Equivalent Manmonths.	Manmonths

25. Signature of Contractor's Project Manager and Date	26. Signature of Government Technical Representative and Date

FIGURE 6: MANPOWER MANAGEMENT REPORT

for the remainder of the fiscal year and for the balance of the contract effort. Variances from the Manpower Plan identified in the Manpower Management Report exceeding thresholds specified in the contract, should be addressed in the Project Status Report.

d. The Project Status Report (PSR) is a concise narrative assessment of the contract status. The contractor identifies accomplishments as well as significant problems affecting performance, and indicates corrective actions required. Also addressed are:

(1) The cost, schedule, and manpower variances reported in the CPR, Cost Management Report, Milestone Schedule and Status Report, and Manpower Management Report, which exceed the agreed to variance thresholds, including the reasons for the variances, impact on the task and on the total contract, and corrective action taken or to be taken. Contractor variance discussions should be presented by WBS reporting element.

(2) The effort to which Undistributed Budget applies or was applied.

(3) The amount of Management Reserve budget applied during the reporting period, including the WBS and organizational elements to which it was applied and the reason for such application .

(4) The adequacy of the remaining Management Reserve budget.

(5) Reasons for shifts in time-phasing of the performance measurement baseline on CPR Format 3 (Baseline).

(6) Changes in total manmonths at completion as well as shifts in time phasing of manpower usage shown in the Manpower Management Report.

(7) Recognized, but unresolved potential problems.

(8) Data showing funding levels and estimated fund requirements identified by WBS element. For example, to obtain a figure for net funds requirements, funding information could be presented in the following manner:

FUNDING INFORMATION

ELEMENT	FUNDING AUTHORIZED TO DATE	ACCRUED COSTS & OUTSTANDING COMMITMENTS	BAC AUTHORIZED WORK	FORECAST NOT YET AUTHORIZED	FORECAST ALL OTHER WORK	TOTAL FUNDING REQUIREMENTS	FUNDS CARRY-OVER	NET FUNDS REQUIRED
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Note: Columns (1) and (2) are self-explanatory. Column (3) shows the accrued cost incurred through the end of the reporting period plus commitments outstanding on that date. The data in column

(4) equal the value on which contractual agreement has been reached plus the estimate of funds required for work which has been authorized but for which no contractual agreement has been reached. Column (5) provides an estimate of funds required for changes which have been proposed, but which have not yet been authorized. Column (6) shows any funds for additional work not yet authorized, but anticipated to be performed and for which the contractor plans to submit a proposal expected to be acceptable to the DOE Project Manager. The funding requirements shown in columns (4), (5), and (6) become progressively more uncertain, with the total shown in column (7). Column (8) provides the dollar value by which incrementally funded contracts had funds in excess of prior years' requirements which, when subtracted from the value in column (7) provide net funds requirements shown in column (9). Where appropriate, all columns (2) through (9) include fee.

5. Exception Reports. When the DOE Project Office directs a change in contract direction, or when a significant contract problem or breakthrough occurs, the contractor should document the change or event and report it to the DOE Project Manager. These reports assist in proper contract budget base management and performance measurement. Exception reports are of two types:

a. The Conference Record documents the contractor's understanding of significant decisions, redirection, or required actions resulting from meetings with DOE representatives.

b. The Hot Line Report provides a rapid means of communication (such as TWX or telegram) to the DOE Project Manager regarding problem situations (e.g., strikes) and important technical breakthroughs or roadblocks that may have an impact on the contractor's performance.

CHAPTER III. PREPARING FOR ANALYSIS

A. USING CPR DATA

1. Background. There are no established rules for or specific kinds of analysis of CPR data. This Guide delineates a number of methods that have proven useful, especially as the analyst gains experience in their use and confidence in the reliability of the results. Additionally, the analyses should improve with increased knowledge of the contractor's operation, the contracted effort, and contractor reporting. Specifically, an analyst should be familiar with:

a. The contractor's organization (company, division, etc.), physical location of contract performance, unique operating location characteristics, management control systems, the accounting cycle, previous cost and schedule performance, as well as DOE experience with any prior contractor reporting;

b. The type of contract, contract scope, contract Work Breakdown Structure, major subcontractors and their management control systems, type of subcontractor cost and schedule reporting; and

c. The reports submitted by the contractor, particularly the CPR formats, CPR format relationships (e.g. the relationship of the Functional Category costs reported on Format 2 to WBS costs reported on Format 1), relationships between CPR and other reports, (e.g. the relationship between planned manhours reported on the Manpower Management Report and the baseline forecast reported on Format 3), terms used in the reporting (e.g., direct cost, indirect cost, accrued costs, estimated costs, BCWS, BCWP, ACWP, etc.), and their relationships.

2. Proper Data Usage. The importance of reviewing and using the CPR data submitted by a contractor cannot be overemphasized. The basic data convey a great deal of information; however, the use of analytical techniques can supplement the data reported and establish a better basis for appropriate decision-making. The analytical techniques described in this Guide are not all inclusive. The analyst should review the data received from the contractor and apply pertinent analysis techniques, emphasizing the information which appears most important in depicting contractor performance. The resulting analysis should be presented in a manner which will fully and fairly inform management. Ways which distort or mislead the meaning of data in a presentation should be avoided. These include, but are not limited to: collapsing vertical scales to level out or obscure variances, enlarging either axis to explode the data and exaggerate the differences between lines, or slanting performance by emphasizing either current or cumulative data to present the desired assessment.

B. CPR VARIANCES

The Cost, Schedule, and At Completion Variances related to the contract WBS elements and the Functional Categories are reported at the levels agreed to. If significant problem areas are identified which indicate the need for further analysis, subsequent selective reporting at a lower level of detail may be required. The contractor must be able to trace the summarized dollar variances to the contributing source or sources at the detail working level. The summary variances that appear on the WBS or Functional Categories formats of the CPR are an advantage in that small variances will usually "wash out" at higher levels resulting in reporting by exception. However, if either the contractor or DOE desires to know the cause of a variance, the precise area can be pinpointed by working progressively downwards through the data. Management techniques, performance measurement visibility, and timely corrective action are enhanced by this capability. The use of CPR data based upon a common and consistent WBS gives DOE visibility over the item being produced and offers both DOE and the contractor a common basis for communicating.

1. Explanation of Variances. The contractor is required to explain all significant variances shown in the CPR adequately and in detail in the Project Status Report. Experience has shown that common causes for unfavorable variances early in the contract life result from poor initial planning or estimating (e.g., underplanned start-up costs), unforeseen technical problems, and labor or material costs higher than planned. Favorable variances can generally be attributed to poor initial planning or estimating (e.g., overplanned start-up costs), technical breakthroughs, labor or material costs lower than planned, front-end loading (deliberate over budgeting early in the life of the program to create a more favorable cost variance early in the program), and method of earning credit affected by report cutoff dates. Favorable variances may not be in the best interests of the contractor and Government; therefore, the analyst must be as critical in determining the reasons for underruns as for overruns.

2. Establishing Thresholds for Significant Variances. A management by exception approach should be used in defining the reporting requirements and the guidelines for thresholds to identify significant variances. These guidelines should be developed jointly by the DOE Project Manager and the contractor. Care must be exercised in the development of thresholds, since they serve as the triggering mechanism for the expenditure of the contractor's resources for variance analysis. Their purpose is to develop a tolerance band which is sensitive to truly significant variances. An analysis or explanation is required for any cost or schedule variance which exceeds either the upper or lower limit of the established threshold. In the development of thresholds, therefore, unnecessary variance analyses should be minimized without dilution of control.

a. Thresholds are based on the value of the performance measurement data elements. Such thresholds may be established either as a percentage of BCWS or BCWP or as a dollar value. For example, ± 10% of cumulative BCWS, or $50,000, whichever is greater illustrates this

method. Another method is to use the Cost and Schedule Variance data elements (e.g., variance analysis is required when either the current period Cost or Schedule Variance exceeds both ± $10,000 and ± 20%). When initially establishing the thresholds, it is advisable to provide for modifying them as the contract progresses, (see Attachment 1 "Guidelines for Establishing Thresholds"). Generally, thresholds may be relaxed as the work remaining decreases and the risk of meeting the contractual objectives is minimized.

b. Thresholds may be established also as percentages of the Budget at Completion (BAC), as follows:

$$\text{Cost Variance Threshold \%} = \frac{(BCWP-ACWP)}{BAC} \times 100\ \%$$

$$\text{Schedule Variance Threshold \%} = \frac{(BCWP-BCWS)}{BAC} \times 100\ \%$$

This results in a relatively fixed dollar threshold which becomes a progressively smaller percentage of cumulative BCWS and BCWP as the contract progresses. Since this type of variance threshold may be relatively loose early in the contract, the threshold for early variances may be supplemented by adding a threshold based on a percentage of cumulative BCWS, (e.g., ± _____% of BAC, or ± _____% of cumulative BCWS, whichever is less).

c. No particular approach or set of thresholds is best for all circumstances. It may be appropriate to use different thresholds for current period and cumulative to date data, for underruns or ahead of schedule conditions, for different WBS or organizational elements, or for other reporting purposes. Too few or too many variance analyses in relation to the performance status of the contract may indicate improperly set thresholds which require adjustment. Whenever it becomes apparent, during the performance of a contract, that existing thresholds are no longer appropriate, they should be revised.

C. CPR VALIDATION

The analyst should perform certain routine audit functions when the CPR is received to ensure that the contractor-submitted data are clear, complete, consistent, and credible. If the CPR or other reports contain questionable data, the contractor should be informed immediately and should be required to submit a corrected report or more detailed analysis, as appropriate. Only after data have been so validated can they be used with confidence for contract performance evaluation. Analysis and use of audited CPR data are

discussed further in Section IV of this Guide. The CPR audit process is accomplished as follows:

1. Work Breakdown Structure (Format 1) and Functional Categories (Format 2) (see Figures 3 and 4).

   a. Review the header information for completeness, e.g. Contract Type/Number, Report Period, Negotiated Cost, etc.

   b. Check the entries in the remainder of the form, including the horizontal and vertical mathematics for accuracy, remembering that variance calculations are algebraic subtractions. Where the report is voluminous or computer generated, spot checks may suffice.

   c. Make a comparison to the previously submitted report and check to compare that the Cumulative to Date data (Columns 7 - 11) on the current report is the sum of the prior reported Cumulative to Date data in Columns 7 through 11, plus the currently reported Current Period data in Columns 2 through 6.

   d. Check to verify that the total Budgeted At Completion (BAC) reported in Column 12 is greater than the Cumulative to Date BCWS reported in Column 7 and that it is equal to the Negotiated Cost plus the Estimated Cost of Authorized Unpriced Work reported in the header. If BAC is greater than the Negotiated Cost plus the Estimated Cost of Authorized Unpriced Work, the "Reconciliation to Contract Budget Base" part of the form must be filled out.

   e. The totals of the WBS Elements in Format 1 should equal the totals of the Functional Categories in Format 2.

   f. Identify the variances exceeding the thresholds that require analysis in the Project Status Report.

2. Baseline (Format 3) (see Figure 5).

   a. Review the header information for completeness, e.g. Contract Type/Number, Report Period, etc.

   b. Check the entries in the remainder of the form to insure that the contractor has planned to the end of the current contract (monthly for six months, quarterly or annually thereafter) and

to note any forecast changes that may require additional investigation.

c. Check the vertical and horizontal additions for accuracy.

d. Make a comparison to the previously submitted report to determine if the PM Baseline (Beginning of Period) is equal to the prior reported PM Baseline (End of Period) plus the prior reported projected BCWS for month + 1 (Column 3).

e. The PM Baseline (End of Period) should equal the Cumulative to Date BCWS (Column 7) on the WBS (Format 1) and Functional Categories (Format 2).

f. The totals for General and Administrative, Undistributed Budget, and Management Reserve reported in Column 12 of the WBS (Format 1) and Functional Categories (Format 2) should equal the totals reported on the Baseline Format (Column 14).

g. Review the Baseline changes and check for any shifts in time-phasing of the PM Baseline that require addressing in the Project Status Report.

3. CPR Data and Project Status Report (PSR)

a. Insure that all variances exceeding the specified thresholds for reporting in the CPR have been examined, analyzed, and explained in the PSR. The narrative variance analysis should include, but is not limited to, the following:

(1) Identification and characterization of the problem, for example, labor variance, material variance, design problem, or test failure;

(2) Identification of the actual variance and percent deviation from plan;

(3) Impact of problem on cost, schedule and related technical performance; and

(4) Corrective action taken or to be taken, including "work arounds" and estimated "get-well" date and costs.

b. Insure that all changes to the Baseline, Management Reserve, and Undistributed Budget are addressed and explained.

c. Correlation of the PSR narrative discussion with both the WBS and Functional Formats in the CPR will provide insight into the area and nature of specific contractor performance that may require an in-depth examination.

CHAPTER IV. PERFORMING THE ANALYSIS

A. IDENTIFYING SIGNIFICANT MANAGEMENT INFORMATION

Individual items of CPR data by themselves do not necessarily provide a basis for decision-making. After establishing CPR data credibility, it is necessary that comparisons be made, relationships be identified, and the data be tabulated, charted, and extrapolated, in order to derive significant information for management. For example, tabulating BCWP data, as displayed below, shows a trend of increasing BCWP each month over a three month period.

	Month Before Last	Last Month	This Month
BCWP	90	95	100

Expansion of this concept to include the relationship between BCWS and BCWP is illustrated below:

	Month Before Last	Last Month	This Month	Next Month
BCWS	100	110	120	130
BCWP	90	95	100	
SV	-10	-15	-20	
% of BCWS	90	86	83	

From this, it is readily apparent that, while BCWP increases month after month at a consistent rate, performance is falling further and further behind the planned BCWS. The above examples illustrate how data can yield significant information simply by display and comparison without the application of statistical techniques. This chapter describes additional tabulating, charting, and statistical analysis techniques the analyst may find helpful in determining current status and in examining trends. The next chapter uses this base for forecasting future performance.

This Guide is not intended to be all encompassing. The various techniques can be used as shown, or can be tailored or combined. Eventually, new and improved techniques may emerge. In this regard, users of this Guide are encouraged to submit techniques for analyzing contractor submitted cost data for possible inclusion in subsequent issues of this Guide. Attachment 2 contains a format for preparing and submitting additional techniques.

B. STATUS ANALYSIS

For performance measurement purposes, current contract status is derived from an analysis of the latest available data in CPR Formats 1 and 2, Columns 2 through 11, and Format 3, Column 2. All subsequent references to Columns of the CPR are to the WBS (Format 1), unless otherwise stated. Also, unless otherwise noted, the Performance Measurement Baseline (Subtotal line) is used as the reference. Current status will be calculated and presented for the Cumulative To Date WBS data only. These same calculations can be made, when appropriate, for the Current Period WBS or Functional Categories or for Cumulative To Date Functional Categories.

1. Variance Determination

a. Basic Dollar Relationships. The variances discussed in this paragraph are the Schedule Variance (SV) and Cost Variance (CV), derived from basic BCWS, BCWP, and ACWP data. The columns referenced are in the December CPR (Figure 3). The data shown in the CPR are in thousands of dollars, a practice which is followed also in subsequent displays of calculations using dollar data.

b. Dollar Variances Without Earned Value Concept. Prior to the development of the "earned value" concept, most contract variances were measured simply as spending variances, i.e., a spend plan was related to the actual cost experienced. For example:

Spending Variance = Budget Expenditure Plan - Actual Costs

= $86,733 - $91,522

= ($4,789)

This means that $4,789 more was spent to date than was planned. Relying on this relationship alone is a fallacy in that the cost experienced is not being measured in terms of what was done, but only in terms of what was planned to be spent or a rate of expenditure. In the example above, the contractor planned to do $86,733 worth of work, and spent $91,522 and may have done no work at all. On the other hand, considerably more work than planned could have been accomplished for the same $91,522. The spending variance equation does not differentiate between the results. To correct this deficiency, the "earned value" concept was added. Simply stated, "earned value" is a measure of the work accomplished (BCWP), determined in terms of the amount planned for that work (BCWS). This can then be compared to the BCWS to determine Schedule Variance, and to ACWP to determine Cost Variance. The basic interpretation of earned value data elements for variance analysis is depicted in Figure 7.

A. INTERPRETATION OF COST AND SCHEDULE VARIANCES

BCWS	BCWP	ACWP	COST VARIANCE	SCHEDULE VARIANCE	DESCRIPTION	
$1	$1	$1	$0	$0	On Cost	On Schedule
$2	$2	$1	$1	$0	Under Cost	On Schedule
$1	$1	$2	($1)	$0	Over Cost	On Schedule
$1	$2	$2	$0	$1	On Cost	Ahead of Schedule
$1	$2	$3	($1)	$1	Over Cost	Ahead of Schedule
$1	$2	$1	$1	$1	Under Cost	Ahead of Schedule
$3	$2	$1	$1	($1)	Under Cost	Behind Schedule
$2	$1	$3	($2)	($1)	Over Cost	Behind Schedule
$2	$1	$1	$0	($1)	On Cost	Behind Schedule

Cost Variance = BCWP – ACWP

Schedule Variance = BCWP – BCWS

B. INTERPRETATION OF AT COMPLETION VARIANCES

BAC	EAC	AT COMPLETION VARIANCE	DESCRIPTION
$1	$1	$0	Forecast On Cost
$2	$1	$1	Forecast Under Cost
$1	$2	($1)	Forecast Over Cost

At Completion Variance = BAC – EAC

FIGURE 7: EARNED VALUE DATA ELEMENTS INTERPRETATIONS

c. Dollar Schedule Variance (SV) With Earned Value Concept. The earned value SV is determined by:

(Col 10) = (Col 8) - (Col 7)

SV = BCWP - BCWS

= $78,875 - $86,733

= ($7,858)

This means that $86,733 worth of work had been scheduled to be accomplished (BCWS), but that work which had been budgeted for only $78,875 had been accomplished (BCWP), for a negative variance of $7,858. The $7,858 is shown in parenthesis to denote the unfavorable, behind schedule condition.

d. Dollar Cost Variance (CV) With Earned Value Concept. The earned value CV is determined by:

(Col 11) = (Col 8) - (Col 9)

CV = BCWP - ACWP

= $78,875 - $91,522

= ($12,647)

This means that $12,647 more was spent on the work accomplished than had been planned for that work. This is far different from the $4,789 that resulted by comparing only the spend plan versus actual accomplishment (see paragraph 1.b. above). Since the cumulative to date position is an overrun condition, the $12,647 is enclosed in parentheses. Note that in calculating each variance, ACWP or BCWS was subtracted from BCWP to obtain the correct sign to denote a favorable or unfavorable variance.

2. Percentage Relationships. The dollar variances discussed above do not always tell the complete story. A variance is significant relative to some base.

a. Percent Schedule Variance (SV) should be related to the amount of work planned to have been accomplished.

Percent SV = (Col 10) / (Col 7)

= SV / BCWS

= ($7,858) / $86,733

= (9.1%)

This means that the contract is 9.1% behind schedule in terms of total work performed at this point in time.

b. Percent Cost Variance (CV) should be related to the amount of work accomplished:

Percent CV = (Col 11) / (Col 8)

= CV / BCWP

= ($12,647) / $78,875

= (16.0%)

This means that the contract has a 16% cost overrun at this point in time.

3. Performance Indices and Factors. A variety of performance indices and factors are used to quantify performance. Some of the more useful ones are presented in this paragraph.

a. Cost Performance Index (CPI). This is an indication of the cumulative to date cost efficiency with which work has been accomplished.

Cumulative CPI = (Col 8) / (Col 9)

= BCWP / ACWP

= $78,875 / $91,522

= .86

This index may be obtained also for a specific month - usually the latest available. For the CPR example in this Guide, the incremental efficiency for December is:

Incremental CPI = (Col 3) / (Col 4)

CPI = BCWP / ACWP

= $13,204 / $13,634

= .97

This means that for each budget dollar spent to date, 86¢ in value was received; in the latest month for which data are available, 97¢ in value was received, a considerable improvement over the cumulative to date figure.

b. Schedule Performance Index (SPI). This is an indication of the schedule efficiency with which work has been accomplished:

SPI = (Col 8) / (Col 7)

= BCWP / BCWS

= \$78,875 / \$86,733

= .91

This means that work has been accomplished to date at a rate of 91% of plan.

c. Schedule-Cost Index (SCI). Some analysts prefer to reduce cost and schedule indices to a single index as follows:

SCI = SPI x CPI

= 0.91 x 0.86

= 0.783

This means that accomplishment is at a rate of 78.3% of plan, considering both schedule and cost. This index may be of value, especially in rating or ranking a number of WBS elements or functional activities under a contract.

A disadvantage in this index is that equal weight is given to each of its components. In order to overcome this disadvantage, weighting factors may be introduced into the equation as follows:

$$\text{Weighted SCI} = \frac{W_s\ (SPI) + W_c\ (CPI)}{W_s + W_c}$$

In this equation, W represents the weight given the index denoted by the subscript (s for schedule, c for cost). For simplicity, if cost is characterized as twice as important as schedule, the following weighted SCI would apply:

$$\text{Weighted SCI} = \frac{1\ (0.91) + 2\ (0.86)}{3}$$

$$= 0.877$$

This means that, giving cost the greater weight due to its greater importance under the given circumstances, a new index is derived with accomplishment at a rate of 87.7% of plan. This skewed the SCI toward the CPI.

d. Percent Complete. This is the relationship of the amount of budgeted work accomplished to date (BCWP) to the amount of budgeted work planned for the total contract, the Budget at Completion (BAC):

Percent Complete = (Col 8) / (Col 12)

= BCWP / BAC

= $78,875 / $292,420

= 27.0%

This means that to date 27.0 % of the total budget (BAC) has been accomplished.

e. Percent Spent. This is the relationship of the amount spent to date (ACWP) to the estimated cost at completion (EAC) for the contract:

Percent Spent = (Col 9) / (Col 13)

= ACWP / EAC

= $91,522 / $281,960

= 32.5%

This means that to date 32.5 % of the total estimated cost has been spent, compared to 27.0 % of the total budget accomplished to date.

The use of EAC is generally associated with cost-type contracts; one might, however, use the BAC as the base:

Percent Spent = (Col 9) / (Col 12)

= ACWP / BAC

= $91,522 / $292,420

= 31.3%

This means that to date 31.3 % of the budget has been spent. When comparing this figure with the percent of BAC accomplished, a question may be raised regarding the adequacy of the budget which has been established for this effort. The above calculation (31.3%) assumes the use of the remaining Management Reserve budget. Another way one might calculate the Percent Spent is to add the remaining Management Reserve to the EAC (Col 13) thereby assuming that the

management reserve will be applied. The Percent Spent under these conditions is as follows:

Percent Spent = (Col 9) (Col 13) + (Col 12)

= ACWP (EAC + MR)

= $91,522 ($281,960 + $11,982)

= $91,522 $293,942

=31.1%

This range of Percent Spent calculations (31.1% to 32.5%) indicates the variations associated with the Budget At Completion (BAC), the Estimate at Completion (EAC), and the application of Management Reserve (MR). The rate of MR application and the variance between the BAC and EAC are factors that should be considered in deciding which Percent Spent calculation to use.

f. "To Complete" Performance Index (TCPI). Another way to look at performance is from an end-of-contract viewpoint. Instead of looking at the Percent Complete compared to the Percent Spent, the relationship between the work remaining may be examined versus the money required to accomplish the work remaining.

TCPI (EAC) = (Col 12 - Col 8) (Col 13 - Col 9)

= (BAC - BCWP) (EAC - ACWP)

= ($292,420 - $78,875) ($281,960 - $91,522)

= $213,545 $190,438

= 1.12 %

This means that the remaining work would have to be accomplished at an efficiency level of 112% in order to complete the effort within the EAC. The prediction of a contract underrun (EAC-BAC) implies a higher level of future performance.

The BAC may be used for the "money left" portion of the index and results in the following:

TCPI (BAC) = (Col 12 - Col 8) (Col 12) - Col 9)

= (BAC - BCWP) (BAC - ACWP)

= ($292,420 - $78,875) ($292,420 - $91,522)

= $213,542 $200,898

= 1.06

Thus, an efficiency level of 106% is required to achieve the BAC. This higher than 100% efficiency is required to compensate for the lower than 100% efficiency indicated by CPI (paragraph 3.a.).

g. Manmonth Cost. The manmonth cost can be used as a performance measurement factor. The average cost to date of a manmonth of work can be used to generate alternative estimates. The cost per manmonth can be used also to assess the credibility of the estimates for completing the work remaining within the BAC or within the EAC. The CPR Format 2 and the Manpower Management Report provide the key information required for such analysis as shown in Table 1 and discussed further in paragraph V.B.4.

h. Management Reserve (MR) Status. MR is budget set aside by the contractor at the onset of a contract for unforeseen in-scope effort in addition to the known and planned work. The adequacy of this budget and its rate of use have a direct bearing on cost performance assessment. For example, cost performance in the early stage of a development contract may appear adequate. However, it is also necessary to examine the rate of use of MR. If this budget has been virtually depleted early in the contract because of work omitted in the original planning, then a serious forthcoming cost problem is indicated and more detailed analysis is required. MR status may be approached in either of two ways:

(1) Direct MR Status. This may be in the form of:

(a) MR Remaining (Format 1, Column 12). The MR remaining on the sample contract is $11,982,000.

(b) MR Applied. This is the summation of MR applications reported in the Project Status Report (PSR).

(c) Percentage Relationships - MR Remaining or MR Applied may be related to the total MR credited to the contract:

$$\%\text{MR Remaining} = \frac{\text{MR Remaining}}{(\text{Initial MR} + \text{MR from Changes})}$$

$$\%\text{MR Applied} = \frac{\text{MR Applied}}{(\text{Initial MR} + \text{MR from Changes})}$$

(2) Effect on At Completion Variance. MR may be viewed in terms of its effect on the At Completion Variance in Column 14. In the example (Figure 3), the $11,982,000 Management Reserve offsets the total unfavorable At Completion Variance of $1,522,000 for a predicted underrun of $10,460,000 at contract completion.

TABLE 1
COST PER MANMONTH FACTORS

ITEM	ACTUAL COST OF WORK PERFORMED				BUDGET TO COMPLETION		ESTIMATE TO COMPLETION		BUDGET AT COMPLETION		ESTIMATE AT COMPLETION	
	CURRENT PERIOD		CUM. TO DATE									
	MM	$(000)	MM	$(000)	MM	$(000)	MM	$(000)	MM	$(000)	MM	$(000)
	MMR COL 17a	CPR COL 4	MMR COL 17c	CPR COL 9	MMR COL 19 LESS COL 17d	CPR COL 12 LESS COL 7	MMR COL 18c LESS COL 17c	CPR COL 13 LESS COL 9	MMR COL 19	CPR COL 12	MMR COL 18c	CPR COL 13
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cost		13,634		91,522		201,563		190,438		280,438		281,960
Less Non-Labor Cost of:												
Procurement		232		1,901		11,859		11,828		13,729		13,729
Material O.H.		12		95		592		591		686		686
Subcontracting		3,678		26,005		41,361		38,013		63,418		64,018
Subtotal		3,922		28,001		53,752		50,432		77,833		78,433
Total Labor-Intensive Items	4,053	9,712	24,258	63,521	69,196	147,811	70,937	140,006	92,755	202,605	95,195	203,527
Cost Per Manmonth		$ 2,396		$ 2,619		$ 2,136		$ 1,974		$ 2,184		$ 2,138

C. TREND ANALYSIS TECHNIQUES

1. Selection of Basic Data. Trend analysis can be performed by using totals (the "bottom line" approach) or by isolating particular line items or groups of line items. To emphasize the analysis of contract work performance, Table 2 and subsequent trend analyses use WBS data and exclude G&A. Analysis of G&A could be combined with the WBS data, depending on the objectives of the analysis, taking into consideration how G&A might impact the analysis.

2. The Extrapolation Approach. Past and current data are often used in forecasting future performance. The extrapolation of historical performance trends to establish future positions is an important and practical analysis tool. Once a trend of performance has been established, it may be expected generally to continue in that direction except for outside or unforeseen influences. These influences may take the form of failures or breakthroughs, corrective action or technical performance parameter changes. The approach which should be taken relative to data extrapolations is:

- o Examine current and historical performance data for trends;
- o Interpret and draw conclusions from the trends;
- o Use the trends, interpretations, and conclusions to predict future positions; and
- o Refine predicting approaches based on results to better predict future positions.

In this section, current and historical data will be examined for trends and for conclusions to be drawn from these trends. The historical data used are from the CPR Format 1 covering the period January 1, 19XX through December 31, 19XX (Attachment 3).

3. Data Organization and Arrangement

a. Tabular Data. Basic data are often difficult to read, analyze, interpret, compare, or draw conclusions from. This is especially true when the relationships are complex, formats are "busy", or period-to-period data are to be compared. An example of this is trying to detect trends by looking at the BCWS, BCWP, or ACWP as presented in the twelve monthly CPRs shown in Attachment 3. To overcome this problem, the data are tabulated before an analysis is undertaken. Table 2 is an example.

TABLE 2

COST PERFORMANCE INDEX

MONTH	INCREMENTAL BCWP CPR Col 3	÷ ACWP CPR Col 4	= CPI	CUMULATIVE TO DATE BCWP CPR Col 8	÷ ACWP CPR Col 9	= CPI
J	1623	1623	1.000	1623	1623	1.000
F	2200	2200	1.000	3823	3823	1.000
M	2362	3266	.723	6185	7089	.872
A	2548	3434	.742	8733	10523	.830
M	3347	3691	.907	12080	14214	.850
J	3804	4487	.848	15884	18701	.849
J	5264	5730	.919	21148	24431	.866
A	7373	8769	.841	28521	33200	.859
S	7668	10132	.757	36189	43332	.835
O	10036	12050	.833	46225	55382	.835
N	11533	13121	.879	57758	68503	.843
D	11613	11991	.968	69371	80494	.862
Totals	69371	80494	10.417	69371	80494	.862

b. Graphic Data. Even the Cost Performance Indices shown in Table 2 are difficult to analyze for trends. When presented in graphic form, as in Figure 8, relationships are generally easier to see and to understand.The solid line in Figure 8 is a graphic display of the incremental CPI by month using the data in Table 2. Even though these monthly data are now in a form which is much easier to visualize than tabular data, it is still relatively difficult to interpret because of the variability of the data. The dashed line in Figure 8 is a graphic display of the cumulative CPI from the data in Table 2. As can be seen, cumulative data smooth the variations which are apparent in the plotting of incremental data. There are a number of methods for smoothing data which makes them more readily understood and interpreted, and thereby easier to be acted upon. Some of these methods are delineated in subsequent paragraphs.

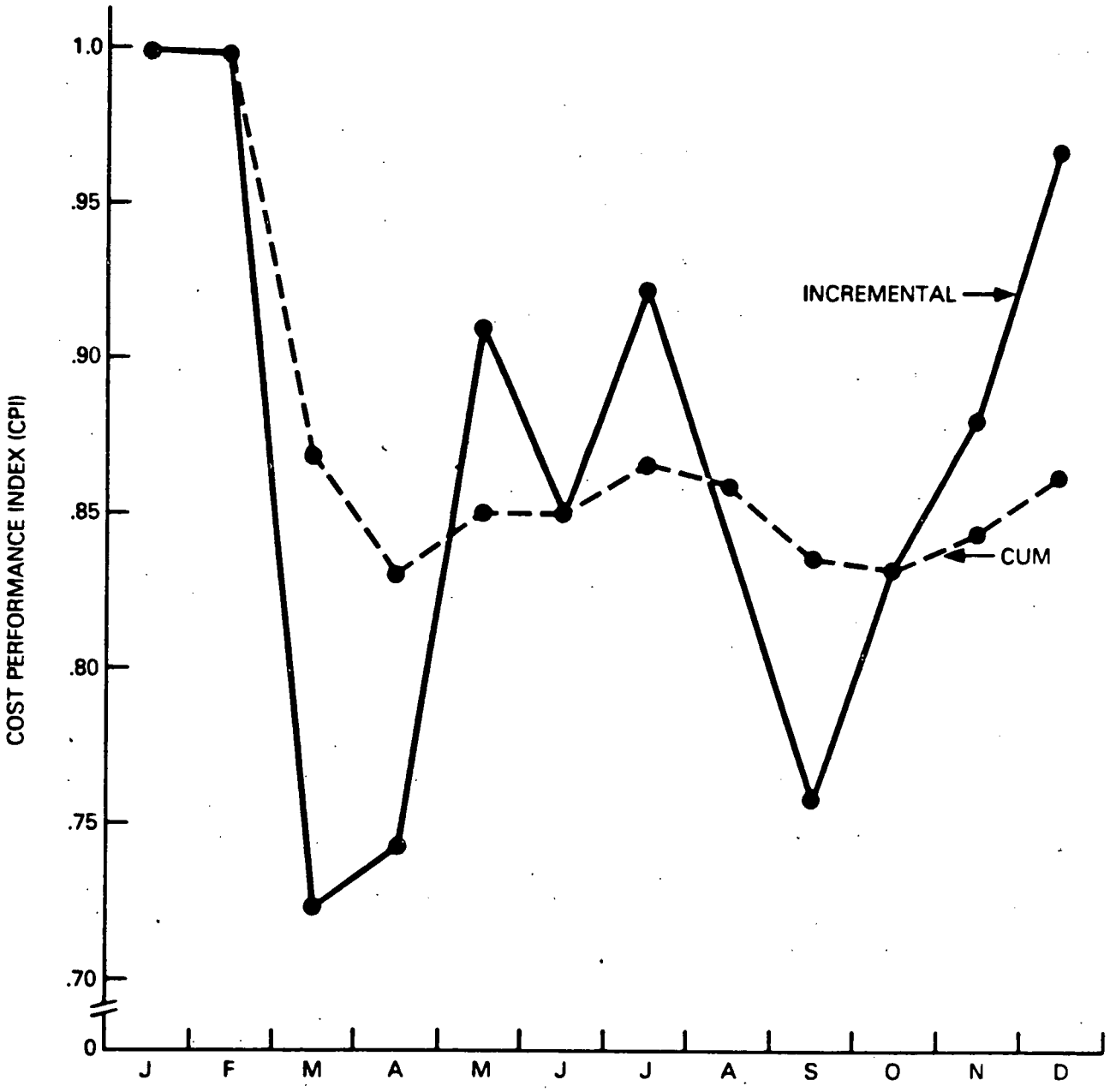


FIGURE 8: COST PERFORMANCE INDEX BY MONTH

c. Smoothing Techniques. Smoothing techniques attempt to cancel out the effects of random variation and presumably reveal the underlying trends being sought. The four types of smoothing techniques discussed are the mean, the moving average, the method of least squares, and curvilinear trends.

(1) The Mean. This is the arithmetic average of the data and is calculated by the equation:

$$\bar{X} = \frac{\Sigma\, xi}{n}$$

where: $\bar{X}$ is the mean

$\Sigma\, xi$ is the sum of the incremental values

n is the number of X values

For the data used (Table 2), the average CPI is

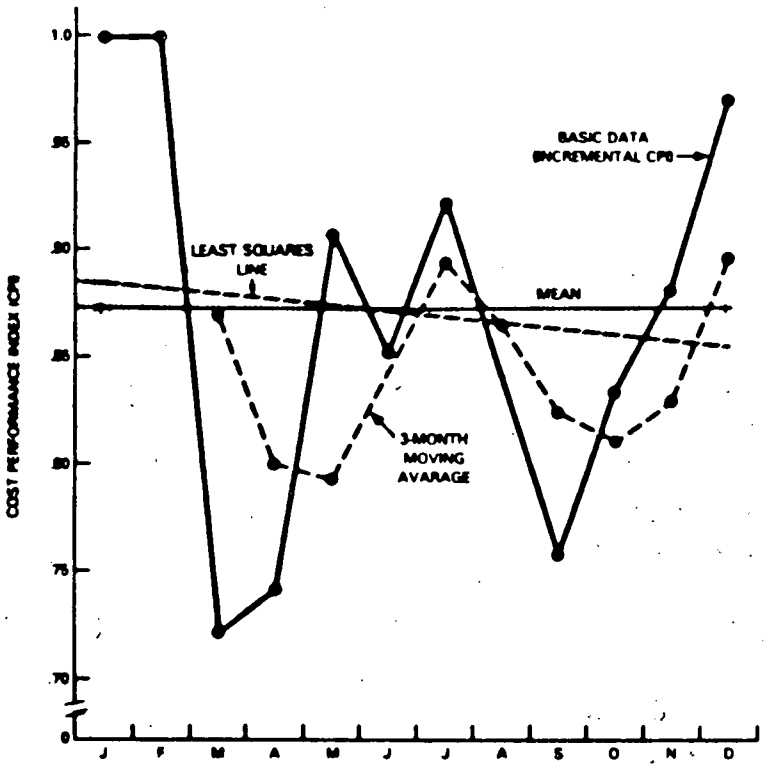
$$\text{Average CPI} = \frac{\text{CPI (total all values)}}{12} = \frac{10.417}{12} = .868$$

This value is shown on Figure 9 The mean is simply the average of past performance amd hence is easy to calculate. However, it reduces all historical data to a single figure and does not identify trends.

(2) The Moving Average. This is a technique whereby the mean of the data for a given number of periods is calculated. Figure 9 shows how to calculate a three-month moving average for the BCWP.The same technique was used to derive a three-month moving average for the ACWP. This ACWP moving average, although not its derivation, is also shown in Figure 9. From these data, a three-month moving average CPI was calculated. These CPI data are plotted as the dash line on Figure 9. The basic data were calculated as shown in Table 2. They are represented by a solid line in the graph.

(3) Regression. In estimating a line of "best fit" through plotted data, one method is to draw a line or curve "free hand". This "eyeball" technique may not give bad results, especially if the points are numerous and cluster closely along the line. One disadvantage of this method is that it is unlikely for two people to get exactly the same result. The alternative to the "free hand" technique is to fit a straight line (or, where applicable, a curvilinear line) by statistical methods.

(a) Method of Least Squares. One frequently used approach to the estimation of a line of "best fit" is to use the method



THREE-MONTH MOVING AVERAGE CALCULATIONS

MONTH	BCWP			ACWP	CPI
	Incremental CPR Col 3	Three-Month Total	Three-Month Mov'g Aver.	Three-Month Mov'g Aver.	BCWP ÷ ACWP
J	1623	--	1623*	1623*	1.000*
F	2200	--	1912*	1912*	1.000
M	2362	6185	2062	2363	.873
A	2548	7110	2370	2967	.799
M	3347	8257	2752	3464	.795
J	3804	9699	3233	3871	.835
J	5264	12415	4138	4636	.893
A	7373	16441	5480	6329	.866
S	7668	20305	6768	8210	.824
O	10036	25077	8359	10317	.810
N	11533	29237	9746	11768	.828
D	11613	33182	11061	12387	.893

*Data for first two months based on less than three-month average.

REGRESSION CALCULATION

Month x	Inc. CPI y	xy	x^2
1	1.00000	1.00000	1
2	1.00000	2.00000	4
3	.72321	2.16963	9
4	.74199	2.96769	16
5	.90680	4.53400	25
6	.84778	5.08668	36
7	.91867	6.43069	49
8	.84080	6.72640	64
9	.75681	6.81129	81
10	.83286	8.32860	100
11	.87897	9.66867	121
12	.96848	11.62176	144
78	10.41637	67.34568	650

$$m = \frac{\eta \Sigma xy - \Sigma x \Sigma y}{\eta \Sigma x^2 - (\Sigma x)^2}$$

$$= \frac{(12)(67.34568) - (78)(10.41637)}{(12)(650) - (78)^2} = \frac{808.1482 - 812.4769}{7800 - 6084} = -.0025$$

$$b = \frac{\Sigma y - m(\Sigma x)}{\eta}$$

$$= \frac{10.41637 - (-.0025)(78)}{12} = \frac{10.81137}{12} = .884$$

Equation for least squares line:

$y = mx + b$

$= -0.0025X + 0.884$

FIGURE 9: COST PERFORMANCE INDEX TRENDS

of least squares. This technique calculates a line, so that the sum of the squares of the vertical deviations from the line is minimum. Assuming that the regression is linear, the equation for a straight line is:

$$y = mx + b$$

where: m is the slope of the line

b is the y intercept when x=0.

The formula and calculation of the regression line, along with the support data is shown in Figure 9.

Substituting the supporting data in these formulae develops a regression line of "best fit" as one which crosses the y axis at 0.884 and has a slope of -0.0025. This line is shown graphically as the dotted line on Figure 9.

(b) Curvilinear Trends. A non linear regression exists whenever one or more of the variables in an equation is of a degree higher than one. The calculations for curvilinear trends are voluminous and should be done by computer.

4. Analysis and Conclusions. A visual examination of Figures 8 and 9 indicates that the January and February data do not follow the pattern of subsequent data. They are probably less solid than subsequent data in the series. This position is partially substantiated by the fact that they are early data, obtained during the data "settling-out" period. On the basis of these facts, it may be desirable to base conclusions on calculations of a new mean, moving average, and regression line based on March - December data only, by which time cumulative effects have established a more valid trend. These calculations are shown in Table 3 and are graphically depicted in Figure 10.

TABLE 3

RECALCULATED TREND DATA

Month	x	Inc. CPI y	Cumul. CPI	3-Mo. Avg. CPI	xy	x2
M	1	.723	.723	.723	.723	1
A	2	.742	.733	.733	1.484	4
M	3	.907	.795	.795	2.721	9
J	4	.848	.811	.835	3.392	16
J	5	.919	.841	.893	4.595	25
A	6	.841	.841	.866	5.046	36
S	7	.757	.819	.824	5.299	49
O	8	.833	.822	.810	6.664	64
N	9	.879	.834	.828	7.911	81
D	10	.968	.855	.893	9.680	100
TOTALS	55	8.417	8.074	8.200	47.515	385

NEW MEAN CALCULATION

$$\text{NEW MEAN} = \frac{\Sigma y}{n} = \frac{8.417}{10} = .842$$

Where n = the number of X values (or observations)

NEW REGRESSION LINE CALCULATION:

$$m = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

$$= \frac{(10)(47.515) - (55)(8.417)}{(10)(385) - (55)^2}$$

$$= \frac{475.150 - 462.935}{3850 - 3025}$$

$$= .0148$$

$$b = \frac{\Sigma y - (m)(\Sigma x)}{n}$$

$$= \frac{8.417 - (.0148)(55)}{10}$$

$$= \frac{8.417 - 0.814}{10}$$

$$= .760$$

Equation for new regression line:

$$y = mx + b$$

$$= .0148x + .760$$

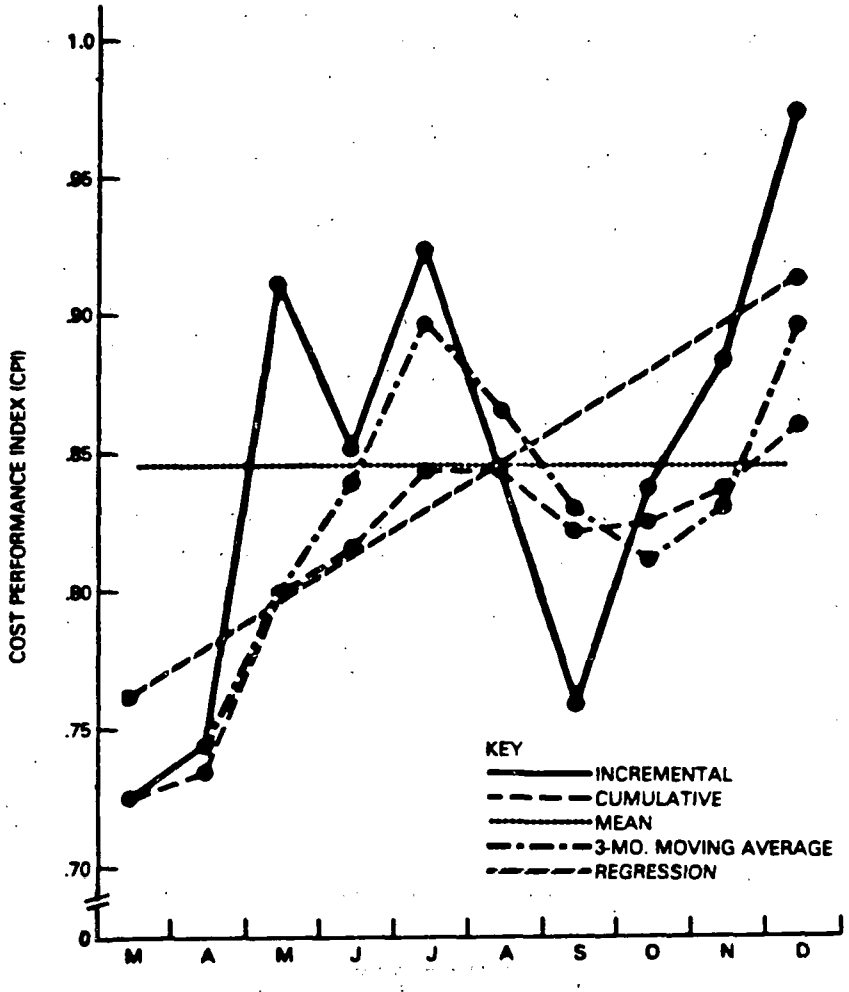


FIGURE 10: REVISED GRAPHICAL TREND DATA

Figure 10 shows the new trends based on the data remaining after elimination of the first two data points. The conclusions which may be drawn from the trend data in Figure 10 are:

- After severe variations in the March through September period, improvement has been dramatic since September.
- A regression of the incremental CPI for the March through December data indicates a positive trend.
- The cumulative and three-month moving average lines substantiate this positive trend.

CHAPTER V. FORECASTING FUTURE PERFORMANCE

A. FORECASTING DEFINED.

Forecasting is the process of calculating, estimating, or predicting future events or conditions, usually as the result of rational study or the analysis of available pertinent data. On the other hand, a plan is a statement of objectives and the steps necessary to reach them. Thus, planning also must consider not only today's conditions, but future circumstances. Therefore, planning and forecasting are related. While a plan may consist of deliberate, specific statements of objectives and of methods for attaining them, the forecasts upon which the plan is based, may be a combination of past experience, known facts, common sense, judgment, and intuition.

One of the important attributes of good performance measurement systems is their ability to predict the future with a reasonable degree of accuracy. The usual future condition to be predicted is the latest revised Estimate at Completion (EAC) provided in Column 13 of Formats 1 and 2 of the CPR. In order to enhance the accuracy in the establishment of an EAC, one should start with the cumulative ACWP. Then, an estimate of the cost of the work remaining to be completed should be prepared and added to the ACWP. This estimate should consider all known or expected impacts -- the identification and quantification of all anticipated problems or breakthroughs. Such an investigation should start at the WBS level at which the condition appears, by the cost account managers involved. For example, a problem which occurs during a subsystem test should be traced further down the WBS to the component or combination of components which caused the problem. At that point, impact assessments and "get well" plans should be made by the responsible cost account managers. Once estimated costs to complete have been calculated at the cost account level, they should be summarized, without allocation, to the reporting level.

A second consideration is that of verifying an EAC previously calculated. This is the usual position taken by the DOE Project Manager in the analysis of a CPR provided by the contractor. The verification of the EAC may be accomplished either by reconstructing the EAC through calculations similar to those made by the contractor (which may not be feasible) or by using current status and trend information. In either case, independent analyses should be made and the results should be compared to the EAC provided in the CPR. Significant variances among EAC's should be investigated.

While current status determinations and trend analyses assist in forecasting future positions, they are no substitutes for a basic knowledge of current and expected problems or breakthroughs. For example, the knowledge that a particular contract has a serious problem in one or more WBS elements, with no known solution at this time, should have a significant impact on the EAC.

Also, even though performance indices are useful for estimating future conditions, it should be remembered that they are valid only to the degree that the future resembles the past. For convenience, the methods of future position determination will be divided into two general categories: point projection and trend extrapolation. These are explained in the following paragraphs.

B. POINT PROJECTION.

This is the use of a single-point, usually a current status indicator, to establish or verify a future cost position depicted by the EAC. Effective trends may be developed by plotting a series of point projections over time. The following paragraphs give examples of point projections and provide a discussion on the accuracy of estimates.

1. EAC and Cumulative ACWP. Comparison of the cumulative ACWP (Column 9) with the EAC (Column 13) may seem to be a rather innocuous indicator of a future cost position. In this situation, however, it is rather

CUMULATIVE TO DATE					AT COMPLETION		
BUDGETED COST		ACTUAL COST	VARIANCE		BUDGET	LATEST REVISED ESTIMATE	VARIANCE
				COST			
(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
260.7	252.5	273.4	(8.2)	(20.9)	275.0	275.0	--

obvious that there is little likelihood that the remaining $22,500 worth of work (Column 12 minus Column 8) will be accomplished for $1,600 (Column 13 minus Column 9). While this is an overstated example, this relationship should be reviewed monthly for each WBS element on the CPR. Another variation of this analysis is to compare the Cumulative Cost Variance with the At Completion Variance, keeping in mind the completion status of the contract. In the example situation above, $20,900 (Column 11) current cost overrun is expected to be recovered prior to completion, while the contract is 91.8% complete. This is highly unlikely. This situation usually exists because the EAC (Column 13) calculation did not use the cumulative ACWP plus the estimated cost of the work yet to be performed to derive the reported figure. It becomes more evident as the contract approaches completion.

In assessing cost overruns, it is helpful to project this overrun condition considering the impact of the application of all the remaining Management Reserve (MR) to the budgeted contract work. To determine the impact of MR application, the cumulative percent cost overrun should be calculated first (using the data illustrated above):

$$\text{Percent Cumulative Cost Overrun} = \frac{\text{BCWP} - \text{ACWP}}{\text{BCWP}}$$

$$= \frac{(252.5 - 273.4)}{252.5}$$

$$= (8.3\%)$$

This percent cost overrun can then be projected to the contract level to analyze the impact of MR application. If the remaining MR is assumed to be $27.5, the projected contract percent cost overrun, after full application of the MR, is determined as follows:

$$\frac{\% \text{ Contract Cost Overrun}}{\% \text{ Cumulative Cost Overrun}} = \frac{BAC-MR}{BAC}$$

$$\frac{\% \text{ Contract Cost Overrun}}{(8.3\%)} = \frac{\$275-\$27.5}{\$275}$$

$$\% \text{ Contract Cost Overrun} = \frac{(8.3\%)\ 247.5}{(275.0)}$$

$$= (7.5\%)$$

In effect full application of the remaining MR will reduce the Percent Cumulative Cost Overrun because of the higher base used and provides a contract overrun percentage prediction at this point in time. When applying this technique to evaluate the impact of MR application, the value for MR may be obtained from Format 3 of the CPR.

2. Budget at Completion (BAC) and Cost Performance Index (CPI). Dividing the BAC (Column 12) by the CPI is a popular method of determining the EAC:

$$EAC = \frac{(BAC - MR)}{CPI}$$

$$= \frac{(\$292,420 - \$11,982)}{.862}$$

$$= \frac{\$280,438}{.862}$$

$$= \$325,334$$

This EAC assumes that the efficiency with which the remainder of the work will be done will continue at 86.2%. This is far different from the $281,960 reported in the CPR, (Column 13), which presumes an efficiency of 99.5%.

An indicator which usually leads the CPR EAC estimate by two to six months is the estimate of the EAC using the Incremental CPI, i.e., (BCWP ACWP), which has been previously calculated to be 0.968.

$$\text{Estimated EAC} = \$280,438 \quad 0.968$$

$$= \$289,709$$

which is also higher than the CPR figure.

It should be noted that the $\frac{\text{Cum ACWP}}{\% \text{ Complete}}$ and the $\frac{BAC}{CPI}$ provide the same EAC since they are algebraically equal.

3. A Comparison of CPI and TCPI. This is a comparison of the cost performance-to-date (CPI) with the cost performance necessary to achieve a given future position. The "To Complete" Performance Index (TCPI) is the cost efficiency level at which work must be accomplished in order to attain the desired final cost, while the CPI is the cost efficiency level at which work has been or is currently being performed. The difference between the two provides an indicator of whether the expected final cost can be met. As the CPI decreases and the TCPI increases, it becomes more likely that the expected final cost will be exceeded.

The TCPI [(BAC - BCWP) (BAC ACWP)], to meet the BAC has been determined previously to be 1.06 (paragraph IV B.3.f.). However, the CPI to date is only .862. Thus, the probability of meeting the BAC is slim unless there is a dramatic increase in efficiency. Even if work is accomplished at the higher CPI of the current period for the remainder of the contract, it will not be high enough to meet the BAC. Hence, forecasts of EAC should acknowledge and incorporate the indices derived from the trend analysis, discussed in the preceding chapter. For example, the incremental CPI for December can be used to forecast an optimistically based EAC, since the December CPI (.968) is higher than the average to date (.862). Using this CPI on the remaining work results in the following point-projection:

Projected ACWP for Work Remaining	=	Budgeted Work Remaining		December CPI
	=	$213,545		.968
	=	$220,604		

Projected EAC	=	ACWP to Date	+	Projected ACWP
	=	$91,522	+	$220,604
	=	$312,126		

As may be seen, the EAC projected on the basis of the current CPI is higher than both the BAC and EAC reported on the CPR.

CPR Reported BAC	=	$292,420
CPR Reported EAC	=	$281,960

4. Cost per Manmonth. A forecast for EAC may also be developed using the cost per manmonth factors as previously generated and discussed in Chapter IV and shown in Table 1.

In this approach the sum of the following data is derived: Labor-related ACWP to date (CPR Format 2, Column 9) plus Estimated Manmonth remaining (MMR Column 18c minus MMR Column 17 c) multiplied by the dollars per manmonth experienced to date, plus Latest Revised Estimate for non-labor related costs (Procurement, Material Overhead, and Subcontracting, from Column

13, CPR Format 2). This total represents an EAC based on actually experienced labor related costs to date and is valid to the degree that these relationships will continue for the remaining work. The following is an example of such a calculation:

EAC = ACWP + (MM remaining x Cumulative $/MM) + Non Labor cost EAC

= $63,521 + (95,195 MM - 24,258 MM)($2,619/MM) + $78,433

= $63,521 + $185,784 + $78,433

= $327,738

The above EAC is understandably higher than the reported estimates since the cost per manmonth experienced in the current period and cumulatively-to-date are higher than all reported cost per manmonth forecasts based on budget to complete, estimate to complete, BAC, and EAC. Table 1, displays these manmonth costs and indicates either the experienced rates per manmonth are higher than those expected in the future or the completions estimates are low.

5. Schedule Estimating. The Schedule Performance Index (SPI) may be used with the Budget at Completion (BAC) and incremental BCWP to estimate the final schedule position. Dividing the BAC by the SPI provides an indication of the value of work which must be accomplished beyond the original schedule:

$$\frac{BAC}{SPI} = \frac{\$292,420}{0.909}$$

= $321,694

Subtracting the BAC, a figure of $29,274 is derived, which is the amount of work to be accomplished beyond the current baseline. At the current (December) rate of work accomplishment (incremental BCWP), this represents an approximately nine week schedule slippage prediction at completion:

Baseline December BCWP = $29,274 $13,204/month
= 2.22 months or 9.4 weeks

Analysis of other measures of budgeted work accomplishment may provide added insight into predicted schedule slippage, i.e. average rate, mean rate, etc.

6. Estimates by Function. Point projections obtained by the use of factors like the CPI assume that the organization will operate at the same efficiency to conclusion that it has operated in the past. One fallacy in this assumption is that different functional organizations peak at different times and have varying efficiencies, depending partially on the particular function's phase. Therefore, a more accurate approach to calculating the EAC would be to consider each function individually as shown in Table 4:

TABLE 4

EAC PROJECTION BY FUNCTIONAL CATEGORY*
(Dollars in Thousands)

Function	ACWP	BCWP	CPI	BAC	Percent Complete (BCWP ÷ BAC)	EAC Projection (BAC ÷ CPI)
Engineering	40,455	33,493	.828	108,798	30.8	131,299
Tooling	83	76	.916	4,257	1.8	4,647
Quality Control	170	162	.953	876	18.5	919
Construction	3,119	2,997	.961	27,463	10.9	28,578
Procurement	1,901	1,870	.986	13,729	13.6	13,924
Material Overhead	95	94	.989	686	13.7	693
Subcontracting	26,005	22,117	.850	63,418	34.9	74,609
Project Management	8,666	8,562	.988	27,421	--	27.754
G&A	11,028	9,504	.862	33,790	--	39,200
Management Reserve	--	--	--	11,982	--	--
TOTAL	91,522	78,875		292,420		321,723

* Basic data from CPR Format 2, Functional Categories, Figure 4.

It is to be noted that the projection of total EAC is not derived by dividing the sum of all BACs by an average CPI, but summing the projections of the individual functional EACs. The total EAC projection reflects the efficiency at which the individual functions are performing. In this example, the more efficient Construction, Tooling, and Quality Control functions are not as far along as the less efficient Engineering and Subcontracting. Consequently, the total EAC projection of $321,723 is less than the $325,334 EAC calculated on the basis of the aggregate BAC/CPI relationship (see paragraph V. B.2).

7. Estimates by Element of Cost. Another approach to the calculation of the EAC is to consider the impact of outside influences on each of the elements of cost. Sample elements of cost with factors which influence them are:

- Labor: overtime (makeup schedules), production rates, pay increases, cost of living index, union contract provisions, schedule changes due to contract changes, work efficiency, inflation, and labor market conditions.
- Material: inflation, shortages and overages, contract changes, and waste.
- Overhead: other business (government and commercial), attrition rate, fringe benefits, schedule changes, labor, material, and other direct charges.
- Other Direct Charges: inflation and costs of services.

8. Calculating Cost Element Changes. The impact of influences on the above cost elements may be incorporated in EAC calculation by addition of the dollar impact or by use of appropriate performance factor, e.g., inflation factor or overhead rate increase, as per the following examples:

a. Direct dollar impact:

- Direct Contract Changes of $5,000 are expected.

  New EAC = (Present EAC + Change)(G&A Rate)

  = ($246,648 + $5,000)(1.137)

  = $286,124

- Expected $200 for overtime and $300 for schedule slippage.

  New EAC = (Present EAC + Increased Schedule Costs)(G&A Rate)

  = ($246,648 + $500)(1.137)

  = $281,007

b. Performance Factor:

- Expected 9% average inflation increase to end of contract.

$$\text{New EAC} = [\text{ACWP} + (\text{BAC}-\text{BCWP})(1+\text{Inflation Factor})][\text{G \& A Rate}]$$

$$= [80{,}494 + (246{,}648-69{,}371)(1.09)][1.137]$$

$$= \$311{,}226$$

- Expected overhead rate increase of 2% across the board to end of contract on an assumed 100% current overhead rate:

$$\text{New EAC} = \{\text{ACWP} + [\text{BAC}-\text{BCWP}][1+(\text{Overhead Portion})(\text{Overhead Rate Increase})]\}\{\text{G \& A Rate}\}$$

$$= \{80{,}494 + [246{,}648-69{,}371][1+(.5)(.02)]\}\{1.137\}$$

$$= \$295{,}102$$

Or, a combination of both:

$$\text{New EAC} = \{[\text{ACWP} + (\text{BAC}-\text{BCWP})(1+\text{Inflation Factor})][1+(\text{Overhead Portion})(\text{Overhead Rate Increase})] + \text{Change Cost} + \text{Schedule Cost}\}\{\text{G \& A Rate}\}$$

$$= \{[80{,}494 + (246{,}648-69{,}371)(1+.09)][1+(0.5)(0.02)] + 5{,}000 + 500\}\{1.137\}$$

$$= \{(80{,}494 + 193{,}232)[1.01] + 5{,}500\}\{1.137\}$$

$$= \{287{,}463 + 5{,}500\}\{1.137\}$$

$$= \$320{,}592$$

9. Estimate Detail. In paragraphs 1. through 5., above, forecasts were made using only top level data. In paragraphs 6, 7, and 8 lower level data in greater detail were used to make predictions. Under the CSCSC concept the burden of providing a good EAC by using data at the working level, rests with the contractor's organization performing the work. Verification of the contractor's EAC is the responsibility of the DOE Project Office. In its efforts to acquire an accurate EAC, the DOE Project Office may require data which are too detailed. This may result in receiving more data than the DOE Project Office can use effectively and in shifting identification and resolution of problems from the contractor to the DOE Project Office.

C. TREND EXTRAPOLATION.

Extrapolation is defined as the projection into the future of a current position or historical trend. Once a performance trend has been established, it may be expected generally to continue unless impacted by outside influences. Therefore, extrapolations, while not absolutely reliable, are useful in predicting the future.

To illustrate trend extrapolation, following typical areas of interest have been selected for presentation:

1. Basic CPR Data
2. Cumulative Dollar Variances versus Time
3. Percent Variance versus Time
4. Cost - Schedule Cartesian coordinates
5. Cost Variance versus At Completion Variance
6. Percent Complete versus Percent Spent
7. Percent Spent at Completion
8. Estimated Cost at Completion
9. Cost Performance Index and To Complete Performance Index
10. Management Reserve Applications
11. Cost Variance versus Management Reserve Usage

The format for presenting each of the above areas follows a two step approach -- the organization of the data in a logical manner and the analysis of the data to draw reasonable conclusions and predictions.

1. BASIC CPR DATA (Figure 11)

a. Data Organization. No calculations are required for the trend extrapolation of basic CPR data. The data are taken directly from the CPR and are tabulated and charted. The extension of the performance measurement baseline (Cum. BCWS) is obtained from the CPR Format 3, Baseline (Figure 5). Figure 11 displays this baseline at the contract level only. Charts of this nature, however, can be prepared (without the future BCWS) for any elements of the WBS or for functional organizations. This should be done whenever problems exist within an organization or WBS element. Normally, these charts are drawn for the life of the project, contract, or cost account, with the BCWS and the "time now" position indicated.

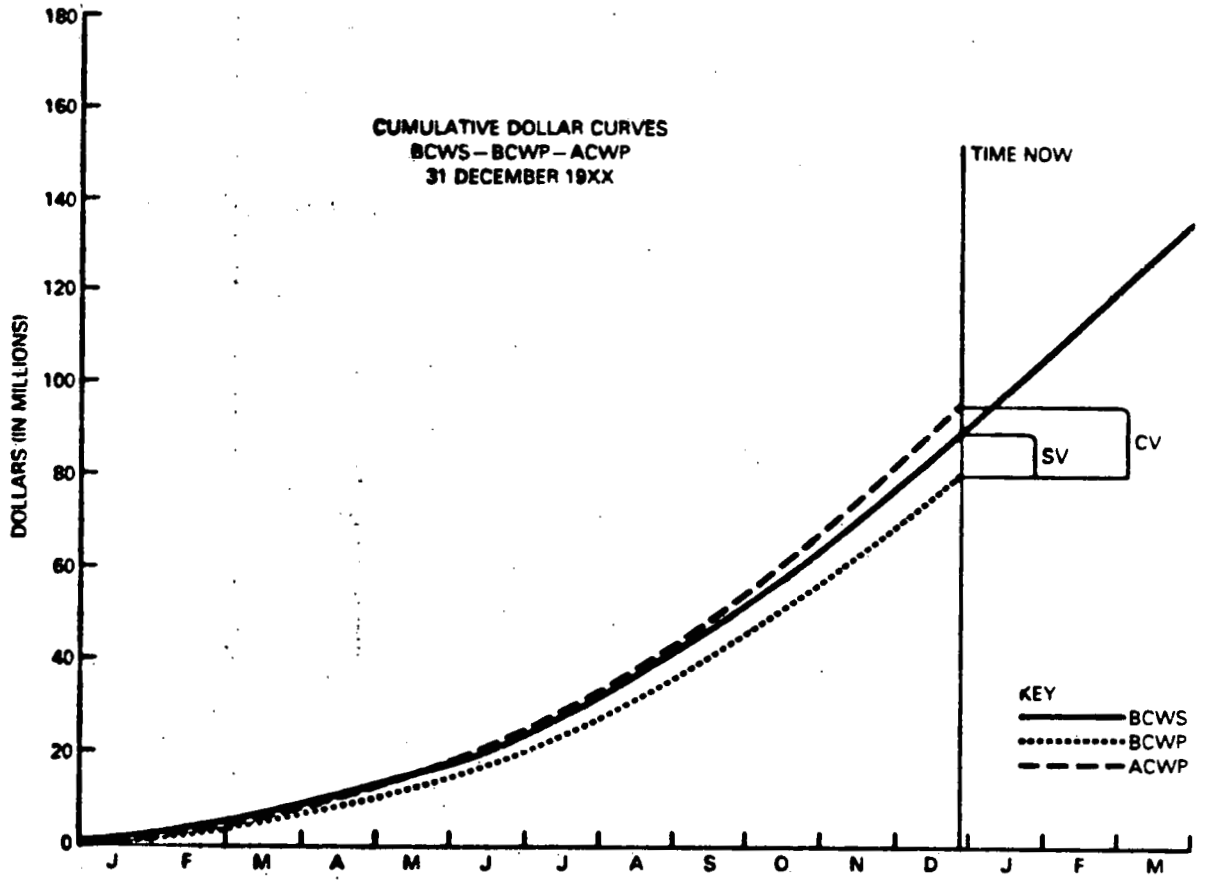


FIGURE 11: PERFORMANCE MEASUREMENT CHART

b. Analysis. The vertical distance between the BCWP and BCWS lines is the Schedule Variance; that between the BCWP and ACWP lines is the Cost Variance. It should be noted that whenever the BCWP line is above one of the other lines, a favorable variance exists in that area.

Management should be alerted whenever:

- o The lines are significantly far apart,
- o The distance between the lines is increasing,
- o Any one of the lines changes direction, or
- o Any two of the lines cross.

Figure 11 indicates that:

- o The contract is overrunning costs relative to the performance measurement baseline, and the amount of overrun is increasing each month. This is indicated by the position and slope of the BCWP line relative to the ACWP line.
- o The contract is behind schedule relative to the performance measurement baseline and the dollar value of the slippage is increasing each month. This is indicated by the position and slope of the BCWS line relative to the BCWP line.

2. CUMULATIVE DOLLAR VARIANCES VERSUS TIME (Figure 12)

a. Data Organization. Cost and Schedule Variances may also be analyzed directly in dollar values. No calculations are required for determining the Cost and Schedule Variances. The data are taken directly from the CPR column 10 for SV, and column 11 for CV. The data for the sample project are plotted (separately for SV and CV).

The charts show the change in dollar variance over time. Cost and Schedule Variance lines are often shown together on the same chart. This practice should be followed only when some relationship between the Cost and Schedule Variance lines is to be emphasized. Other charts may be used to show dollar Cost and Schedule Variances, as indicated by the following examples.

b. Analysis. Management should be alerted to a significant slope change or reversal of a trend, or whenever a predetermined threshold limit has been breached. These charts are especially adaptable for the application of control limits. The analysis of the charts in Figure 12 reveals that both Cost and Schedule Variances have been getting worse each month, but the downward trend is beginning to taper off.

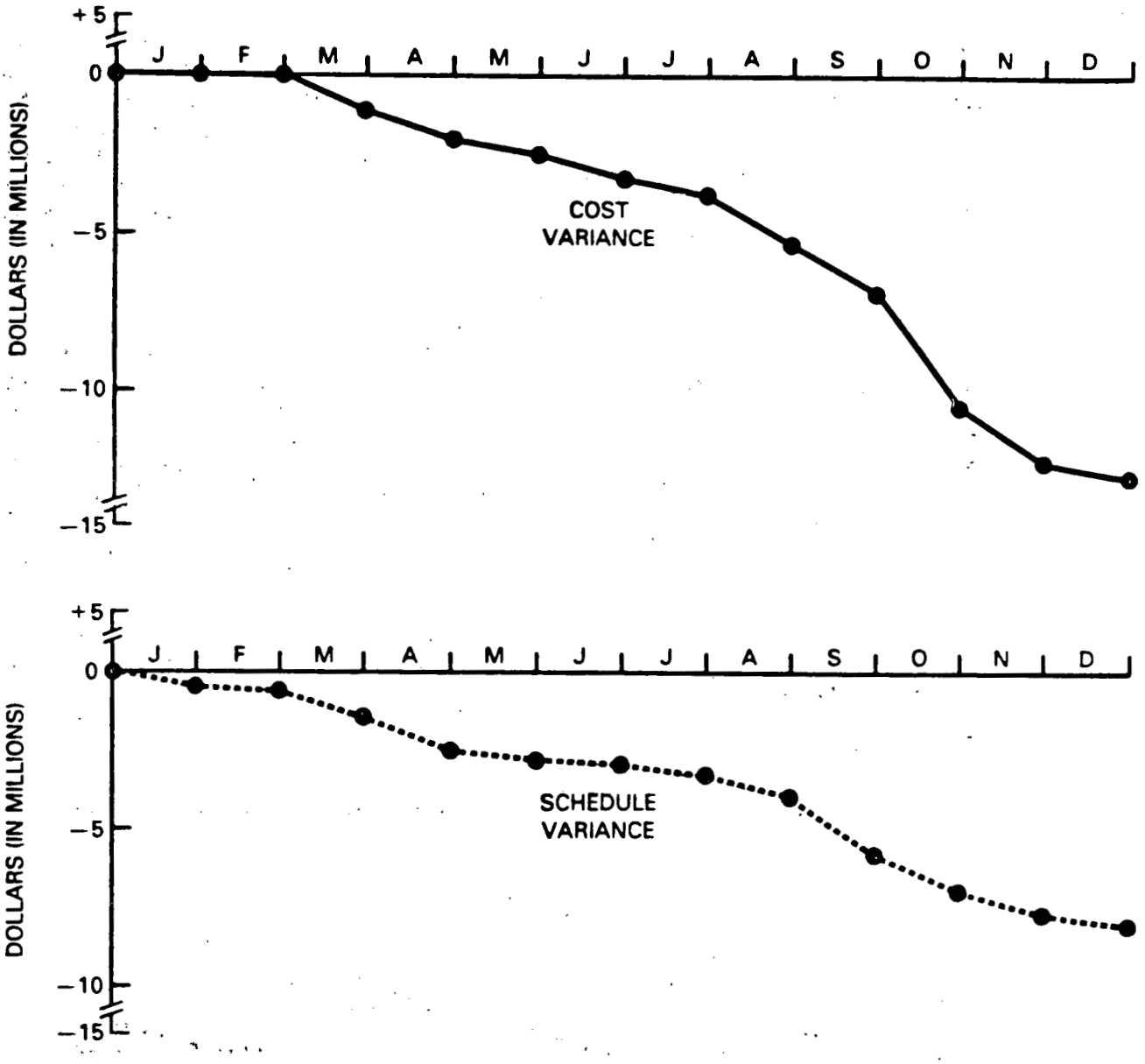


FIGURE 12: CUMULATIVE COST AND SCHEDULE DOLLAR VARIANCE TREND CHARTS

3. PERCENT VARIANCES VERSUS TIME (Figure 13, Table 5)

a. Data Organization. Cost and Schedule Variances may be analyzed also on a percentage basis. While dollar variances are getting progressively worse, as shown in Figure 12, as a percentage of the base they may be getting better, as shown in Figure 13. The base for the Schedule Variance percentage is the BCWS while that for the Cost Variance is the BCWP. The base for calculating the percent At Completion Variance (ACV) is the BAC. The results for twelve months and a sample calculation from the December CPR data are shown in Table 5.

b. Analysis. The percent cost variance appears to be clustered around an 18% overrun as shown in Figure 13. This figure could be used for projection purposes unless the trend starting in November continues or levels off at a higher figure. Control limits might be established for this chart at 20% and 15% overrun and whenever either line is crossed management is alerted. The reasons for the change in trend should be identified, investigated, and reported. Management should be alerted to significant slope changes or trend reversals.

The analysis for the lower portion of this chart is similar to that for the percent Cost Variance (upper portion). A favorable trend is being experienced in percent schedule variance. If this trend continues, the project could be back on schedule in another year to 18 months.

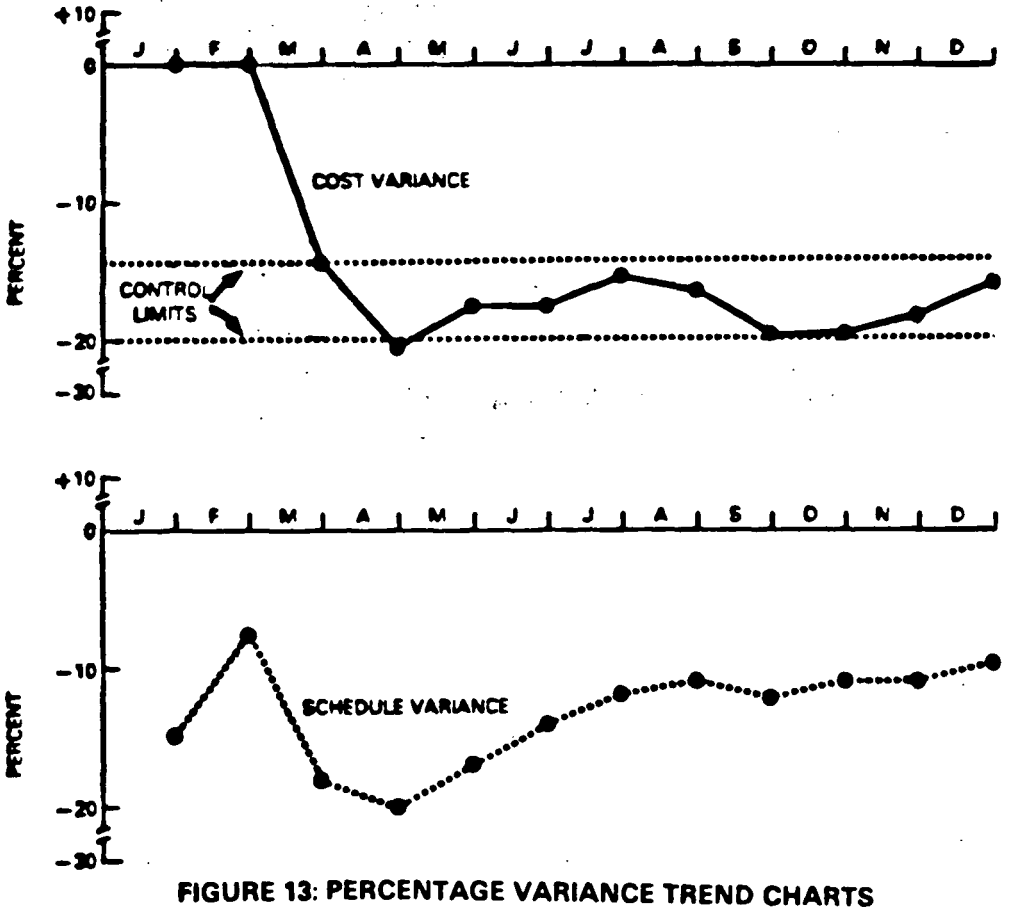


FIGURE 13: PERCENTAGE VARIANCE TREND CHARTS

Table 5

COST, SCHEDULE, AND AT COMPLETION PERCENT VARIANCES

Month	CV%	SV%	ACV%
J	0	(14.3)	9.10
F	0	(7.3)	9.10
M	(14.6)	(17.3)	7.71
A	(20.5)	(19.2)	7.18
M	(17.7)	(16.2)	7.86
J	(17.7)	(13.6)	7.23
J	(15.5)	(11.6)	6.00
A	(16.4)	(10.5)	5.28
S	(19.7)	(12.0)	3.70
O	(19.8)	(11.5)	3.09
N	(18.6)	(10.3)	3.07
D*	(16.0)	(9.1)	3.58

*The following are sample calculations for the Month of December 19XX:

Cost Variance Percent = (Col 11) (Col 8)

= CV BCWP

= -11,123 69,371

= -16%

Schedule Variance Percent = (Col 10) (Col 7)

= SV BCWS

= -6,911 76,282

= -9.1%

At Completion Variance Percent = (Col 14) Col 12)

= Variance at Completion + Budget at Completion

= 10,460 292,420

+ 3.58%

The CV and SV percentage data are based on the WBS subtotal line in the CPR. The ACV is based on the total line, including G&A and MR. Additional charts can be prepared from the data in Table 5, as shown in subsequent paragraphs.

4. CARTESIAN COORDINATE PLOT (Figure 14).

a. Data Organization. This chart uses the four combinations of cost (over and under) and schedule (ahead or behind) to provide a view of the combined impact of cost and schedule. The percentage cost variance and schedule variance for each month are plotted (see figure 14) as a single point.

The four cost-schedule combinations are interpreted as follows:

- Ahead of schedule and underrunning costs (top right quadrant) - definitely favorable.
- Behind schedule and overrunning costs (bottom left quadrant) - definitely unfavorable.
- Ahead of schedule and overrunning cost (bottom right quadrant) or behind schedule and underrunning cost (top left quadrant) - should be examined for detailed determination.

The direction and length of each line are important:

- A direction toward the upper right quadrant is favorable.
- The distance between the points represents the amount of change - horizontal, schedule; vertical, cost; or diagonal, combination cost and schedule.

This type of chart can be constructed using other elements for comparison:

- Dollar Cost and Schedule Variances.
- Cost and Schedule Variances as a percent of total budget: cost (CV ÷ BAC or CV ÷ EAC); schedule (SV ÷ BAC or SV ÷EAC).

b. Analysis. The contract performance consistently has been in the definitely bad quadrant - behind schedule and overrunning cost. The analysts reviewing this chart should consider also the percent cost and schedule variance charts:

- Cost Variance - during the period April through December has been fluctuating between 15% and 20% overrun. This is also apparent in Figure 13.
- Schedule Variance - following the unfavorable variances in March and April, the schedule variance has been getting progressively better. This is indicated in Figure 14 by the emerging trend toward the favorable quadrants in the Cartesian Coordinates.

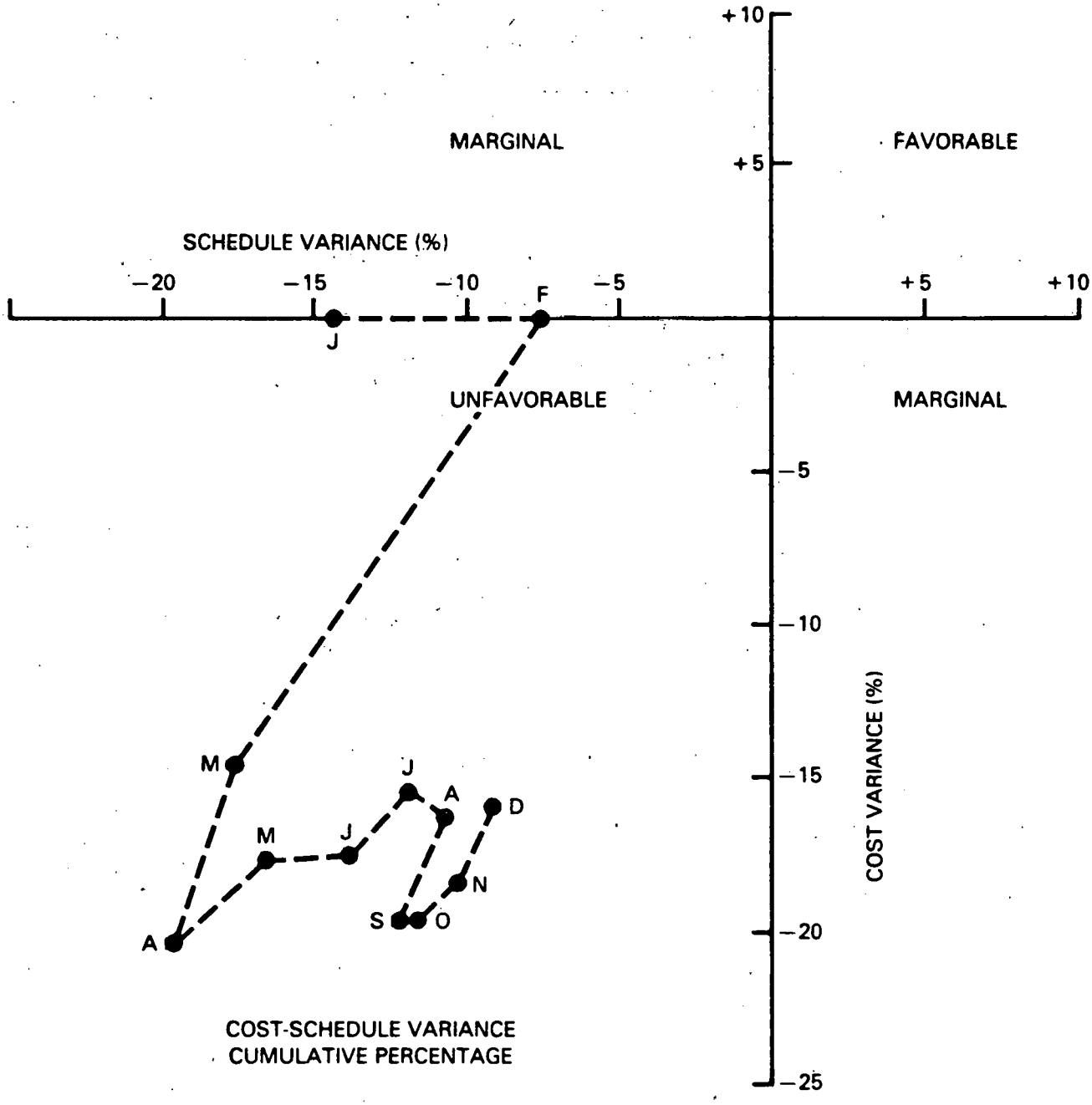


FIGURE 14: COST-SCHEDULE CARTESIAN COORDINATES

5. COST VARIANCE VERSUS AT COMPLETION VARIANCE (Figure 15)

a. Data Organization. This chart shows the relationship between the cumulative percentage Cost Variance and the predicted At Completion Variance as compiled in Table 5. Usually, the At Completion Variance line descends to meet the Cost Variance line. The CV line may be adjusted for the effect of withholding Management Reserve as previously described in Chapter IV. This chart may also be drawn using dollar variances.

b. Analysis. The At Completion Variance has changed direction at the end of October and is now showing a positive trend. This may be due to the two favorable trend months in the Cost Variance. One must determine the causes of these trends to determine their permanence. Should the old downward trend be reestablished, one would expect a "facing-up" to an eventual unfavorable At Completion Variance. This is the point at which the Management Reserve (if any is still held) will be compared to the net result of positive and negative cost variances in Column 14 of the CPR.

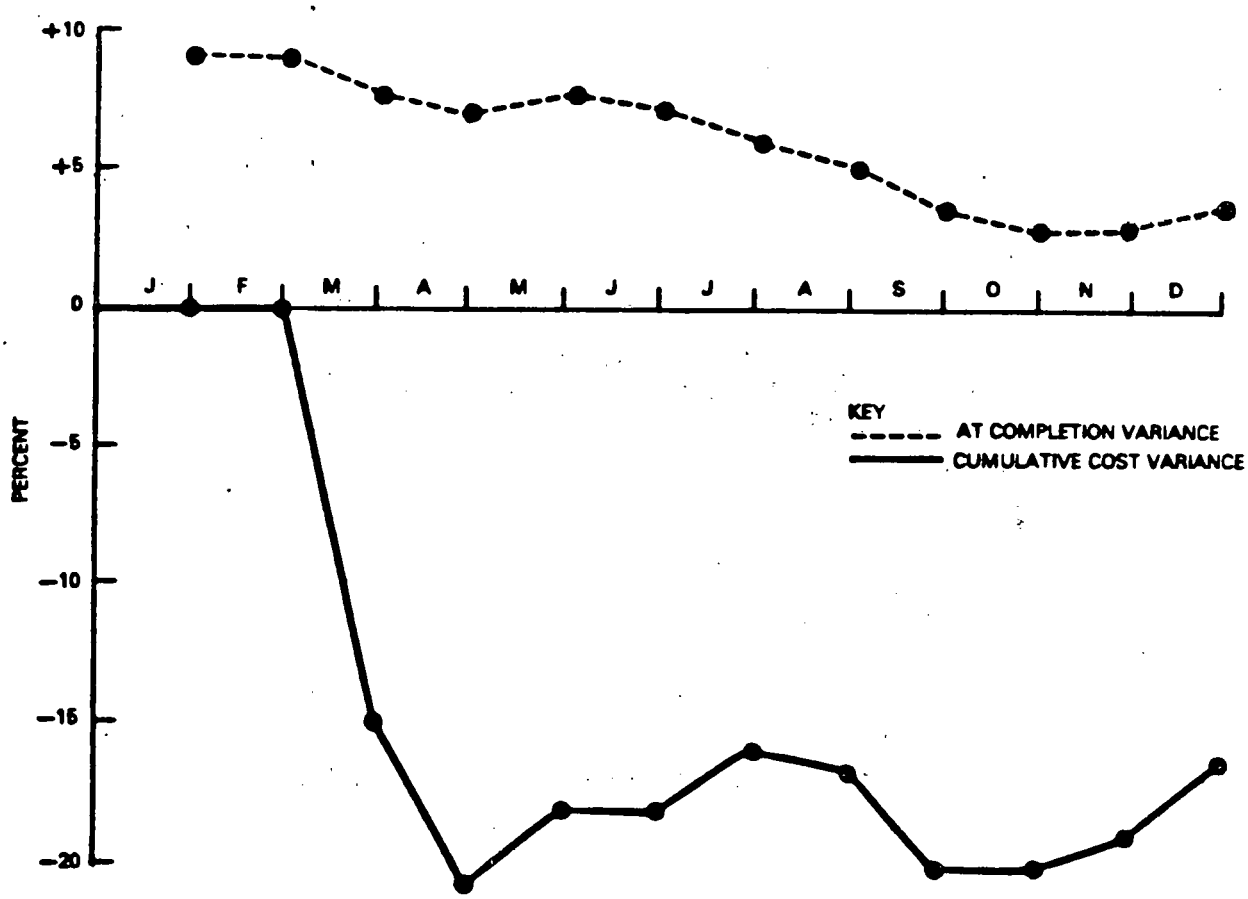


FIGURE 15: CUMULATIVE COST VARIANCE VS AT COMPLETION VARIANCE CHART

6. PERCENT COMPLETE VERSUS PERCENT SPENT Figure 16).

a. Data Organization. This is a comparison of the rate of expenditure (ACWP ÷ EAC) or (ACWP ÷ BAC) relative to the rate of work accomplished (BCWP ÷ BAC). The calculations are performed as previously explained. The results of these calculations for the contract are shown in Table 6.

Table 6

PERCENT COMPLETE AND PERCENT SPENT

Month	Percent Complete	Percent Spent	
	(BCWP)/(BAC)	(ACWP)/(EAC)	(ACWP)/(BAC)
J	0.81	0.89	0.81
F	1.90	2.09	1.90
M	2.91	3.61	3.33
A	3.79	4.92	4.56
M	5.06	6.46	5.96
J	6.13	7.79	7.22
J	8.22	10.11	9.50
A	11.09	13.63	12.91
S	14.07	17.50	16.85
O	17.97	22.22	21.53
N	22.46	27.48	26.64
D	26.97	32.46	31.30

Note that the percent spent based on the EAC is higher than that based on the BAC because an underrun is predicted at completion. The percent spent and percent complete for each month are plotted as a single point. Figure 16 uses data from Table 6. The percent spent selected is based on the EAC. An "Estimate-At-Completion" point (when all the work is done) is shown on the chart. This point is obtained from the formula:

$$\text{Percent Spent at Completion} = \frac{\text{EAC}}{\text{BAC}}$$

$$= \frac{\$281,960}{\$292,420}$$

$$= 96.4\%$$

This point is plotted at the intersection of a line drawn vertically from 96.4% spent and one drawn horizontally from 100% complete.

Note that the percent spent line can exceed 100% while the percent complete cannot.

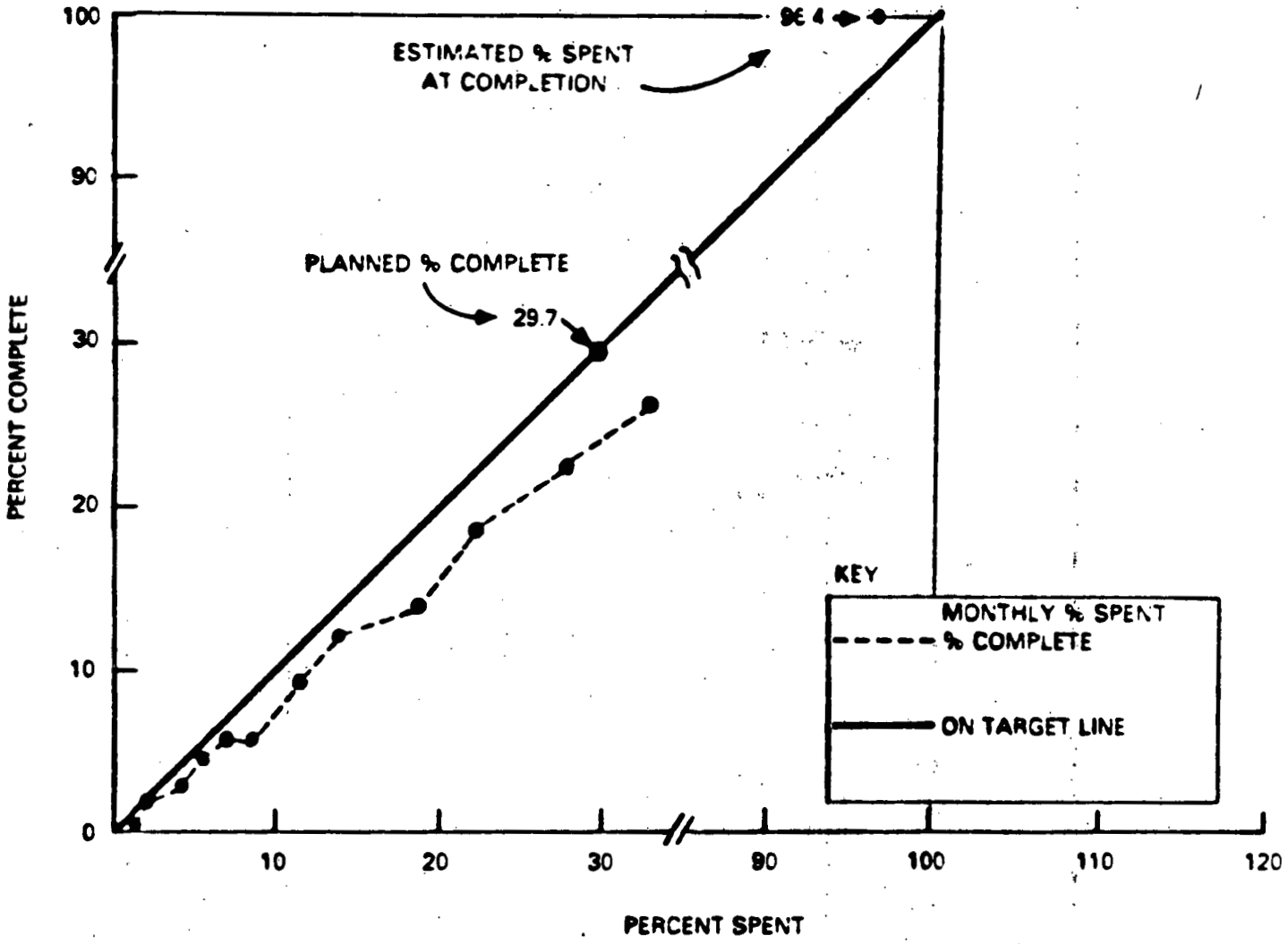


FIGURE 16: PERCENT COMPLETE VS PERCENT SPENT CHART

An "on target" 45-degree line is drawn from the origin (0% spent, 0% complete) to the 100% spent, 100% complete point. A point falling on this line indicates that accomplishment and spending are progressing together; above the line indicates accomplishment faster than spending (good), below the line, spending is faster than accomplishment (bad).

Another point of interest which has been added to this chart is the Planned Completion Percent. Since the planned completion is the BCWS, this figure can be determined from:

Planned Completion Percent = BCWS ÷ BAC

= $86,733 ÷ $292,420

= 29.7%

This point is plotted at the intersection of the 45-degree line with a horizontal line drawn from 29.7% complete. It provides a reference point for a quantitative measurement of deviation from "normal".

b. Analysis. Management should be notified whenever the trend direction changes, the "on target" line is crossed in either direction, or there is an abrupt change in slope.

An analysis of Figure 16 indicates that:

- Money is being spent faster than work is being accomplished.
- The situation is worsening each month.
- It appears questionable that the predicted favorable position at completion can be achieved.

The trend may be extrapolated out to its intersection with the 100% complete line to provide an indication of the expected cost at completion.

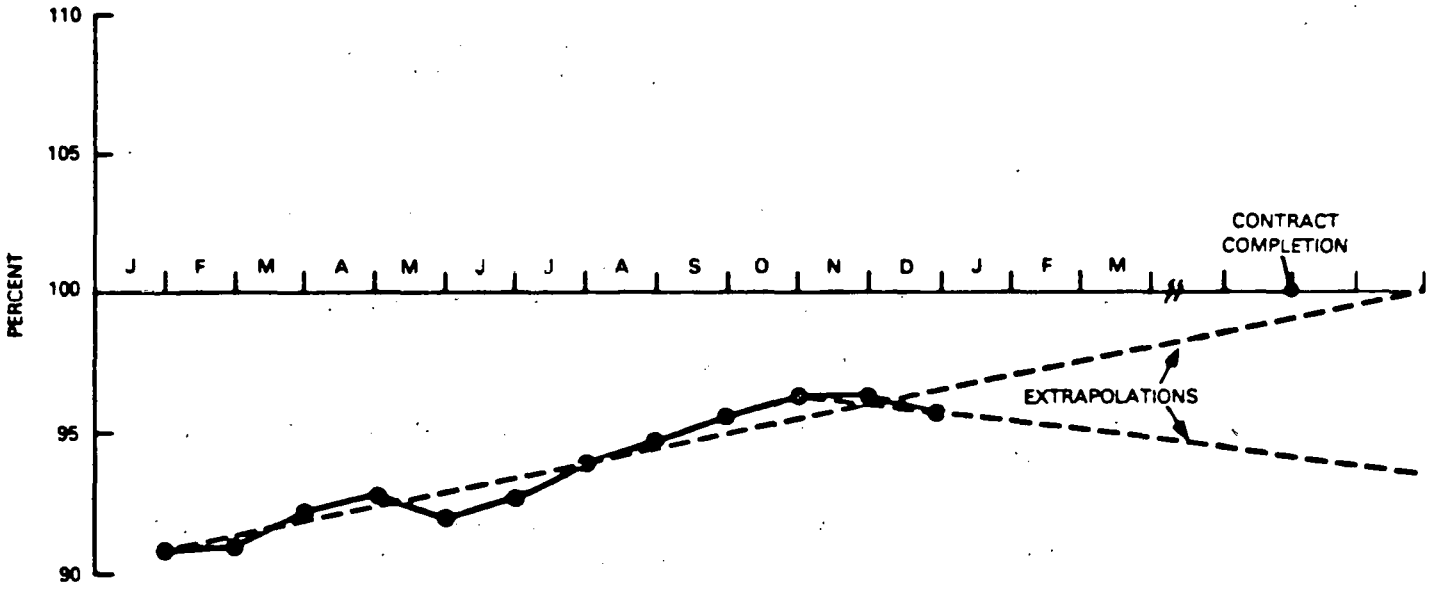
7. PERCENT SPENT AT COMPLETION (Figure 17).

a. Data Organization. This technique reflects the ratio between the contractor's latest estimated cost to complete all the authorized work and the budgeted cost for the same work. Since the monthly percentage reflects the contractor's assessment of the cost needed to complete all budgeted work, a percentage greater than 100 indicates an anticipated overrun budget and less than 100% indicates an underrun budget. The percent spent at completion is calculated by dividing the EAC by the BAC:

Percent Spent at Completion = EAC / BAC

The results of these calculations for the sample contract are displayed and plotted in Figure 17.

b. Analysis. Extrapolation of the data predicts an overrun unless a new trend is starting, indicated by the last three months data.



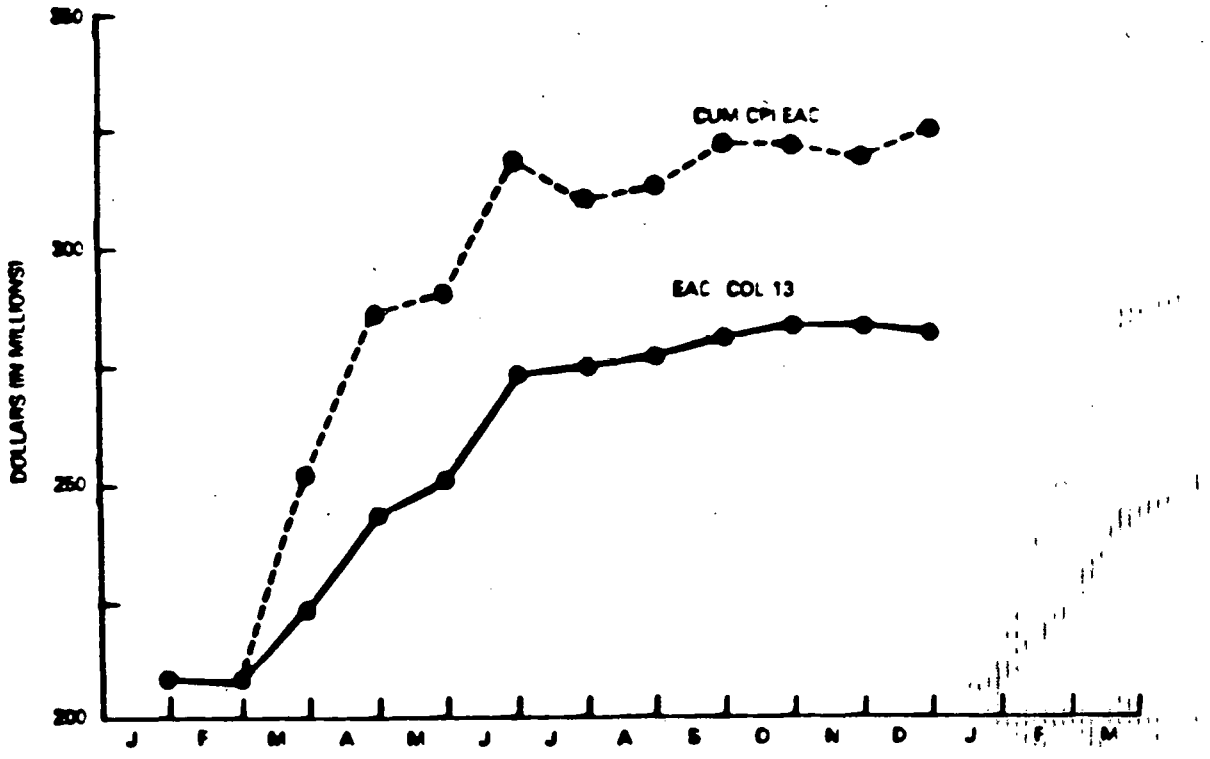
Month	% Spent At Completion EAC ÷ BAC	Month	% Spent At Completion EAC ÷ BAC
J	90.90	J	94.00
F	90.90	A	94.72
M	92.29	S	96.30
A	92.82	O	96.91
M	92.14	N	96.93
J	92.77	D	96.42

FIGURE 17: PERCENT SPENT AT COMPLETION

8. ESTIMATED COST AT COMPLETION (Figure 18).

a. Data Organization. Dividing the BAC by the cumulative CPI results in new EACs which for the sample contract, are displayed in Figure 18. Since this index is usually compared to the EAC as reported in the CPR, these data are also provided in Figure 18.

b. Analysis. The EAC developed from the cumulative CPI is $30 to $45 million over the EAC reported on the CPR. The divergence of the two EACs increases in each month with the exception of June when application of a substantial amount of Management Reserve is apparent. The EAC based on the cumulative CPI appears the more realistic figure, provided no significant breakthroughs are encountered in cost performance. In light of the cost performance experienced to date, the EAC as reported on the CPR appears optimistic.



Month	BAC-MR Cum CPI	CPR (Col. 13)	Month	BAC-MR Cum CPI	CPR (Col. 13)
J	208071	208071	J	310702	274883
F	208071	208071	A	313234	276983
M	252284	223326	S	322237	281600
A	287131	243324	O	322237	283386
M	290185	249990	N	319179	283438
J	319247	273102	D	325334	281960

FIGURE 18: ESTIMATED COST AT COMPLETION

9. COST PERFORMANCE INDEX (CPI) AND TO COMPLETE PERFORMANCE INDEX (TCPI) (Figures 19 and 20).

a. Data Organization. This technique compares the trend in CPI for work accomplished and that necessary to accomplish the remaining work in order to meet the BAC or EAC. The development of the CPI and the TCPI is delineated in Chapter IV under Performance Indices and Factors. The CPI's and TCPI's for the sample contract are shown in Table 7.

TABLE 7

CPI AND TCPI

Month	Inc CPI	Cum CPI	EAC TCPI	BAC TCPI
J	1.000	1.000	1.101	1.000
F	1.000	1.000	1.102	1.000
M	.723	.872	1.091	1.004
A	.742	.830	1.090	1.008
M	.907	.850	1.102	1.010
J	.848	.849	1.097	1.012
J	.919	.866	1.086	1.014
A	.841	.859	1.087	1.021
S	.757	.835	1.082	1.033
O	.833	.835	1.088	1.045
N	.879	.843	1.103	1.057
D	.968	.862	1.121	1.063

The data in Table 7 are graphically displayed in two charts,

- o TCPI (EAC) versus TCPI (BAC) in Figure 19.
- o TCPI (EAC) versus cumulative CPI in Figure 20.

b. Analysis

(1) TCPI (EAC) versus TCPI (BAC) (Figure 19). The higher the TCPI, the greater is the cost performance efficiency required to meet either the EAC or BAC. The distance between the two lines indicates the degree of optimism in the establishment of the EAC, the value most directly influenced by the contractor, relative to the BAC in the sample data. A look at these two formulae shows that the relationship between the EAC and the BAC establishes the difference in the two TCPI values:

$$\text{TCPI (EAC)} = (\text{BAC} - \text{BCWP}) \div (\text{EAC} - \text{ACWP})$$
$$\text{TCPI (BAC)} = (\text{BAC} - \text{BCWP}) \div (\text{BAC} - \text{ACWP})$$

The upward trend of the TCPI (BAC) line shown in Figure 19, indicates that it is becoming increasingly difficult to meet the BAC; that is, the amount of money available for the remaining work is decreasing relative to the amount of work left.

The disparity between the TCPI EAC and TCPI BAC, specifically the change in the direction of the TCPI (EAC) line during October, November and December, and any pronounced change in either TCPI should be examined in depth. Such questions as the following should be asked:

- Is work not being accomplished (BAC-BCWP) or is money being spent too fast (EAC-ACWP)?
- Is the EAC keeping pace with spending and work accomplishment?
- Which is the main contributor to the trends? BCWP? ACWP? EAC?

The TCPI alone does not tell the entire story. It should be compared with the CPI.

(2) CPI and TCPI (EAC) (Figure 20). The fact that the distance between the TCPI (EAC) line and the CPI (EAC) line remains approximately constant, beginning in May, means that a constant level of optimism is present in the establishment of the EAC. For the sample contract, the EAC is about 25 index points above the CPI indicating that a dramatic increase is required in work efficiency to meet the EAC.

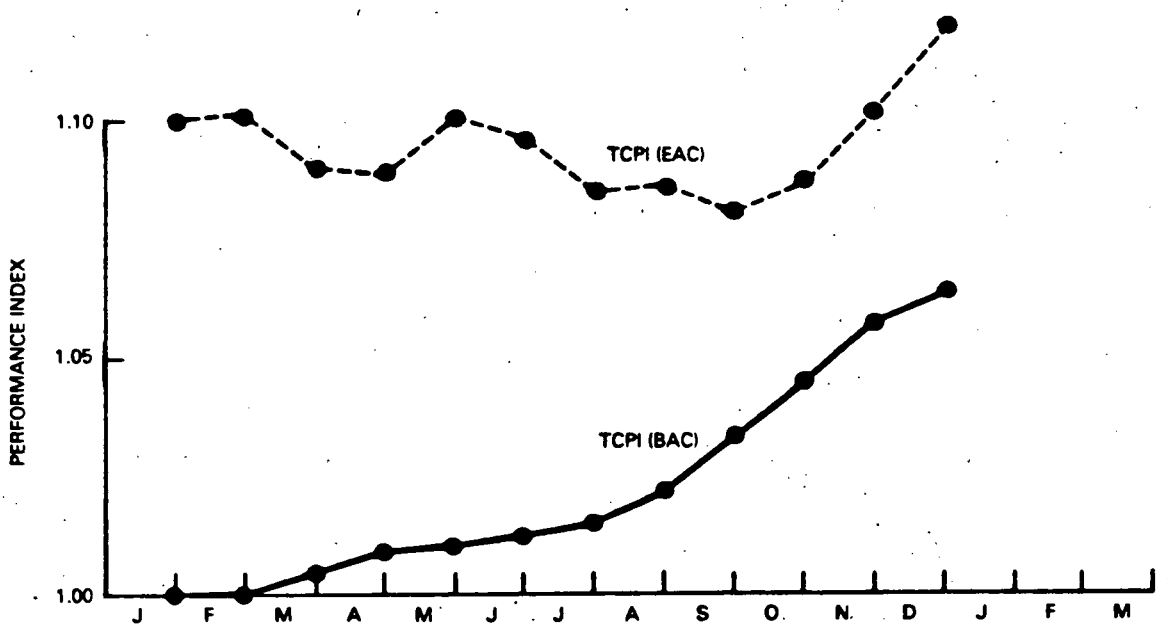


FIGURE 19: TCPI (EAC) VS TCPI (BAC)

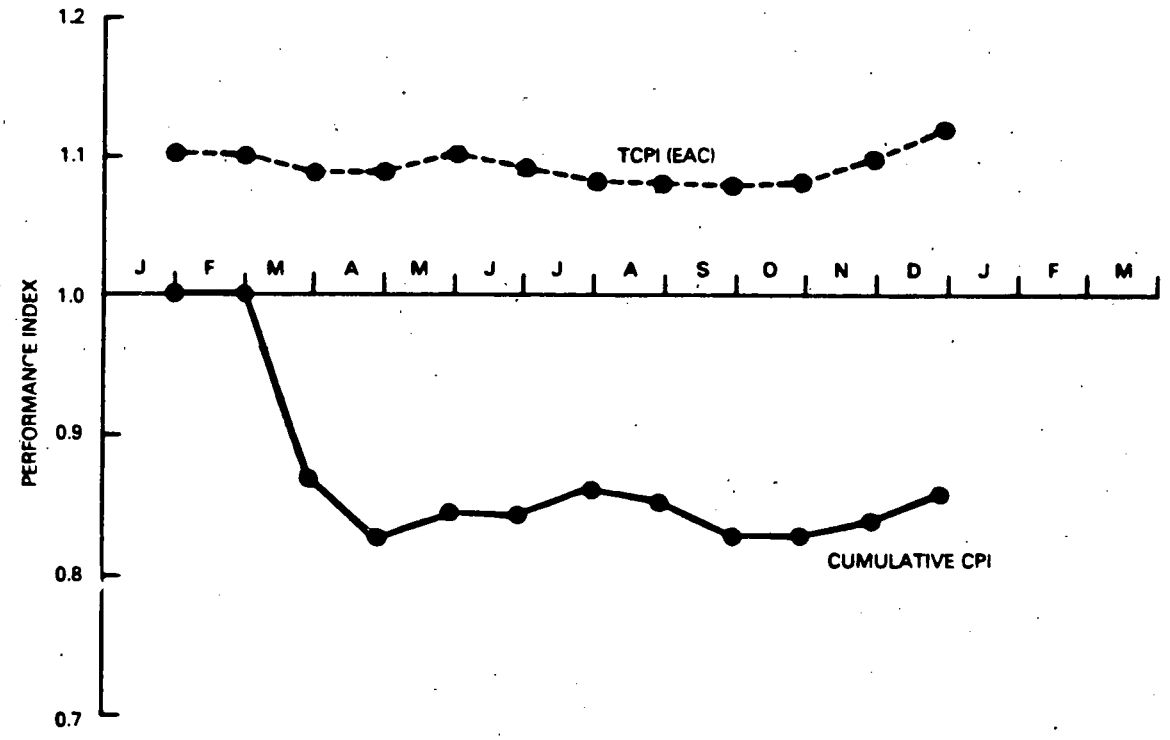


FIGURE 20: CPI VS TCPI (EAC)

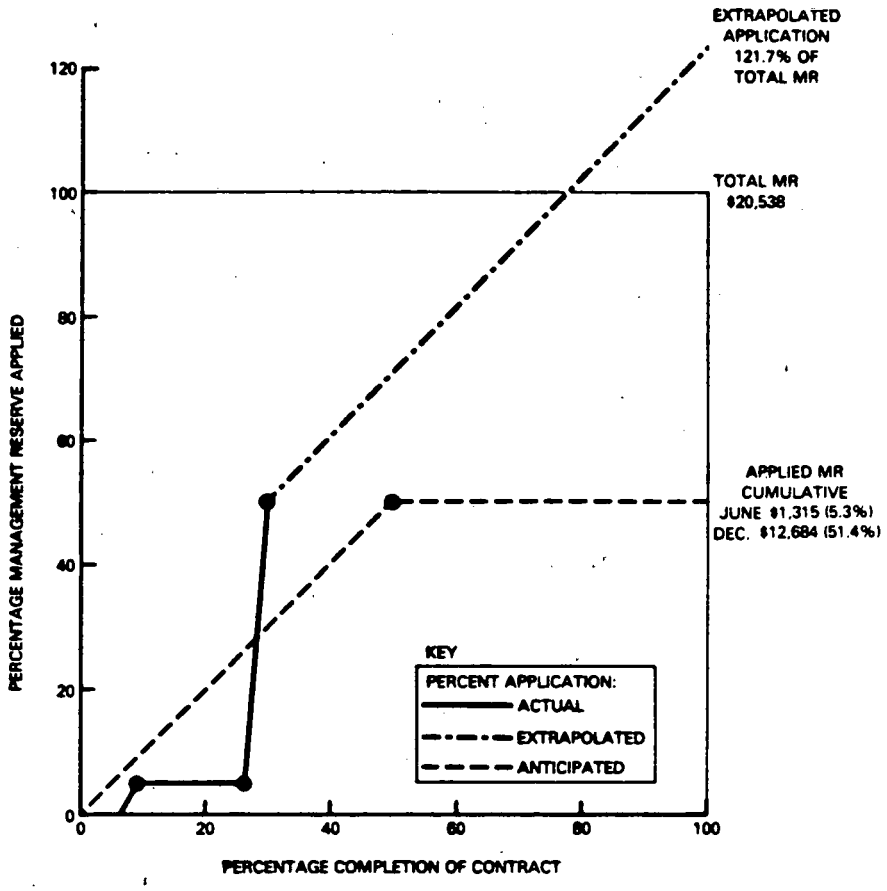
10. MANAGEMENT RESERVE APPLICATION (Figure 21).

a. Data Organization. The technique requires the comparisons of ratios of Management Reserve applied to total Management Reserve, and of BCWS to Budget at Completion. It provides the trend in applying Management Reserve (on a percentage basis) in relation to percent completion of the contract effort. The data are plotted on a chart with horizontal and vertical axes as percentages. Figure 21 displays tabular and graphic data from the sample project.

b. Analysis. An examination of the data indicates that at the end of December, 51.4% of the Management Reserve Budget has been applied while only 29.7% of the contract work has been scheduled. Extrapolating a normal, i.e. uniform rate of application of MR (a 45^{o} line from 0 to 100), but using as a starting point the actual percent of MR applied to date, indicates a significant over-application may be experienced -- see the dot-dash line in Figure 21. Comparing this extrapolation of the projected use of Management Reserve as reported in the "At Completion" portion of the Cost Performance Reports, and plotted in Figure 21 as a dashed line, indicates different results. This comparison should be discussed with the contractor to determine:

- What previous problems caused this present over-application of Management Reserve and have these problems been corrected?
- Can the indicated improvement in the projected application of Management Reserve Budget be attained?
- Is the remaining $11,982,000 (48.6%) Management Reserve budget adequate for the completion of the remaining 70.3% (100%-29.7%) of the contract work effort?

It should be recognized that the MR remaining must cover all cost, including G&A, which leaves only $10,538,000 to be applied to efforts on WBS elements.



	JAN	FEB	MAR	APR	MAY	JUNE
CUM BCWS / TOTAL BUDGET	2,153 / 228,900	4,687 / 228,900	8,507 / 241,992	12,287 / 262,151	16,381 / 271,323	20,909 / 294,393
% Complete of Contract	.9	2.1	3.5	4.7	6.0	7.1
CUM MR APPLIED / PEAK MR AVAILABLE	0 / 20,829	0 / 20,829	0 / 22,000	0 / 23,832	0 / 24,656	1,314 / 24,666
% AVAILABLE MR APPLIED	0	0	0	0	0	5.3

	JUL	AUG	SEP	OCT	NOV	DEC
CUM BCWS / TOTAL BUDGET	27,200 / 292,420	36,228 / 292,420	46,735 / 292,420	59,420 / 292,420	73,182 / 292,420	86,733 / 292,420
% Complete of Contract	9.3	12.4	16.0	20.3	25.3	29.7
CUM MR APPLIED / PEAK MR AVAILABLE	1,314 / 24,666	1,314 / 24,666	1,314 / 24,666	1,314 / 24,666	1,314 / 24,666	12,684 / 24,666
% AVAILABLE MR APPLIED	5.3	5.3	5.3	5.3	5.3	51.4

CONTRACT MANAGEMENT RESERVE	$ 24,666
CUMULATIVE APPLICATION	$ 12,684
REMAINING MANAGEMENT RESERVE	$ 11,982
% COMPLETION OF CONTRACT	29.7
% APPLICATION OF MR TO DATE	51.4
% EXTRAPOLATED APPLICATION	121.7
EXTRAPOLATED APPLICATION	$30,019

FIGURE 21: EXTRAPOLATION OF MANAGEMENT RESERVE APPLICATION

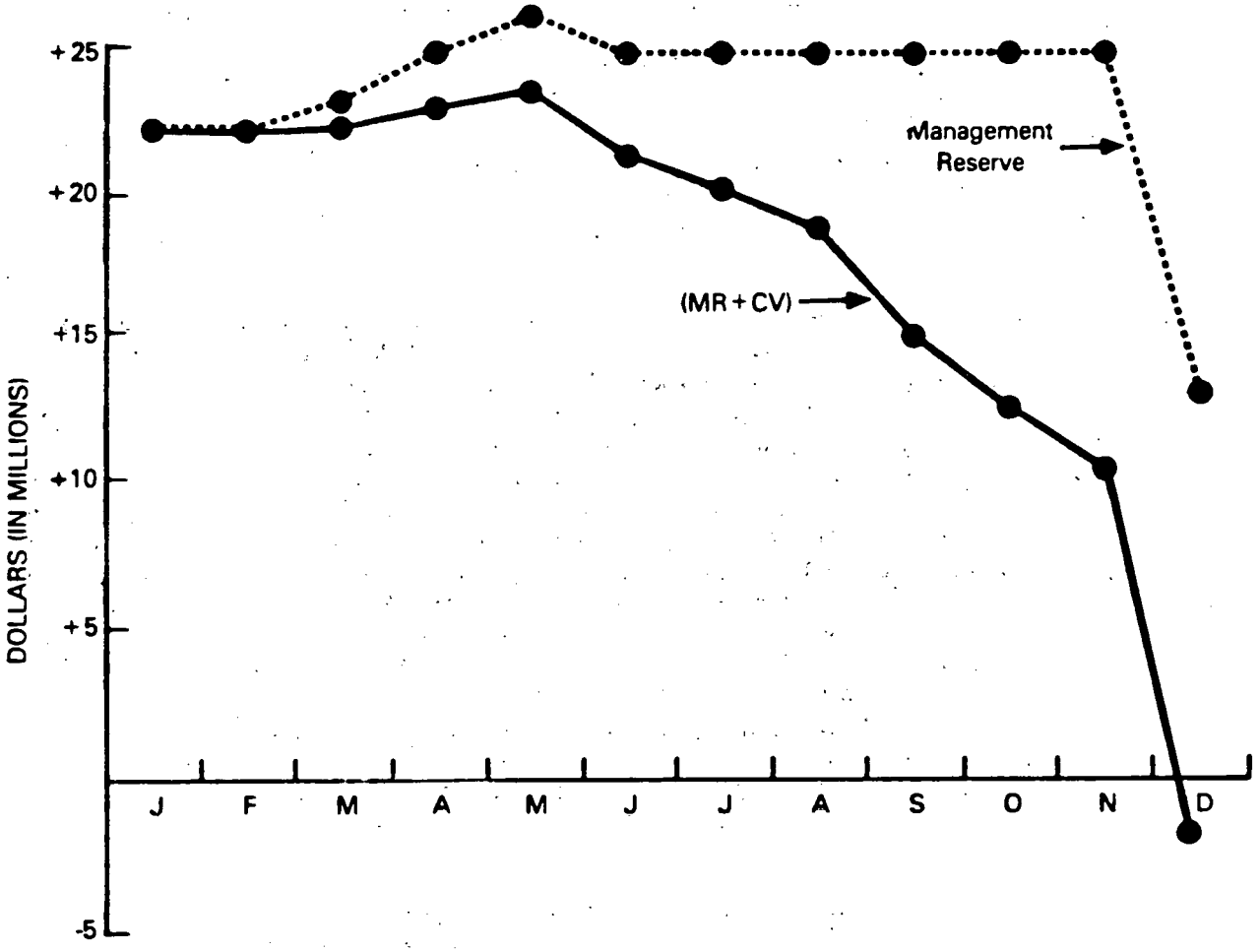
11. MANAGEMENT RESERVE USAGE VERSUS COST VARIANCE (Figure 22).

a. Data Organization. A way to view Management Reserve, for analysis purposes only, is to look at its effect on the cumulative-to-date Cost Variance in Column 11 of the CPR. The purpose of Management Reserve budget, like any other contract budget, is not to offset or act as a cushion against unfavorable Cost Variances; however, it has this effect in the calculations in Column 14 of the CPR. In order to examine this relationship, the algebraic sum of Management Reserve and the Cost Variance to date are obtained. The data from the CPR are tabulated and plotted in Figure 22.

b. Analysis. Management should be alerted to a significant slope change or reversal of a trend, or whenever a predetermined limit has been reached. This chart is especially adaptable for the application of control limits. Looking at Cost Variances alone can be misleading, especially when trying to gauge the effect the Cost Variance might eventually have on the At Completion Variance. For analysis, the Management Reserve can be considered to act as a cushion against the predicted At Completion Variance and can be viewed similarly against the cumulative to date Cost Variance. In the example, the application of Management Reserve during December does not affect the Cost Variance line in Figure 12. However, in Figure 22 the line showing the sum of Management Reserve and Cost Variance (MR+CV) has dropped below the zero line. This means the Management Reserve remaining is not enough to offset the Cost Variance and unless the contractor improves his efficiency, there will be an unfavorable At Completion Variance even if all the Management Reserve remaining is applied.

Also, questionable application of Management Reserve can effectively mask Cost Variance problems on trend charts such as in Figure 12. For example, large amounts of Management Reserve might be applied to bring about inflated budgets for additional work identified within the scope of the contract and scheduled for accomplishment in the near future. This could result in a positive cost variance for the new work which, if large enough, could offset negative Cost Variances in other areas of the contract and affect the slope of the trend line of Figure 12. Since the chart in Figure 22 shows the combined effect of cumulative Cost Variance and Management Reserve, the "true" cost variance position is visible. If the MR + CV line is below the Management Reserve line, the Cost Variance is unfavorable; if above, it is favorable.

The application of Management Reserve in December is clearly shown in Figure 22. When all Management Reserve has been applied this line will stop at zero, since there can be no negative Management Reserve. In that case, the (MR + CV) line will consist solely of the negative Cost Variance.



Month	MR (Col. 12)	CV (Col. 11)	(MR + CV)
J	18319	0	18319
F	18319	0	18319
M	19349	(1028)	18321
A	20960	(2035)	18925
M	21649	(2426)	19268
J	20538	(3203)	17335
J	20538	(3733)	16805
A	20538	(5320)	15218
S	20538	(8122)	12416
O	20538	(10411)	10127
N	20538	(12217)	8321
D	10538	(12647)	(2109)

FIGURE 22: MANAGEMENT RESERVE USAGE VS. COST VARIANCE

CHAPTER VI - AUTOMATED ANALYSIS

A. GENERAL

Preceding chapters of this Guide provide a collection of techniques available to manually analyze contractor cost and schedule performance data and to forecast future performance. This chapter briefly addresses automated processing and analysis of Cost Performance Report (CPR) data, as well as development of indices, relationships, trends, and projections. The advantages of these automated processes are apparent when they are compared with manual analysis of CPR data. The latter involves combining the latest reports with prior reports to depict progress versus plan, to generate trends, and to provide indicators of contract problems. Where a computer graphics capability is used, trend analysis is even more readily available.

While saving time in the analysis process, this automated aid should not be viewed as a substitute for, but as another input to carefully developed, in-depth analyses of performance. In addition to the basic data validation concerns, the user of automated analysis programs must recognize the need for validating the program both structurally and operationally. The DOE Controller should be consulted for advice with respect to automated analysis.

B. DATA DISPLAYS

Computer generated charts and tables used to plot cost and schedule performance data can be maintained and used in preparing overall independent assessment summaries of project status for higher level DOE management. The displays, which facilitate evaluation of project status at a summary level, are described below:

1. The Contract Performance Chart (Figure 23) provides the overall status of the contract or specific WBS element. This chart which is comparable to the Performance Measurement Chart (Figure 11), reflects changes to budgets, schedules, and estimates at completion as they have occurred since the beginning of the project. It also shows cumulative cost and schedule performance to date. Major baseline changes are easy to identify and, by showing the entire time span of the project, current status is put in proper perspective. This display depicts total project history and status; however, it does not highlight recent performance.

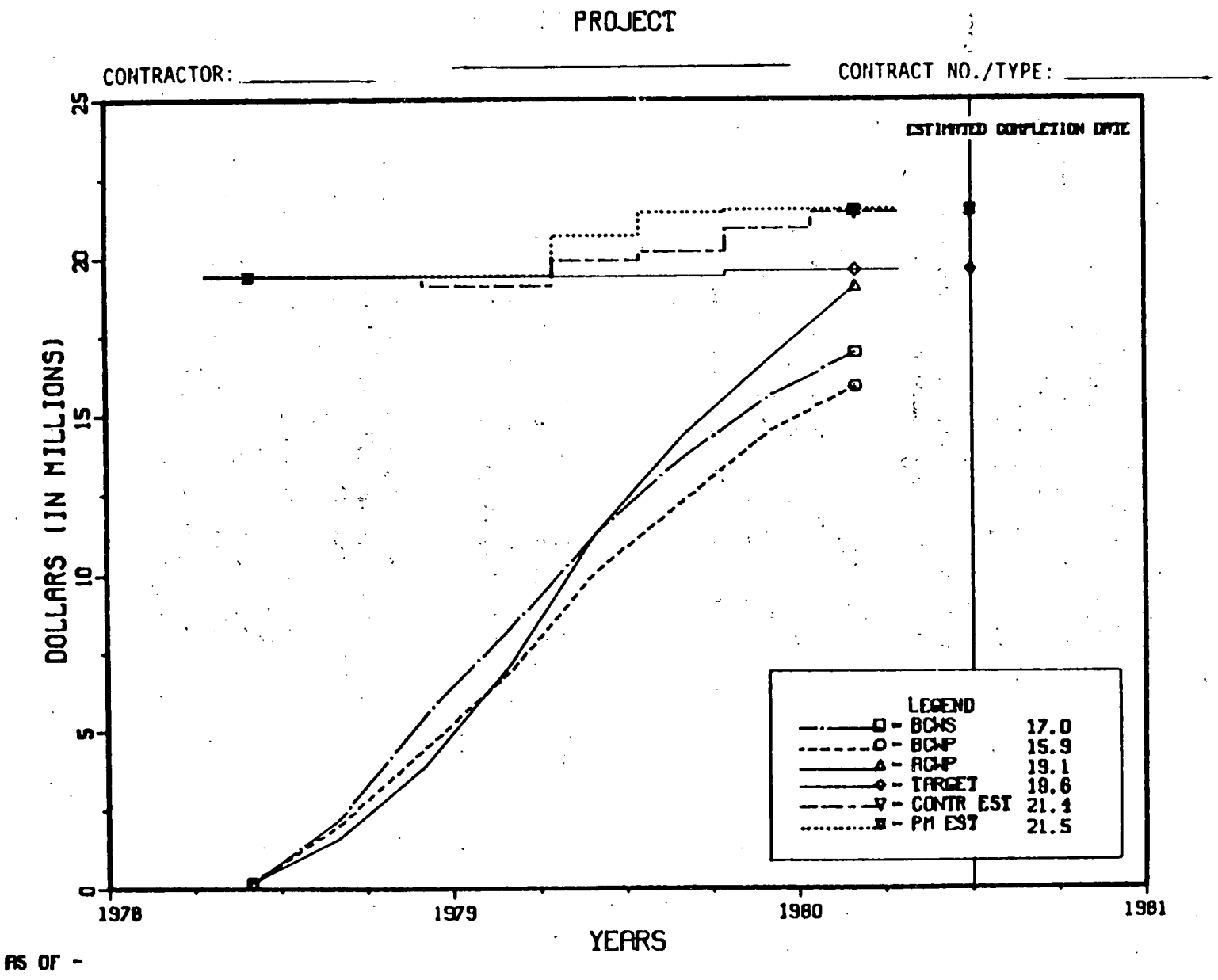


FIGURE 23: CONTRACT PERFORMANCE CHART

2. The Cost/Schedule Variance Trends Chart (Figure 24) is used in conjunction with the Contract Performance Chart and clearly shows the recent performance in relation to a 10% threshold band. The chart also provides visibility of the use of management reserve budget, which is not available on the preceding chart. Use of management reserve budget is a valuable indicator of problems and should be considered together with the cost variance trend line in assessing performance.

3. The Contract Performance Summary, in addition to the above charts, tabulates the data, also automatically, in both dollars and percentages. This summary includes also a Controller independent estimate of cost at completion, based on performance to date and a brief analysis of the latest available data. A sample of such a combined computer/analyst generated summary is provided in Figure 25.

Figures 23, 24 and 25 differ physically from other charts in this Guide since they are copies of actual outputs generated automatically from the DOE Controller computer capability.

C. USE OF OUTPUT PRODUCTS

A major objective of this type of CPR data analysis is to track project progress between acquisition key decision points and to focus DOE management's attention at the earliest possible time to projects which are experiencing unfavorable performance trends.

In addition to the above, a summary report of project cost and schedule performance can be prepared quarterly for use by higher levels of management. Management reporting in these summaries is on an exception basis; i.e., the reports are limited to those projects deviating from plan by 10% or more at the total project level.

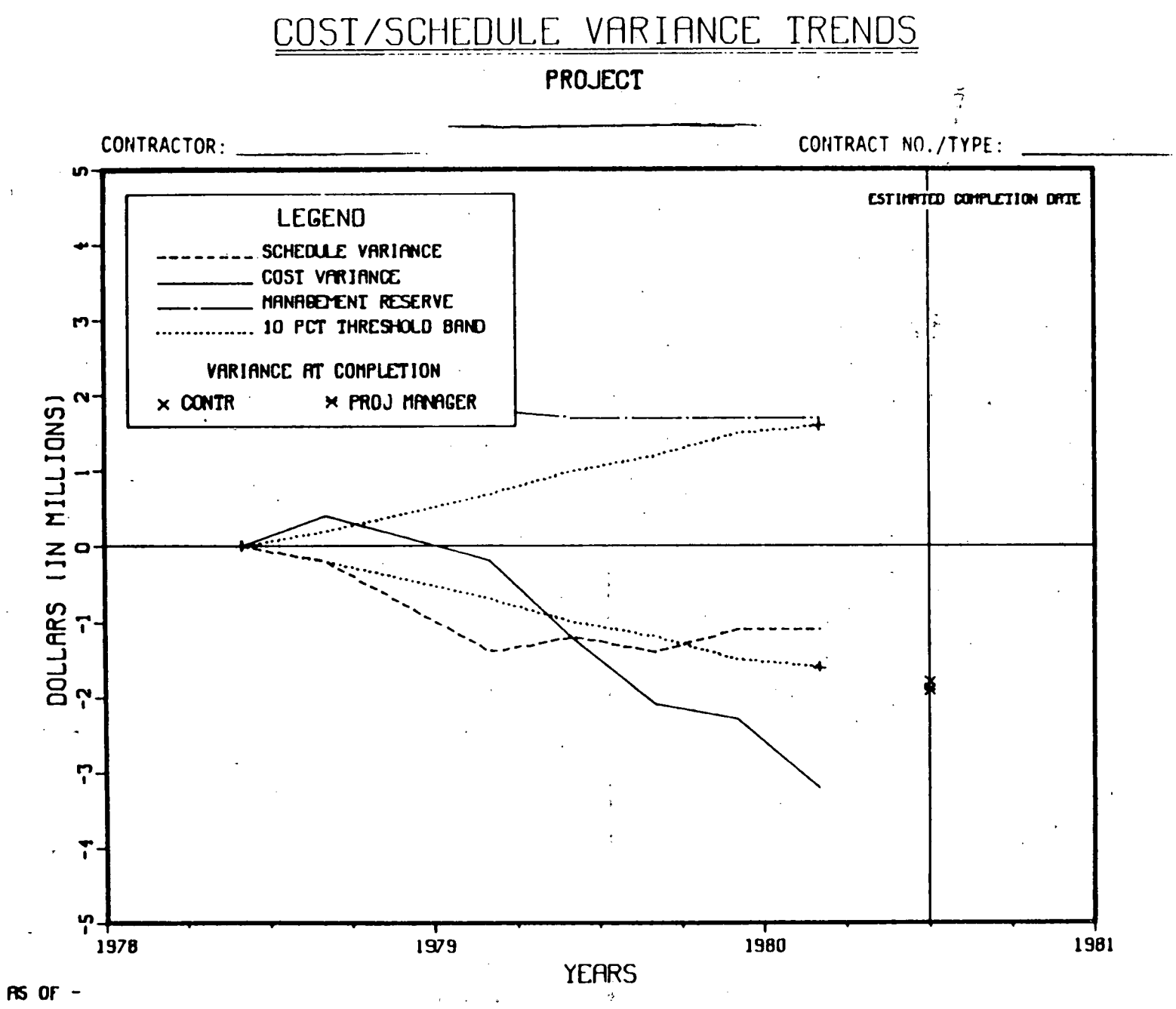


FIGURE 24: COST/SCHEDULE VARIANCE TRENDS CHART

CONTRACT PERFORMANCE SUMMARY

(DOLLARS IN MILLIONS)

SYSTEM:

REPORT PERIOD:

DESCRIPTION:
CONTRACT NO./TYPE:
CONTRACTOR:
REPRESENTS:

	DOLLARS	PERCENT
A. BUDGETED COST FOR WORK SCHEDULED(BCWS):	$17.0	87%
B. BUDGETED COST FOR WORK PERFORMED(BCWP):	$15.9	81%
C. ACTUAL COST OF WORK PERFORMED(ACWP):	$19.1	97%
D. SCHEDULE VARIANCE (B)-(A):	$-1.1	-6%
E. COST VARIANCE (B)-(C):	$-3.2	-20%
F. TARGET COST:	$19.6	100%
G. CONTRACTOR'S ESTIMATE AT COMPLETION:	$21.4	109%
H. VARIANCE AT COMPLETION (F)-(G):	$-1.8	-9%
I. PROJECT MANAGER'S ESTIMATE AT COMPLETION:	$21.5	110%
J. DOE CONTROLLER ESTIMATE AT COMPLETION:	$23.5	120%

REMARKS:

Contract is 81% complete. Cost and schedule variances are attributed to the welder's strike and to delay of subcontractor component deliveries which resulted in a four-month delay in first deliveries and two-month delay in final deliveries. However, while schedule trends have been stable since the strike, costs continue to deteriorate. Furthermore, two of the first three items failed tests, requiring redesign of sub-components; another component failed initial qualification test.

The DOE Controller estimate is based on performance to date and does not address the cost and schedule impact of the problems addressed above. The estimate will be revised when the impact of the component problems can be fully established.

BCWS - THE VALUE OF THE WORK THE CONTRACTOR PLANNED TO ACCOMPLISH
BCWP - THE VALUE OF THE WORK THE CONTRACTOR HAS ACTUALLY COMPLETED
ACWP - THE ACTUAL COST OF THE COMPLETED WORK

FIGURE 25: CONTRACT PERFORMANCE SUMMARY

Attachment 1

GUIDELINES FOR ESTABLISHING THRESHOLDS FOR VARIANCE ANALYSIS REPORTING

TYPE OF VARIANCE			FREQUENCY		COMPLETION STAGE OF CONTRACT		DEGREE OF VARIANCE PERCENT & DOLLARS*
COST		SCHEDULE					
CUM.	INCREM.		MONTHLY	QUARTERLY	FIRST 1/4	LAST 3/4	
X			X		X		± 10% & more than $8000
	X		X		X		± 25% & more than $5000
X			X			X	± 5% & more than $12000
	X		X			X	± 25% & more than $5000
		X		X	X		± 15% & more than $12000
		X		X		X	± 10% & more than $18000

* BOTH CONDITIONS MUST BE MET.

RATIONALE FOR GUIDELINES

- The higher tolerances in the first 1/4 of the contract are to allow for "settling down". Normally, greater ranges of variance are to be expected in the earlier stages until cumulative effects establish a more valid trend.
- Wider % tolerances for incremental variances reflect normally expected wider fluctuations of incremental % variances.
- A schedule variance is more prone to have greater fluctuation than a cost variance and could still be in a controlled situation.
- Monitoring of schedule variance is more meaningful when done on a quarterly basis rather than on a monthly basis.

Comments: The above guidelines for dollars variance were based on a contract value of approximately $50,000,000. These dollar variance guidelines are for guidance purposes only. Each contract requires reviews for individual tailoring.

ADDITIONAL GUIDELINES

Restrictions:

- Variance Analysis must be provided on all variances over $100,000 regardless of whether it is within the percentage allowance.

Exemptions for repetitive cumulative variances (Consecutive cumulative sub-task variances on which a variance analysis has previously been provided):

- Variance analysis is not required if the cumulative variance is favorable.
- Variance analysis is not required if an unfavorable cumulative variance has a favorable incremental variance.
- Only an incremental variance analysis is required when an unfavorable cumulative variance has an unfavorable incremental variance.

Note: In these above three exemptions, reference should be made to the monthly report which explains the causes of the variance. In addition, the contractor can comment as he may see fit.

RATIONALE FOR ADDITIONAL GUIDELINES

- Dollar size of the variance becomes predominant when it exceeds a certain size.
- Favorable variances are not as critical in monitoring the program as unfavorable variances. Most project attention centers on the unfavorable variances rather than the favorable variances.
- As long as favorable incremental variances are taking place on cumulative unfavorable variances, it can be construed that effective corrective action is being accomplished.
- An incremental variance analysis will provide more insight when variance analysis is required on repetitive cumulative variances. (Previous cumulative variance analysis having been provided.)

Comments: The above guidelines for dollars variance were based on a contract value of approximately $50,000,000. These dollar variance guidelines are for guidance purposes only. Each contract requires reviews for individual tailoring.

Attachment 2

SUBMITTING DATA ANALYSIS TECHNIQUES

Users of this guide are encouraged to furnish data analysis techniques for consideration for use in future editions. A review of the techniques used on a particular project may identify examples of analysis which can be adapted to other projects. The proposed techniques should be sent in duplicate to the Office of the Controller, Department of Energy, Washington, D.C. 20585. The suggested format for this submission is shown below and is followed by an example of a completed format.

SUGGESTED FORMAT

Title
Select a title consistent with the analysis technique (e.g., percentage relationship, performance index, etc.) presented.

Author
Name(s) of person (s) who developed the technique.

Narrative
Explain the technique in clear, concise terms, using the following outline:

- Purpose. Identify a typical situation to be analyzed by applying the technique. Explain the type of data needed. Realistic examples are desired, but names of specific projects and contractors or propriety information should not be used. Hypothetical situations should be used as a background for the technique.

- Source of Data. Identify the origin of the data used. Indicate who prepares the data before it is analyzed, frequency of updating, and the method of obtaining the data.

- Organization of Data. Describe the data obtained and its arrangement (e.g., tables, graphs, etc.) prior to analysis.

- Application. Explain how the technique was used to analyze the situation identified in the "Purpose" section, how the information is used, and how often the analysis should be done.

- Conclusion. State benefits gained by applying the technique. Identify strengths and weaknesses of the technique in view of the results obtained. Indicate how the technique may be refined to become more effective in the future.

- Recommendation. Note the potential for applying this technique to other situations. Suggest criteria for its application to other contracts and projects.

EXAMPLE OF DATA ANALYSIS TECHNIQUE SUBMISSION

Title: Performance Indices Tracking

Author: T. Andrews, Project Control, Energistic Project Office

Purpose:

The purpose of this analysis technique is to estimate if the Actual Cost for Work Performed (ACWP) will exceed the Budget at Completion (BAC). This is done by calculating and plotting the Cost Performance Index (CPI) (past cost efficiency) and the To Complete Performance Index (TCPI) which must be achieved on the remaining contract effort to bring the ACWP in at budget.

Source of Data:

Contractor submitted Cost Performance Report (CPR).

Organization of Data:

The following CPR data were tabulated by month:

Cumulative To Date BCWP,
Cumulative To Date ACWP, and
Budget At Completion

The following indices were then calculated and tabulated by month:

$$\text{Cost Performance Index (CPI) to Date} = \frac{\text{BCWP (Col. 8)}}{\text{ACWP (Col. 9)}}$$

$$\text{TCPI} = \frac{\text{Work Left}}{\text{Money Left}} = \frac{\text{BAC (Col. 12)} - \text{BCWP (Col. 8)}}{\text{BAC (Col. 12)} - \text{ACWP (Col. 9)}}$$

Application:

The CPI and TCPI were plotted each month over the period for which data were available (See Figure A-1). Examination of the plots reveals that the CPI started at a value greater than 1.00 and somewhat gradually declined to a value of 0.92. The TCPI started at a value slightly less than 1.00, crossed the value of 1.00 at the same time as the CPI (going in the opposite direction) and then curved rapidly upward. As the TCPI increased, the potential existed for the ACWP at completion to exceed the BAC. At 24 months into the contract, where the CPI was 0.96 and the TCPI was 1.05, there was an

appreciable chance that the ACWP at completion would overrun the BAC. At 28 months into the contract, where the CPI was 0.95 and the TCPI was 1.10, there was a very good chance that the ACWP at completion would exceed the BAC. At 31 months into the contract, where the CPI had degraded to 0.92 and TCPI had climbed to 1.24, it could be stated with near certainty that ACWP at completion would exceed the BAC. It was at this point that the contractor admitted that an overrun of BAC would occur. The rising trend of the TCPI beyond 21 months indicated that recovery was not possible.

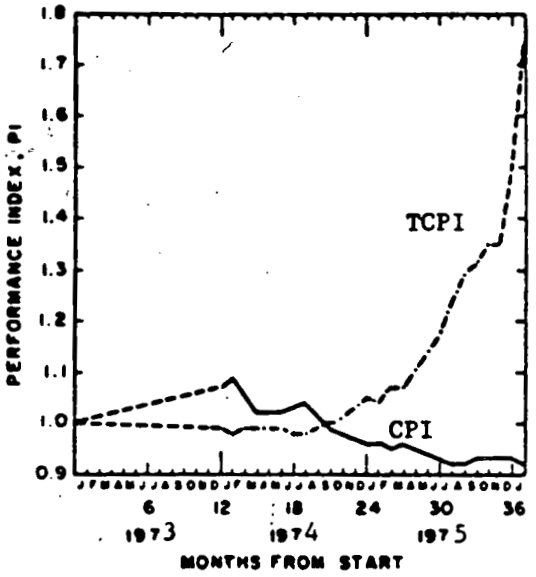


Figure A-1.
PERFORMANCE INDICES VERSUS TIME

Conclusion:

Comparison of the CPI with the TCPI, over a number of months indicated that the ACWP would exceed the BAC. This analysis technique was developed using historical data and it was not in use on the contract from which the data were obtained. Further experience is needed with this technique in order to determine index values which would provide an early indication that a contractor will overrun the BAC.

Recommendation:

It is recommended that project management on new projects calculate and track the TCPI as well as the CPI in order to estimate a contractor's possibility of completing the contract on budget.

ATTACHMENT 3

BASIC DATA FOR SAMPLE PROJECT

TWELVE MONTHLY COST PERFORMANCE REPORTS, FORMAT 1

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2) (2222)	Energistic	1-1-XX to 1-31-XX	J. S. Browning
LOCATION: Germantown, Maryland				TITLE: Project Director
				DATE: 2-6-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$228,900	-0-	$6867/3%	$235,767	$214,313	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHED-ULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1280	1190	1116	(90)	74	1280	1190	1116	(90)	74	62900	62900	0
SITE & BLDGS.	42	0	34	(42)	(34)	42	0	34	(42)	(34)	48900	48900	0
BALANCE OF PLANT	18	14	19	(4)	(5)	18	14	19	(4)	(5)	14500	14500	0
TRAINING	1	0	0	(1)	-	1	0	0	(1)	-	1400	1400	0
SUPPORT EQUIP.	0	0	0	-	-	0	0	0	-	-	2300	2300	0
SYS. TEST & EVAL.	30	42	43	12	(1)	30	42	43	12	(1)	22000	22000	0
PROJ. MGT.	508	363	393	(145)	(30)	508	363	393	(145)	(30)	18000	18000	0
DATA	15	14	18	(1)	(4)	15	14	18	(1)	(4)	7900	7900	0
FUEL	0	0	0	-	-	0	0	0	-	-	5100	5100	0
WBS Subtotal	1894	1623	1623	(271)	0	1894	1623	1623	(271)	0	183000	183000	0
GENERAL AND ADMINISTRATIVE	259	222	222	(37)	0	259	222	222	(37)	0	25071	25071	0
UNDISTRIBUTED BUDGET,											0	0	
SUBTOTAL	2153	1845	1845	(308)	0	2153	1845	1845	(308)	0	208071	208071	0
MANAGEMENT RESERVE											20829		20829
TOTAL	2153	1845	1845	(308)	0	2153	1845	1845	(308)	0	228900	208071	20829

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2, (2222)	Energistic	2-1-XX to 2-28-XX	J. S. Browning TITLE Project Director DATE 3-6-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$228,900	-0-	$6867/3%	$235,767	$214,313	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST			
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1191	957	989	(234)	(32)	2471	2147	2105	(324)	42	62900	62900	0
SITE AND BLDGS.	115	203	202	88	1	157	203	236	46	(33)	48900	48900	0
BALANCE OF PLANT	35	267	268	232	(1)	53	281	287	228	(6)	14500	14500	0
TRAINING	1	3	3	2	-	2	3	3	1	-	1400	1400	0
SUPPORT EQUIP.	0	0	0	-	-	0	0	0	-	-	2300	2300	0
SYS. TEST & EVAL.	241	203	192	(38)	11	271	245	235	(26)	10	22000	22000	0
PROJ. MGT.	624	542	521	(82)	21	1132	905	914	(227)	(9)	18000	18000	0
DATA	21	25	25	4	-	36	39	43	3	(4)	7900	7900	0
FUEL	0	0	0	-	-	0	0	0	-	-	5100	5100	0
WBS Subtotal	2228	2200	2200	(28)	0	4122	3823	3823	(299)	0	183000	183000	0
GENERAL AND ADMINISTRATIVE	306	302	302	(4)	0	565	524	524	(41)	0	25071	25071	0
UNDISTRIBUTED BUDGET											0	0	
SUBTOTAL	2534	2502	2502	(32)	0	4687	4347	4347	(340)	0	208071	208071	0
MANAGEMENT RESERVE											20829		20829
TOTAL	2534	2502	2502	(32)	0	4687	4347	4347	(340)	0	228900	208071	20829

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2) (2222)	Energistic	3-1-XX to 3-31-XX	J. S. Browning TITLE Project Director DATE 4-7-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$228,900	$13,092	$6867/3%	$235,767	$230,026	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHED-ULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1602	1031	1555	(571)	(524)	4073	3178	3660	(895)	(482)	62900	62900	0
SITE AND BLDGS	264	202	240	(62)	(38)	421	405	476	(16)	(71)	53504	56436	(2932)
BALANCE OF PLANT	360	101	365	(259)	(264)	413	382	652	(31)	(270)	14500	14500	0
TRAINING	6	5	7	(1)	(2)	8	8	10	-	(2)	1443	1443	0
SUPPORT EQUIP.	0	0	0	-	-	0	0	0	-	-	2300	2300	0
SYS. TEST & EVAL.	414	432	425	18	7	685	677	660	(8)	17	22267	22267	0
PROJ. MGT.	632	545	549	(87)	(4)	1764	1450	1463	(314)	(13)	18087	18087	0
DATA	82	46	125	(36)	(79)	118	85	168	(33)	(83)	7938	7938	0
FUEL	0	0	0	-	-	0	0	0	-	-	5100	5100	0
WBS Subtotal	3360	2362	3266	(998)	(904)	7482	6185	7089	(1297)	(904)	188039	190971	(2932)
GENERAL AND ADMINISTRATIVE	460	323	447	(137)	(124)	1025	847	971	(178)	(124)	25761	26163	(402)
UNDISTRIBUTED BUDGET											6192	6192	
SUBTOTAL	3820	2685	3713	(1135)	(1028)	8507	7032	8060	(1475)	(1028)	219992	223326	(3334)
MANAGEMENT RESERVE											22000		22000
TOTAL	3820	2685	3713	(1135)	(1028)	8507	7032	8060	(1475)	(1028)	241992	223326	18666

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, March 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2) (2222)	Energistic	4-1-XX to 4-30-XX	J. S. Browning TITLE Project Director DATE 5-7-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$231,110	$31,041	$6933/3%	$238,043	$250,624	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST			
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1445	1100	1606	(345)	(506)	5518	4278	5266	(1240)	(988)	63367	63801	(434)
SITE AND BLDGS.	327	217	253	(110)	(36)	748	622	729	(126)	(107)	62616	66328	(3712)
BALANCE OF PLANT	362	120	265	(242)	(145)	775	502	917	(273)	(415)	16205	16460	(255)
TRAINING	10	6	6	(4)	-	18	14	16	(4)	(2)	1578	1578	0
SUPPORT EQUIP.	0	0	0	-	-	0	0	0	-	-	2300	2300	0
SYS. TEST & EVAL.	472	392	587	(80)	(195)	1157	1069	1247	(88)	(178)	22923	22923	0
PROJ. MGT.	640	662	682	22	(20)	2404	2112	2145	(292)	(33)	18294	18294	0
DATA	69	51	35	(18)	16	187	136	203	(51)	(67)	8057	8057	0
FUEL	0	0	0	-	-	0	0	0	-		5100	5100	0
WBS Subtotal	3325	2548	3434	(777)	(886)	10807	8733	10523	(2074)	(1790)	200440	204841	(4401)
GENERAL AND ADMINISTRATIVE	455	349	470	(106)	(121)	1480	1196	1441	(284)	(245)	27460	28063	(603)
UNDISTRIBUTED BUDGET											10419	10419	
SUBTOTAL	3780	2897	3904	(883)	(1007)	12287	9929	11964	(2358)	(2035)	238319	243323	(5004)
MANAGEMENT RESERVE											23832		23832
TOTAL	3780	2897	3904	(883)	(1007)	12287	9929	11964	(2358)	(2035)	262151	243323	18828

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, April 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2) (2222)	Energistic	5-1-XX to 5-31-XX	J. S. Browning TITLE Project Director DATE 6-5-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$257,531	$13,792	$7726/3%	$265,257	$257,490	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHED-ULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1652	1387	1823	(265)	(436)	7170	5665	7089	(1505)	(1424)	67438	68650	(1212)
SITE AND BLDGS.	357	325	241	(32)	84	1105	947	970	(158)	(23)	66562	68024	(1462)
BALANCE OF PLANT	345	396	237	51	159	1120	898	1154	(222)	(256)	19388	19645	(257)
TRAINING	7	8	6	1	2	25	22	22	(3)	0	1660	1660	0
SUPPORT EQUIP.	0	0	0	0	0	0	0	0	0	0	2300	2300	0
SYS. TEST & EVAL.	540	429	625	(111)	(196)	1697	1498	1872	(199)	(374)	23574	23574	0
PROJ. MGT.	646	702	722	56	(20)	3050	2814	2867	(236)	(53)	18498	18498	0
DATA	53	100	37	47	63	240	236	240	(4)	(4)	8172	8172	0
FUEL	0	0	0	0	0	0	0	0	0	0	5100	5100	0
WBS Subtotal	3600	3347	3691	(253)	(344)	14407	12080	14214	(2327)	(2134)	212692	215623	(2931)
GENERAL AND ADMINISTRATIVE	494	459	506	(35)	(47)	1974	1655	1947	(319)	(292)	29138	29540	(402)
UNDISTRIBUTED BUDGET											4827	4827	
SUBTOTAL	4094	3806	4197	(288)	(391)	16381	13735	16161	(2646)	(2426)	246657	249990	(3333)
MANAGEMENT RESERVE											24666		24666
TOTAL	4094	3806	4197	(288)	(391)	16381	13735	16161	(2646)	(2426)	271323	249990	21333

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2) (2222)	Energistic	6-1-XX to 6-30-XX	J. S. Browning
LOCATION: Germantown, Maryland				TITLE: Project Director DATE: 7-6-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$273,749	$20,644	$8,212/3%	$281,961	$281,295	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST			
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	1840	1706	2230	(134)	(524)	9010	7371	9319	(1639)	(1948)	69336	70192	(856)
SITE AND BLDGS.	410	353	395	(57)	(42)	1515	1300	1365	(215)	(65)	73896	74489	(593)
BALANCE OF PLANT	340	375	363	35	12	1460	1273	1517	(187)	(244)	21207	21570	(363)
TRAINING	10	9	10	(1)	(1)	35	31	32	(4)	(1)	1795	1795	0
SUPPORT EQUIP.	0	0	0	0	0	0	0	0	0	0	2300	2300	0
SYS. TEST & EVAL.	641	584	692	(57)	(108)	2338	2082	2564	(256)	(482)	24128	24128	0
PROJ. MGT.	687	723	742	36	(19)	3737	3537	3609	(200)	(72)	18667	18667	0
DATA	55	54	55	(1)	(1)	295	290	295	(5)	(5)	8267	8267	0
FUEL	0	0	0	0	0	0	0	0	0	0	5100	5100	0
WBS Subtotal	3983	3084	4487	(179)	(683)	18390	15884	18701	(2506)	(2817)	224696	226508	(1812)
GENERAL AND ADMINISTRATIVE	545	521	615	(25)	(95)	2519	2176	2562	(343)	(386)	30782	31031	(249)
UNDISTRIBUTED BUDGET											15563	15563	
SUBTOTAL	4528	4325	5102	(204)	(778)	20909	18060	21263	(2849)	(3203)	271041	273102	(2061)
MANAGEMENT RESERVE											23352		23352
TOTAL	4528	4325	5102	(204)	(778)	20909	18060	21263	(2849)	(3203)	294393	273102	21291

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, June 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/	Energistic	7-1-XX to	J. S. Browning
LOCATION:	(10-10-10-2)		7-31-XX	TITLE: Project Director
Germantown, Maryland	(2222)			DATE: 8-6-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$288,525	$3,895	$8756/3%	$297,281	$283,129	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHED-ULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	2122	2045	2243	(77)	(198)	11132	9416	11562	(1716)	(2146)	71234	73022	(1788)
SITE AND BLDGS.	1687	1530	1636	(157)	(106)	3202	2830	3001	(372)	(171)	79494	81822	(2328)
BALANCE OF PLANT	444	451	499	7	(48)	1904	1724	2016	(180)	(292)	23026	23389	(363)
TRAINING	15	15	14	0	1	50	46	46	(4)	0	1930	1930	0
SUPPORT EQUIP.	5	5	5	0	0	5	5	5	0	0	2386	2386	0
SYS. TEST & EVAL.	578	541	649	(37)	(108)	2916	2623	3213	(293)	(590)	24681	25316	(635)
PROJ. MGT.	640	635	640	(5)	(5)	4377	4172	4249	(205)	(77)	18836	18836	0
DATA	42	42	44	0	(2)	337	332	339	(5)	(7)	8362	8362	0
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	5533	5264	5730	(269)	(466)	23923	21148	24431	(2775)	(3283)	236648	241762	(5114)
GENERAL AND ADMINISTRATIVE	758	721	785	(37)	(64)	3277	2897	3347	(380)	(450)	32420	33121	(701)
UNDISTRIBUTED BUDGET											0	0	
SUBTOTAL	6291	5985	6515	(306)	(530)	27200	24045	27778	(3155)	(3733)	269068	274883	(5815)
MANAGEMENT RESERVE											23352		23352
TOTAL	6291	5985	6515	(306)	(530)	27200	24045	27778	(3155)	(3733)	292420	274883	17537

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2)	Energistic	8-1-XX to 8-31-XX	J. S. Browning
LOCATION: Germantown, Maryland	(2222)			TITLE: Project Director
				DATE: 9-7-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292,420	-	$8,773/3%	$301,193	$285,292	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	3240	3071	3839	(169)	(768)	14372	12467	15401	(1885)	(2914)	71234	73559	(2325)
SITE AND BLDGS.	2808	2531	3009	(277)	(478)	6010	5361	6010	(649)	(649)	79494	81822	(2328)
BALANCE OF PLANT	580	524	598	(56)	(74)	2484	2248	2614	(236)	(366)	23026	23389	(363)
TRAINING	20	19	19	(1)	0	70	65	65	(5)	0	1930	1930	0
SUPPORT EQUIP.	20	21	20	1	1	25	26	25	1	1	2386	2386	0
SYS. TEST & EVAL.	591	526	586	(65)	(60)	3507	3149	3799	(358)	(650)	24681	26626	(1945)
PROJ. MGT.	639	638	648	(1)	(10)	5016	4810	4897	(206)	(87)	18836	18836	0
DATA	42	43	50	1	(7)	379	375	389	(4)	(14)	8362	8362	0
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	7940	7373	8769	(567)	(1396)	31863	28521	33200	(3342)	(4679)	236648	243609	(6961)
GENERAL AND ADMINISTRATIVE	1088	1010	1201	(78)	(191)	4365	3907	4548	(458)	(641)	32420	33374	(954)
UNDISTRIBUTED BUDGET											-	-	
SUBTOTAL	9028	8383	9970	(645)	(1587)	36288	32428	37748	(3800)	(5320)	269068	276983	(7915)
MANAGEMENT RESERVE											23352		23352
TOTAL	9028	8383	9970	(645)	(1587)	36228	32428	37748	(3800)	(5320)	292420	276983	15437

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

COST PERFORMANCE REPORT—WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2)	Energistic	9-1-XX to 9-30-XX	J. S. Browning
LOCATION: Germantown, Maryland	(2222)			TITLE: Project Director DATE: 10-5-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292420	-0-	$8773/3%	$301,193	$290,048	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST			
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	3392	2145	3793	(1247)	(1648)	17764	14632	19194	(3132)	(4562)	71234	74749	(3515)
SITE AND BLDGS	3632	3418	4109	(214)	(691)	9642	8779	10119	(863)	(1340)	79494	84055	(4561)
BALANCE OF PLANT	787	778	833	(9)	(55)	3271	3026	3447	(245)	(421)	23026	23026	0
TRAINING	32	30	32	(2)	(2)	102	95	97	(7)	(2)	1930	1930	0
SUPPORT EQUIP.	23	21	22	(2)	(1)	48	47	47	(1)	0	2386	2386	0
SYS. TEST & EVAL.	680	583	644	(97)	(61)	4187	3732	4443	(455)	(711)	24681	27626	(2945)
PROJ. MGT.	642	643	647	1	(4)	5658	5453	5544	(205)	(91)	18836	18836	0
DATA	53	50	52	(3)	(2)	432	425	441	(7)	(16)	8362	8362	0
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	9241	7668	10132	(1573)	(2464)	41104	36189	43332	(4915)	(7143)	236648	247669	(11021)
GENERAL AND ADMINISTRATIVE	1266	1051	1388	(215)	(337)	5631	4958	5936	(673)	(979)	32420	33931	(1511)
UNDISTRIBUTED BUDGET											-	-	
SUBTOTAL	10507	8719	11520	(1788)	(2801)	46735	41147	49268	(5588)	(8122)	269068	281600	(12532)
MANAGEMENT RESERVE											23352		23352
TOTAL	10507	8719	11520	(1788)	(2801)	46735	41147	49268	(5588)	(8122)	292420	281600	10820

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, September 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2) (2222)	Energistic	10-1-XX to 10-31-XX	J. S. Browning TITLE Project Director DATE 11-9-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292,420	-0-	$8773/3%	$301,193	$291,890	N/A	N/A.	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED	WORK PERFORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	3833	3204	4553	(629)	(1349)	21597	17836	23747	(3761)	(5911)	71234	76284	(5050)
SITE AND BLDGS.	4772	4499	4795	(273)	(296)	14414	13278	14914	(1136)	(1636)	79494	84016	(4522)
BALANCE OF PLANT	950	907	947	(43)	(40)	4221	3933	4394	(288)	(461)	23026	23026	0
TRAINING	40	45	47	5	(2)	142	140	144	(2)	(4)	1930	1930	0
SUPPORT EQUIP.	23	22	21	(1)	1	71	69	68	(2)	1	2386	2386	0
SYS. TEST & EVAL.	740	558	867	(182)	(309)	4927	4290	5310	(637)	(1020)	24681	27703	(3022)
PROJ. MGT.	644	645	660	1	(15)	6302	6098	6204	(204)	(106)	18836	18836	0
DATA	154	156	160	2	(4)	586	581	601	(5)	(20)	8362	8362	0
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	11156	10036	12050	(1120)	(2014)	52260	46225	55382	(6035)	(9157)	236648	249242	(12594)
GENERAL AND ADMINISTRATIVE	1528	1375	1651	(153)	(276)	7160	6333	7587	(827)	(1254)	32420	34146	(1726)
UNDISTRIBUTED BUDGET											-	-	
SUBTOTAL	12684	11411	13701	(1273)	(2290)	59420	52558	62969	(6862)	(10411)	269068	283388	(14320)
MANAGEMENT RESERVE											23352		23352
TOTAL	12684	11411	13701	(1273)	(2290)	59420	52558	62969	(6862)	(10411)	292420	283388	9032

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, October 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc.	CPFF/ (10-10-10-2) (2222)	Energistic	11-1-XX to 11-30-XX	J. S. Browning
LOCATION: Germantown, Maryland				TITLE: Project Director
				DATE: 12-4-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292,420	-0-	$8773/3%	$301,193	$291,941	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED COST		ACTUAL COST WORK PERFORMED	VARIANCE		BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST	WORK SCHEDULED	WORK PERFORMED		SCHEDULE	COST			
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	4038	3611	4354	(427)	(743)	25635	21447	28101	(4188)	(6654)	71234	77584	(6350)
SITE AND BLDGS.	5282	5164	5947	(118)	(783)	19696	18442	20861	(1254)	(2419)	79494	83855	(4361)
BALANCE OF PLANT	1098	1176	1047	78	129	5319	5109	5441	(210)	(332)	23026	23239	(213)
TRAINING	60	56	61	(4)	(5)	202	196	205	(6)	(9)	1930	1930	0
SUPPORT EQUIP.	24	23	23	(1)	0	95	92	91	(3)	1	2386	2386	0
SYS. TEST & EVAL.	800	680	877	(120)	(197)	5727	4970	6187	(757)	(1217)	24681	26695	(2014)
PROJ. MGT.	638	640	642	2	(2)	6940	6738	6846	(202)	(108)	18836	18836	0
DATA	164	183	170	19	13	750	764	771	14	(7)	8362	8062	300
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	12104	11533	13121	(571)	(1588)	64364	57758	68503	(6606)	(10745)	236648	249286	(12638)
GENERAL AND ADMINISTRATIVE	1658	1580	1798	(78)	(218)	8818	7913	9385	(905)	(1472)	32420	34152	(1732)
UNDISTRIBUTED BUDGET											0	0	
SUBTOTAL	13762	13113	14919	(649)	(1806)	73182	65671	77888	(7511)	(12217)	269068	283438	(14370)
MANAGEMENT RESERVE											23352		23352
TOTAL	13762	13113	14919	(649)	(1806)	73182	65671	77888	(7511)	(12217)	292420	283438	8982

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

CPR, Format 1, November 19XX

COST PERFORMANCE REPORT–WORK BREAKDOWN STRUCTURE (Format 1)

CONTRACTOR:	CONTRACT TYPE/NO.	PROJECT NAME/NUMBER	REPORT PERIOD	SIGNATURE
A.U.S. Inc. LOCATION: Germantown, Maryland	CPFF/ (10-10-10-2) (2222)	Energistic	12-1-XX to 12-31-XX	J. S. Browning TITLE Project Director DATE 1-8-XX

QUANTITY	NEGOTIATED COST	EST. COST OF AUTH. UNPRICED WORK	TARGET PROFIT/ FEE %	TARGET PRICE	ESTIMATED PRICE	SHARE RATIO	CONTRACT CEILING	ESTIMATED CEILING
1	$292,420	-0-	$8773/3%	$301,193	$290,419	N/A	N/A	N/A

ITEM	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	BUDGETED COST		ACTUAL COST	VARIANCE		BUDGETED COST		ACTUAL COST	VARIANCE				
	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHED-ULE	COST	WORK SCHED-ULED	WORK PER-FORMED	WORK PER-FORMED	SCHEDULE	COST	BUDGETED	LATEST REVISED ESTIMATE	VARIANCE
(1) WORK BREAKDOWN STRUCTURE	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
NSSS	4140	3901	4134	(239)	(233)	29775	25348	32235	(4427)	(6887)	76234	76584	(350)
SITE AND BLDGS.	5076	5064	5147	(12)	(83)	24772	23506	26008	(1266)	(2502)	82494	83255	(761)
BALANCE OF PLANT	1080	1076	1055	(4)	21	6399	6185	6496	(214)	(311)	23026	23239	(213)
TRAINING	72	75	80	3	(5)	274	271	285	(3)	(14)	1930	1930	0
SUPPORT EQUIP.	24	23	23	(1)	0	119	115	114	(4)	1	2386	2386	0
SYS. TEST & EVAL.	760	685	788	(75)	(103)	6487	5655	6975	(832)	(1320)	26681	26995	(314)
PROJ. MGT.	630	642	624	12	18	7570	7380	7470	(190)	(90)	18836	18836	0
DATA	136	147	140	11	7	886	911	911	25	0	8362	8062	300
FUEL	0	0	0	0	0	0	0	0	0	0	6699	6699	0
WBS Subtotal	11918	11613	11991	(305)	(378)	76282	69371	80494	(6911)	(11123)	246648	247986	(1338)
GENERAL AND ADMINISTRATIVE	1632	1591	1643	(41)	(52)	10451	9504	11028	(947)	(1524)	33790	33974	(184)
UNDISTRIBUTED BUDGET											0	0	
SUBTOTAL	13550	13204	13634	(346)	(430)	86733	78875	91522	(7858)	(12647)	280438	281960	(1522)
MANAGEMENT RESERVE											11982		11982
TOTAL	13550	13204	13634	(346)	(430)	86733	78875	91522	(7858)	(12647)	292420	281960	10460

(All Entries in Thousands of Dollars)

RECONCILIATION TO CONTRACT BUDGET BASELINE

VARIANCE ADJUSTMENT													
TOTAL CONTRACT VARIANCE													

United States
Department of Energy
Washington, D.C. 20585

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