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OFFICE OF THE PROJECT MANAGER SELECTED AMMUNITION D0--ETC F/G 14/1
A COMPUTER PROGRAM FOR TRACKING COST/SCHEDULE CONTROL SYSTEMS C--ETC(U)
JUN 77 L M SMITH

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REPORT NO. PMSA-2-5

A COMPUTER PROGRAM FOR TRACKING
COST/SCHEDULE CONTROL SYSTEMS CRITERIA

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JUNE 1977



LOUIS M. SMITH

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SELECTED AMMUNITION
DOVER, NEW JERSEY

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REPORT NO. PMSA-2-5

A COMPUTER PROGRAM FOR TRACKING
COST/SCHEDULE CONTROL SYSTEMS CRITERIA

JUNE 1977

LOUIS M. SMITH
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ABSTRACT

This report describes a computer program that provides a means for tracking contractor's performance where Cost/Schedule Control Systems Criteria are utilized. The program was specifically designed for the Control Data Corporation 6500/6600 computer system at USA Armament Research and Development Command, Dover, NJ. Input data for the program are those normally found in a contractor's Cost Performance Report. Program output is a series of cost and Schedule Performance Index graphs, a summary variance graph, and a set of table that summarizes CS² parameters.

INTRODUCTION

The purpose of this report is to describe the computer program currently being utilized by adjuncts of the Project Manager for Selected Ammunition, Dover, NJ, to satisfy Cost/Schedule Control Systems Criteria (CS²) requirements.

The CS² requirements, procedures and techniques are adequately documented¹ and these policies will not be further propounded. For purposes of clarity, however, some basic terms and acronyms are described throughout the report to assist those readers who have not totally committed to memory the CS² jargon.

The program is written in Fortran IV for the CDC 6500/6600 computer and uses a plotting technique, PRINTERPLOT², written specifically for local utility. (The author of PRINTERPLOT has expressed his willingness to provide the routine and assist in its placement into computer libraries at other installations.) The Fortran statements written to produce printer graphs with the PRINTERPLOT routines are almost identical to those statements used for CALCOMP plotting. With some further effort, the pertinent Fortran lines in this program can be converted to CALCOMP plotting or other plotting instruments.

¹Superscripts refer to similarly numbered entries in the References.

INPUT DESCRIPTION

The CS² Terminology

Budgeted Cost of Work Scheduled (BCWS) - The budget cost of the effort on a work package (element), completed or in-progress, that was scheduled to be accomplished at the time of the reporting period.

Budgeted Cost of Work Performed (BCWP) - The budgeted dollar value of the accomplishments achieved on a work element at the time of the reporting period.

Actual Cost of Work Performed (ACWP) - The cost actually incurred and recorded in accomplishing the work performed on a work element at the time of the reporting period.

Other Input Terminology

Contract Target Cost - The total budget as defined by the negotiated contract cost (including the following 3 terms described below).

Management Reserve - An amount of the total budget withheld for management control purposes and not assigned to a specific work element.

Undistributed Budget - An amount of the total budget which has not been assigned to a specific work element. For the purposes of this program this item can be additionally defined: it is a part of the total budget which has been assigned to a specific work element which was not scheduled to begin at the time of the reporting period.

G and A - An amount of the total budget set aside for general and administrative purposes.

Estimated Cost at Completion (EAC) - The contractors estimated cost at completion of the contract effort including the actual direct costs and indirect costs of all work completed and authorized work remaining.

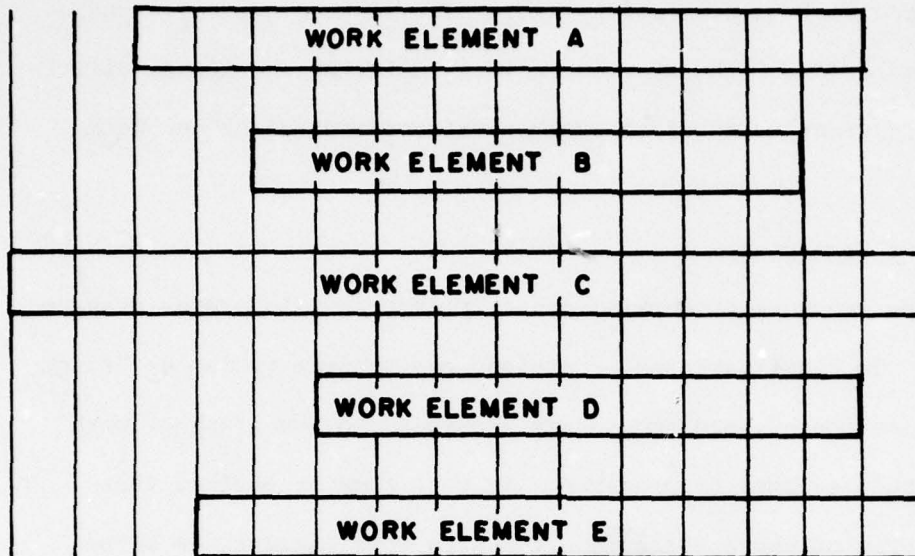
Work Element Schedules

The time sequence of work elements is important to proper program execution. To facilitate and understand the program variables "first month", "last month", and "months in progress", a bar-graph of work element schedules must be prepared. It will then be obvious that the definition of these variables, for each work element, is keyed to the earliest starting element. A typical work element/schedule chart and values assigned to the three variables is shown in Figure 1.

Casting Out Zeros

The program contains many computations, cost variance percent and schedule variance percent are two examples, that involve simple division. In the two examples cited, the available values of the current BCWP and ACWP are used as denominators. Zero values for these CS^2 terms are not uncommon, viz, work scheduled for a work element may not have been accomplished and no charges were accrued; thus $BCWP = ACWP = 0$. (Persons responsible for tracking CS^2 will attest that reasons for the above occurrence are legion.)

The program will not accept zeros for values of BCWP and ACWP. Therefore, to allow computations to proceed when a 0 value is reported,



J F M A M J J A S O N D J F M
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



SCHEDULED START/COMPLETION TIME (MONTHS)

<u>WORK ELEMENT</u>	<u>FIRST MONTH</u>	<u>LAST MONTH</u>	<u>MONTHS IN PROGRESS (JULY)</u>
A	3	14	5
B	5	13	3
C	1	15	7
D	6	14	2
E	4	15	4

Fig. 1 Typical Bar Chart of Program Element Schedules

the user must enter the value, 1 (dollar). The program results will not be altered in that gross cost and schedule variances will still be highlighted.

Program Limits

The program will accept data for as many as twenty (20) program elements for a duration of twenty (20) months.

Dollar values entered may be exact to the dollar up to 8 digits (99999999 max) or may be rounded-off as desired. All values must have similar units. Whole dollar and rounded-off dollar entries will result in erroneous output and may prematurely terminate the execution of the program.

Related CS² Input

The program allows in summary fashion, the inclusion of CS² information of a related effort. Thus, if an in-house effort, with CS² provisions is in progress concurrent with a contract effort, the data provided in the Cost Performance Report of the in-house effort can be included for consideration in the program output. Other uses for this optional input are possible.

THE DATA DECK

Data Card Formats

Table I is a description of each of the cards in the data deck including the variable names, their purpose, their column location and the formats of the entered values.

Typical Data Deck Setup

Figure 2 illustrates the setup of a typical data deck. If the value on Card Type 1 is a 0 (zero), Card Type 1a is omitted. Any value other than zero on Card Type 1 must be accompanied by a Card Type 1a.

The illustration shows the repetitive nature of Card Types 10 through 12 for a job with two program elements, each element schedule being three months in length.

Data Deck for a Sample Case

Table II is typical of input for this program, each line representing one data card type as described by Table I. This fictitious input data is used as a sample case to provide reference material, Appendix A, for the discussion of program output.

TABLE I - DATA CARD FORMATS

<u>CARD TYPE</u>	<u>VARIABLE NAME</u>	<u>COLUMN</u>	<u>FORMAT</u>	<u>DESCRIPTION</u>
1	KEY3	1	I1	KEY3 = 1; allows program reading of related effort data, card 1a. KEY3 = 0; no related effort exists.
1a	DBCWS	1-10	F10.0	For related effort: the budgeted cost of work scheduled.
	CBCWP	11-20	F10.0	The budgeted cost of work performed.
	CACWP	21-30	F10.0	The actual cost of work performed.
	CCV	31-40	F10.0	The cost variance.
	CSC	41-50	F10.0	The schedule variance.
	CGTB	51-60	F10.0	The total budget.
	CEST	61-70	F10.0	The estimated cost at completion.
2	OCTC	1-10	F10.0	The total budget as defined by the negotiated contract cost.
3	KEY1	1-5	I5	KEY1 = 0 prevents printing of cost and schedule variance graphs. KEY1 = 1; allows graphic output.
	KEY2	6-10	I5	KEY2 = 0; prevents printing of CS ² elements graph. KEY2 = 1; allows graphic output.
4	DA1	1-10	A10	Alphanumeric date of report. Max = 20 characters.
	DA2	11-20	A10	
	WKS	21-25	F5.0	The number of weeks in the current + 2 previous reporting periods.
5	NK	1-3	I3	Number of work elements as of the current report period.
6	HTN	1-10	A10	Alphanumeric month of the earliest starting work element.
	IYR	11-14	I5	Year of earliest starting work element.

TABLE I (continued)

<u>CARD</u> <u>TYPE</u>	<u>VARIABLE</u> <u>NAME</u>	<u>COLUMN</u>	<u>FORMAT</u>	<u>DESCRIPTION</u>
7	NAME(1,NK+1)	1-10	A10	Alphanumeric title of the program including contractor name, item name and nomenclature, and contract number. In any order, max = 50 characters.
	NAME(2,NK+1)	11-20	A10	
	NAME(3,NK+1)	21-30	A10	
	NAME(4,NK+1)	31-40	A10	
	NAME(5,NK+1)	41-50	A10	
8	UB	1-10	F10.0	The undistributed budget.
	GA	11-20	F10.0	The original contract G&A amount.
	GA1	21-30	F10.0	The current contract G&A amount. This value may be identical to the original G&A.
9	MRO	1-10	I10	The original contract Management Reserve.
	MRP	11-20	I10	The Management Reserve that was current in the previous reporting period.
	MRC	21-30	I10	The current Management Reserve.

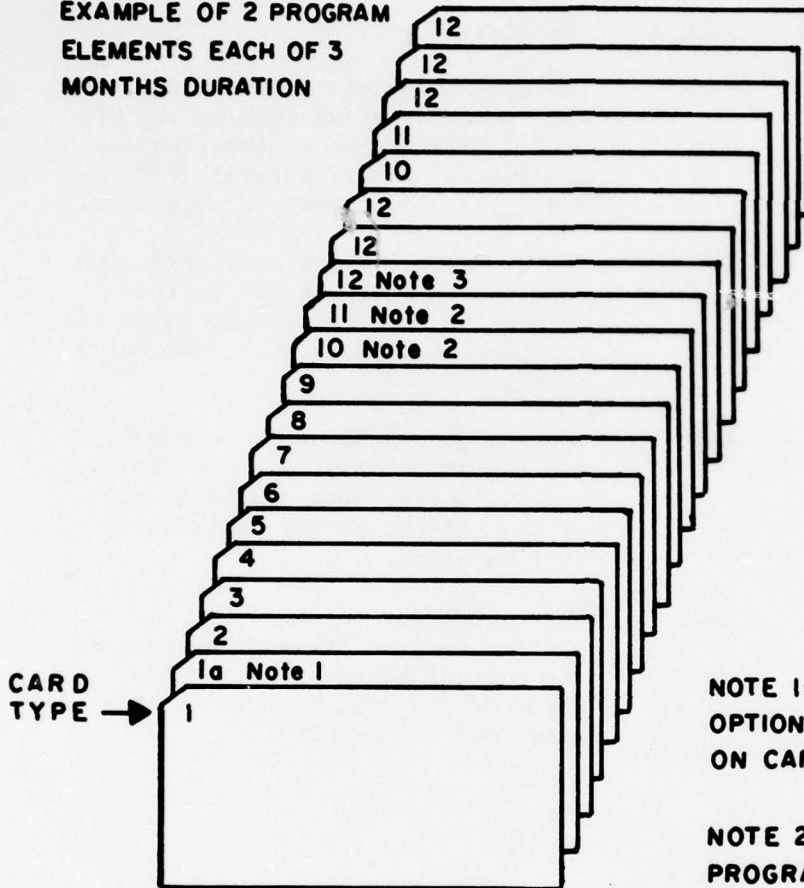
Card Types 10 through 12 are grouped for each of the NK work elements.

10	NAME(1,i)	1-10	A10	Alphanumeric title of the ith program element. Max - 20 characters.
	NAME(2,i)	11-20	A10	
11	M(i)	1-5	I5	Months in progress for the ith work element.
	IFM(i)	6-10	I5	The numerical value of the first month of the ith work element. See text "Input Description - Work Element Schedules)."
	LM(i)	11-15	I5	The numerical value of the last month of the ith work element. See text noted above.
	TB(i)	16-25	F10.0	The total budget for the ith work element.

Card Type 12 is repeated for each month of the existence of the i th work element. The number of cards will be $LM(i) - IFM(i) + 1$.

<u>CARD</u> <u>TYPE</u>	<u>VARIABLE</u> <u>NAME</u>	<u>COLUMN</u>	<u>FORMAT</u>	<u>DESCRIPTION</u>
12	BCWS(i,j)	1-8	F8.0	The budgeted cost of work scheduled for the i th work element on the j th month. For future months, (beyond the current report period), only the BCWS(i,j) will appear on this card.
	BCWP(i,j)	9-16	F8.0	The budgeted cost of work performed for the i th work element in the current month. For months ahead of the current period, this entry will be blank.
	ACWP(i,j)	17-24	F8.0	The actual cost of work performed for the i th work element in the current month. For months ahead of the current period, this entry will be blank.
	CEAC(i,j)	25-32	F8.0	The contractor estimate at completion for the i th work element in the current month. For months ahead of the current period, this entry will be blank.

**EXAMPLE OF 2 PROGRAM
ELEMENTS EACH OF 3
MONTHS DURATION**



**NOTE 1: THIS CARD TYPE IS
OPTIONAL-DEPENDENT UPON VALUE
ON CARD TYPE 1.**

**NOTE 2: REPEAT FOR EACH
PROGRAM ELEMENT.**

**NOTE 3: REPEAT FOR EACH
MONTH OF THE SCHEDULE OF
THE PROGRAM ELEMENT.**

Fig. 2 Typical Data Deck Setup

TABLE II - TYPICAL INPUT FOR SAMPLE CASE

0
 1281591
 1 1
 31 SEP 1977 13
 8
 APRIL 1975
 WHOSOMEVER ED CONTRACT 76-(0214 CART, XM185E1
 888003 1076420
 310347 310347 310347
 SYSTEM INTEGRATION
 6 1 10 116113
 6278 8629 8629 80469
 20415 20200 20200 78587
 34252 30000 29995 79995
 50273 49208 49200 79408
 63510 61000 60580 73330
 71713 63400 73400 117764
 81313
 92913
 104513
 116113
 CARRIER METAL PARTS
 6 1 10 95413
 6664 6562 6560 76307
 16733 19200 19200 80074
 32132 37300 37262 85962
 52424 53500 53538 78338
 67323 70500 70537 83937
 81413 81200 81200 95181
 86613
 91213
 94813
 95413
 GRENADE METAL PARTS
 6 1 9 197377
 8712 7800 7805 69570
 25151 27400 27400 79385
 49540 34400 34353 67753
 59582 66400 86708 99408
 66171 80000 101473 106323
 114377 102200 124200 197216
 182177
 195577
 197377
 FUZE ASSEMBLY
 6 1 9 151106
 17612 13918 13900 74613
 30061 33400 33400 83131
 46790 58000 57944 83644
 68182 71500 71470 100770
 76011 82000 84721 95221

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TABLE II - TYPICAL INPUT FOR SAMPLE CASE (cont)

10210E	98600	98600	151649
12030E			
13850E			
15110E			
GRENADE LDG+ASSBLY			
6	1	10	37933
700		800	800 24039
4088		2400	2400 19709
8979		4700	4765 23865
13808		8800	8802 21902
14509		12300	12253 19753
15053		15000	25000 37923
17473			
24693			
31913			
37933			
PROJECTILE ASSEMBLY			
6	1	10	21559
600		620	620 12018
2418		1400	1400 11794
4739		2600	2628 13428
7708		5200	5249 12149
9500		8200	8170 10970
10279		12100	12635 21509
11179			
14319			
17459			
21559			
SELF DESTRUCT			
6	1	10	283500
32830		32420	32420 250845
197702		42700	42700 250324
217574		184700	184717 249217
229914		197600	197615 257615
239786		228000	235403 248403
245700		246000	246000 283834
257100			
268500			
279900			
283500			
TOOLING			
6	1	9	54232
6980		7100	7120 52178
16890		9400	9400 50269
29685		16000	16020 51135
39405		32300	32298 49298
41770		40300	40127 45627
44872		49900	49900 54175
49992			
52112			
54232			

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OUTPUT DESCRIPTION

The output of the program consists of 4 optional graphs for each program element and the total program (all the elements summarized), a variance graph for the total program, and a set of tables that presents various facets and types of CS² information. Each of the separate kinds of output is discussed below.

The Schedule and Cost Performance Index Graphs

The schedule and cost performance graphs for each element and the total program are plotted in the format of Favorable/Unfavorable (performance) vs Months in Progress. When the variable KEY1 = 0, these graphs will be omitted. For each program element, the zero baseline of the index is its scheduled performance. Favorable or unfavorable performance indices range from 0 to + 1.0 and 0 to - 1.0, respectively. The indices are computed and the graph routines are defined in SUBROUTINE INDEX. The Schedule Performance Index is the difference between BCWP and BCWS as a fraction of BCWP, or:

$$\text{Schedule Performance Index} = (\text{BCWP} - \text{BCWS}) \div \text{BCWP}$$

The Cost Performance Index is the difference between BCWP and ACWP as a fraction of BCWP, or:

$$\text{Cost Performance Index} = (\text{BCWP} - \text{ACWP}) \div \text{BCWP}$$

Note that the indices will be + 1.0 (most favorable) when BCWS or ACWP is zero or when the BCWP is twice the value of BCWS or ACWP; both of these occurrences are improbable. Poor performance indices occur when the BCWP falls below the level of BCWS or the ACWP climbs above the BCWP.

This program gives special treatment to computation of performance indices (and Estimates of Cost at Completion) for the 1st three months of effort on program elements greater than 6 months duration. The purpose for this treatment is in recognition of the fact that as a result of start-up efforts larger unfavorable performances may be encountered regardless of a contractor's demonstrated proficiency. To compute performance indices and Estimates of Cost at Completion based on such early subnormal performance, when it occurs, would raise flags prematurely. To preclude this, the program redefines the contractor's BCWP by the following formulas:

1st Month: $BCWP = .3 BCWS + .7 BCWP$ (as reported)

2nd Month: $BCWP = .1 BCWS + .9 BCWP$ (as reported)

3rd Month: $BCWP = .05 BCWS + .95 BCWP$ (as reported)

In the event that the contractor's cost or schedule variance is unfavorable, as indicated by his reported BCWP, the above formulas will reduce his apparent deficit. Note that as the effort on an element approaches 3 months, the reduction of the contractor's deficit tends to disappear. In the 4th month, finally, he is burdened with the full impact of his unfavorable variance.

When that contractor reports no variances, the formulas will not alter the reported BCWP.

In the same manner that the program gives the contractor a 'break' when reporting early subpar performances, it tends to 'disbelieve' early efficiencies when the contractor reports ahead of schedule or

underrun cost performance, i.e., $BCWP > BCWS$ or $BCWP > ACWP$. But the formulas will also reduce to zero, on the 4th month, the extent of disbelief. The effects of the formulas on the reported BCWP both favorable and unfavorable, are shown schematically in Figure 3.

It should again be stressed that the reformulation of the contractor's reported BCWP does not occur in program elements that are shorter than 7 months in duration. In such a program element the contractor is given no leeway in regard to his performance.

Finally, reformulated BCWP values are used only for computation of performance indices and Estimates of Cost at Completion. The reported BCWP is shown in all tables, which will be discussed later in this report.

Cost Performance Index 3-Month Moving Average Graph

When the contract effort reaches 3 months, this graph shows the trend of the Cost Performance Index, of individual program elements and the total program, by averaging the values of the index over the previous three months. The 3-month moving average of the Cost Performance Index is a statistic that is not usually discussed in CS² circles and this graph is provided for the casual interest of the users. In certain instances it may provide a special insight to the progress of the program. This graph is also omitted when variable KEY1 = 0.

The Summary Graph

The fourth graph provided in the output, again for each program element and the total program, plots the cumulative BCWS, BCWP and

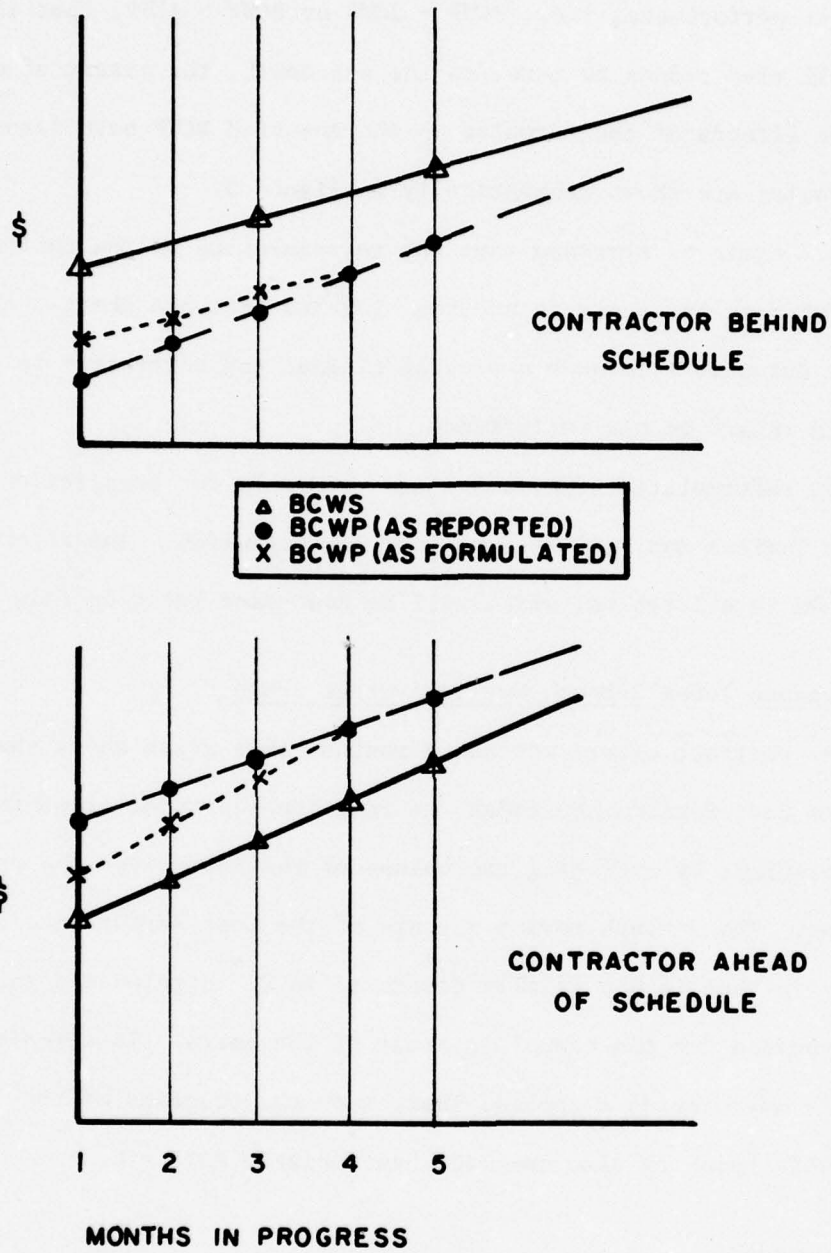


Fig. 3 Schematic Drawing Showing Relationship Between Reported and Formulated BCWP

ACWP dollar values against time in months that the effort has progressed. The complete schedule, cumulative BCWS, is shown from first month to last month. In the event that BCWP and ACWP are very close in value, the graph prints the code letter A (ACWP) preferentially and suppresses the printing of code letter P (BCWP). This graph is structured and printed by SUBROUTINE GRAPH and may be omitted by setting variable KEY2 = 0.

The Variance Analysis Graph

One of the key graphs in the output of this program is the variance analysis graph. No option is provided for eliminating this graph which is structured and printed from SUBROUTINE TREND. The format of the graph is Favorable/Unfavorable (performance in dollars) vs calendar Month/Year and it tracks the progress of the dollar schedule and cost variances of the total program (all elements summarized). The base line of performance (zero dollars) is the sum of all the program element BCWP's and the cost and schedule variances are measured and plotted against this base line.

This graph presents an excellent overview of the progress of the contractor's effort on the overall program. While this CS² computer program was conceived and generated prior to the existence of the US Army Materiel Development and Readiness Command (DARCOM), this graph very nearly fulfills the DARCOM Review and Command Assessment of Projects (RECAP)³ requirement for the "Contractor Cost/Schedule Variance Trends....." chart, a sample of which is shown on page A-36 of the

referenced publication. The various parameters shown in the Variance Analysis graph are discussed below.

Cost Variance - The difference, in dollars, between the BCWP and ACWP, or:

$$\text{Cost Variance} = \text{BCWP} - \text{ACWP}.$$

The cost variance is also expressed in % by:

$$\text{Cost Variance (\%)} = \text{Cost Variance (dollars)} \div \text{BCWP}$$

Schedule Variance - The difference in dollars between BCWP and BCWS, or:

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

Schedule Variance is also expressed in % by:

$$\text{Schedule Variance (\%)} = \text{Schedule Variance (\$)} \div \text{BCWS}.$$

Schedule Variance in Weeks - This parameter is a conversion of the schedule variance in dollars into time. The time factor is based on the BCWP experience of the contractor over approximately 4 months. It is computed from the following:

$$\text{Schedule Variance(weeks)} = \text{Schedule Variance(dollars)} \div \text{BCWP(avg)}$$

Where: $\text{BCWP(avg)} = \frac{\text{Cumulative current BCWP} - \text{Cumulative BCWP 3 months previous to the current month}}{\text{number of weeks in the current and 2 previous reporting periods}}.$

Other Parameters - In addition to printing the progression of dollar schedule and cost variances in symbolic form (S or C), the graph

displays the cumulative schedule and cost dollar variances and percent variances through the current month. Negative values reflect unfavorable variances. Finally, for informational purposes solely, original and current contract costs and government and contractor Estimates of Cost at Completion - taken from other sections of the computer program, are printed above the variance graph. The current contract cost shown on the variance graph may differ from the original contract cost as a result of changes occurring during the life of the contract (changes of scope, etc.). Input data will reflect these changes in the form of higher element budgets or new program elements. The computer program will track these changes and display the new total on the variance graph.

The user does not have control of the limits of the axes of the variance graph. The Y axis (dollars) extremes are fixed by the level of the schedule or cost variance. The X axis (calendar months/years) minima is 1 month prior to the start of the contract effort (from input data) and extends for a 15 month period.

Cumulative CS² Data Table

Table 1 of the output provides a summary of the CS² data for the current reporting period and the computed cost and schedule variances. Each program element and the summary of all the elements is treated. The variances shown for the over-all program "All Elements" are those printed on the variance graph. Negative values designate unfavorable

situations. Information regarding management reserve funds is shown at the bottom of the tabulation.

Flagged Variances Table

In order to highlight significant results, both favorable and unfavorable, the computer program selectively prints, in Table 2 of the output, any cost or schedule variance percent that is greater than +10% or less than -10%. Similar guidelines are applied to contractor and Government Estimates of Cost at Completion where the program element budget is used as the baseline. The source of the government estimate at completion will be discussed separately in connection with Table 3 output.

With the Office of PM Selected Ammunition special attention is given to the output in Table 2. Persons responsible for tracking CS² information on contracts under the purview of PMSA must specifically address the causes for variances or estimates of cost falling outside of the + 10% guidelines. This procedure allows the Project Manager to be fully and continuously aware of potential cost problems. Favorable results, while desirable, also require explanation. Contrary to the popular maxim, the proverbial "gift horse" must be fully examined.

The 10% guideline may be altered as desired. The controlling statement appears in SUBROUTINE TABLES starting 2 lines below Statement Label 2. See Appendix B.

Cost at Completion Estimates Table

The output in Table 3 consists of Estimates of Cost at Completion computed by various methods.

Estimates based on:

Cost Variance = Element Budget ÷ Cost Variance %

Schedule Variance = Element Budget ÷ Schedule Variance %

Cost and Schedule Variance = Element Budget ÷ Multiple of Cost and Schedule Variance %

Trend of Cost Variance = Element Budget ÷ Average Cost Variance % of 3 previous report periods

Average of Variance = Summ of above variances ÷ 4

Contractor Estimate of Cost at Completion is input data.

DARCOM CS² procedures dictate the need for developing a government estimate at completion. The requirement is correctly based on the idea that a contractor's estimate at completion should be at all times open to question. Many techniques are available for forming an independent estimate. An excellent overview of these techniques is provided by a DSMS Research Report⁴. Most are statistical and/or historical in nature and complex techniques are also available. The procedure to obtain this number in many instances remains at the discretion of the government's CS²er.

The cost and schedule variance estimates discussed at the beginning of this section are standard techniques that are historical in nature; the contractor's past performance rigidly defines his future performance.

The cost and schedule variance estimate and trend of cost variance estimate are subject to the same qualification. This program provides all the variance-based estimates, including their average, and a potential user may prefer one or the other. The Office of the Project Manager for Selected Ammunition, for whom this computer program was written, uses the Bayesian technique for formulating its Government Estimate Cost at Completion.

Bayesian Forecasting

The Bayesian Approach⁵ for forecasting the estimate at completion can be described most succinctly as a method to improve predictions using objective managerial judgement in conjunction with historical performance. It accomplishes this by calculating an ensuing probability from an assumed prior probability and applying this calculation to current data to derive its forecast of completion cost. However, no Bayesian estimate is derived for any program element that is less than 3 months old. This occurs because the Bayesian estimate requires values of the standard deviation of the dispersion of the ACWP and the contractor's Estimate at Completion and no values are formulated until adequate data is available. (The Bayesian technique also allows for an estimate of these values for earlier forecasts - but this option has not been written into the computer program.)

The mathematics of the technique are adequately described in the referenced report. The Bayesian technique equations are relatively

simple to manipulate; it uses only the CS² input data which has been dealt with throughout this report; and over several years of use by this office its forecast has proven to be most reasonable.

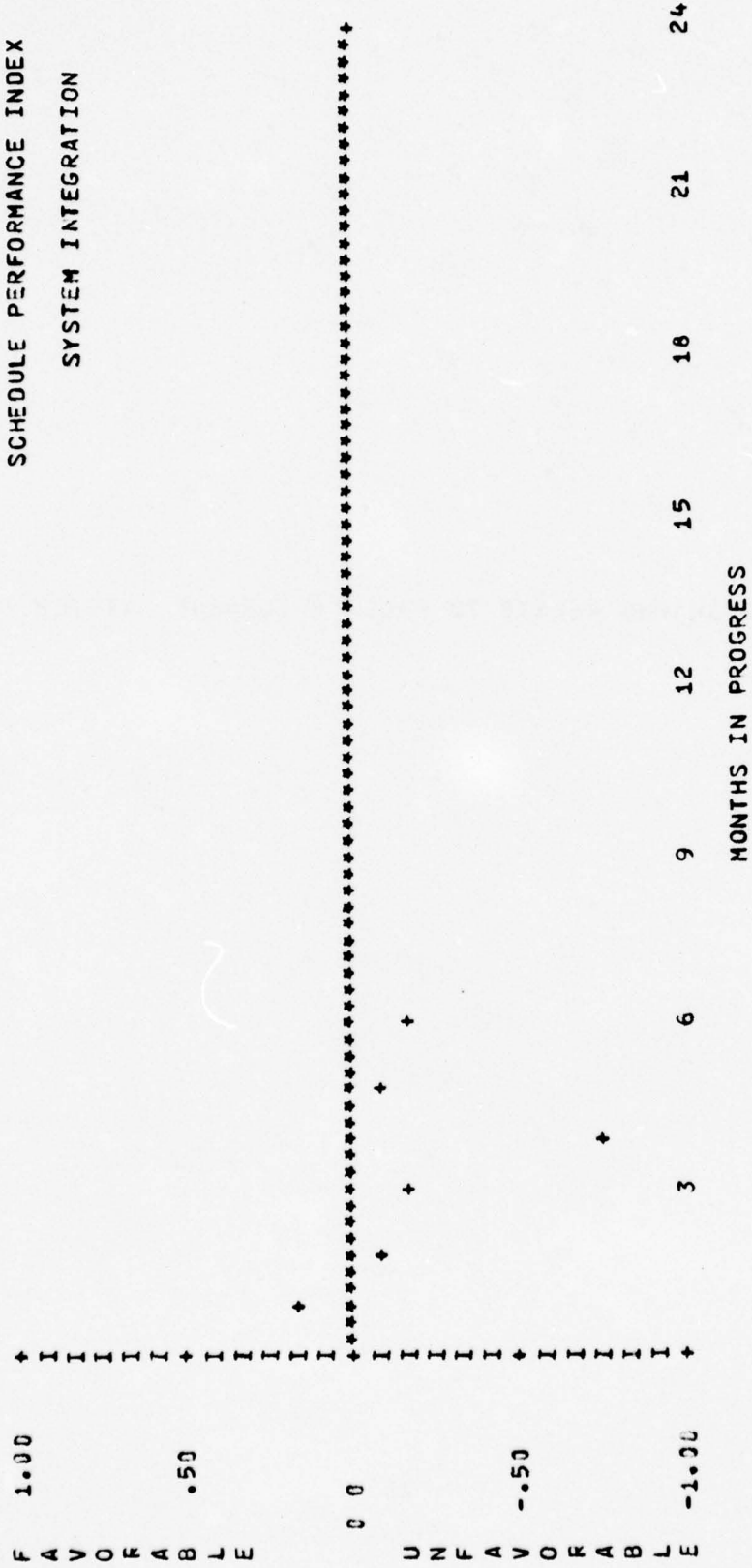
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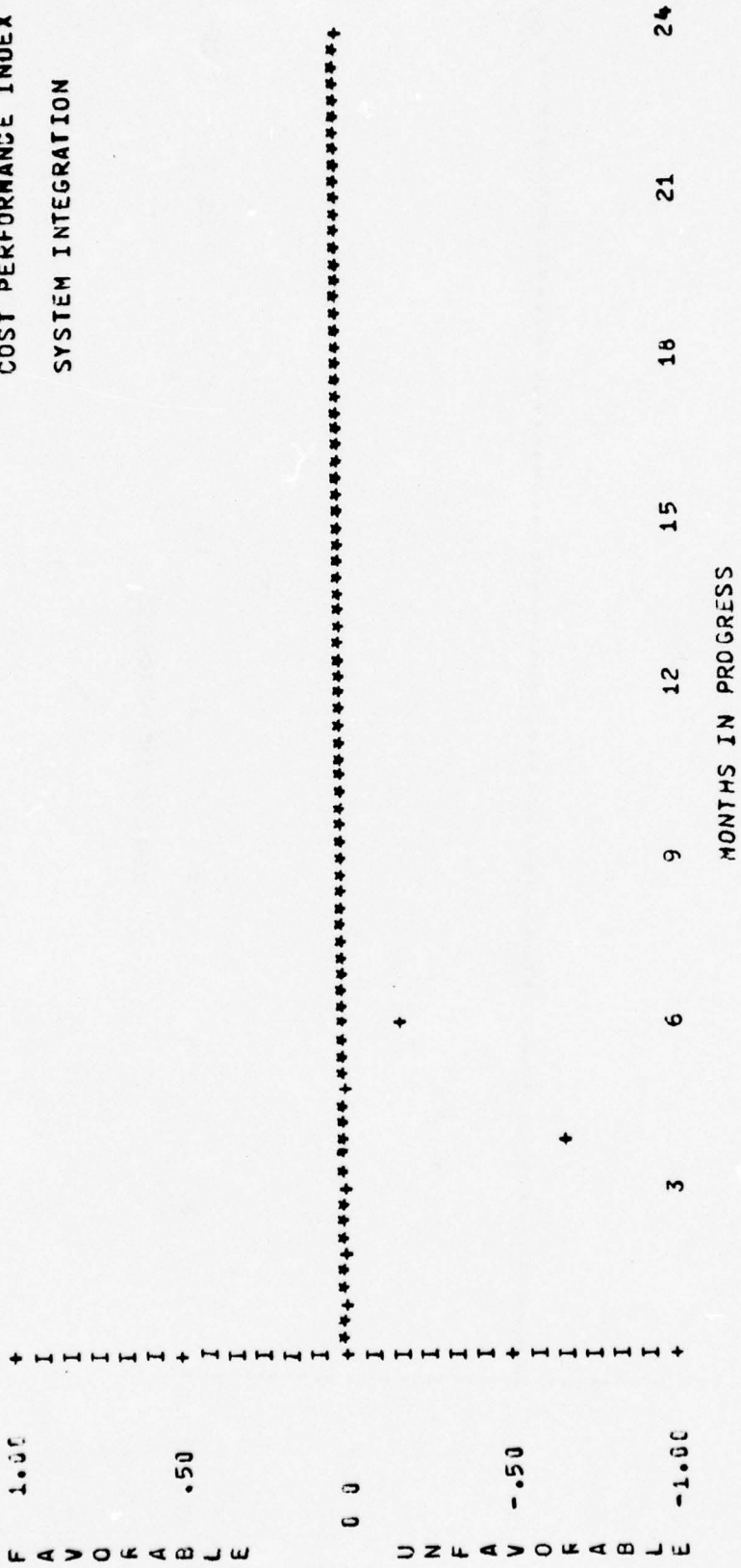
APPENDIX A
SAMPLE CASE OUTPUT

THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT SYSTEM INTEGRATION

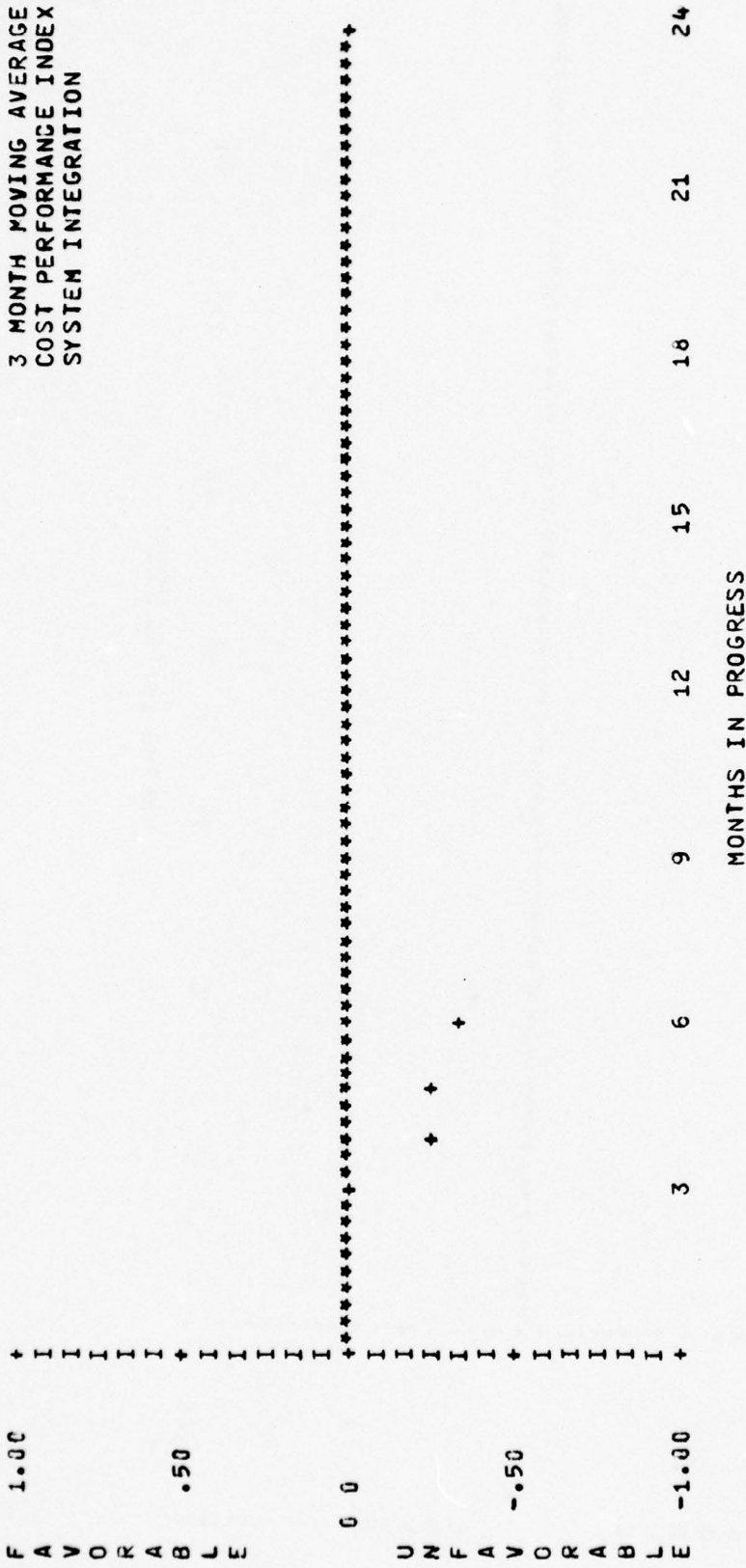
SCHEDULE PERFORMANCE INDEX
SYSTEM INTEGRATION



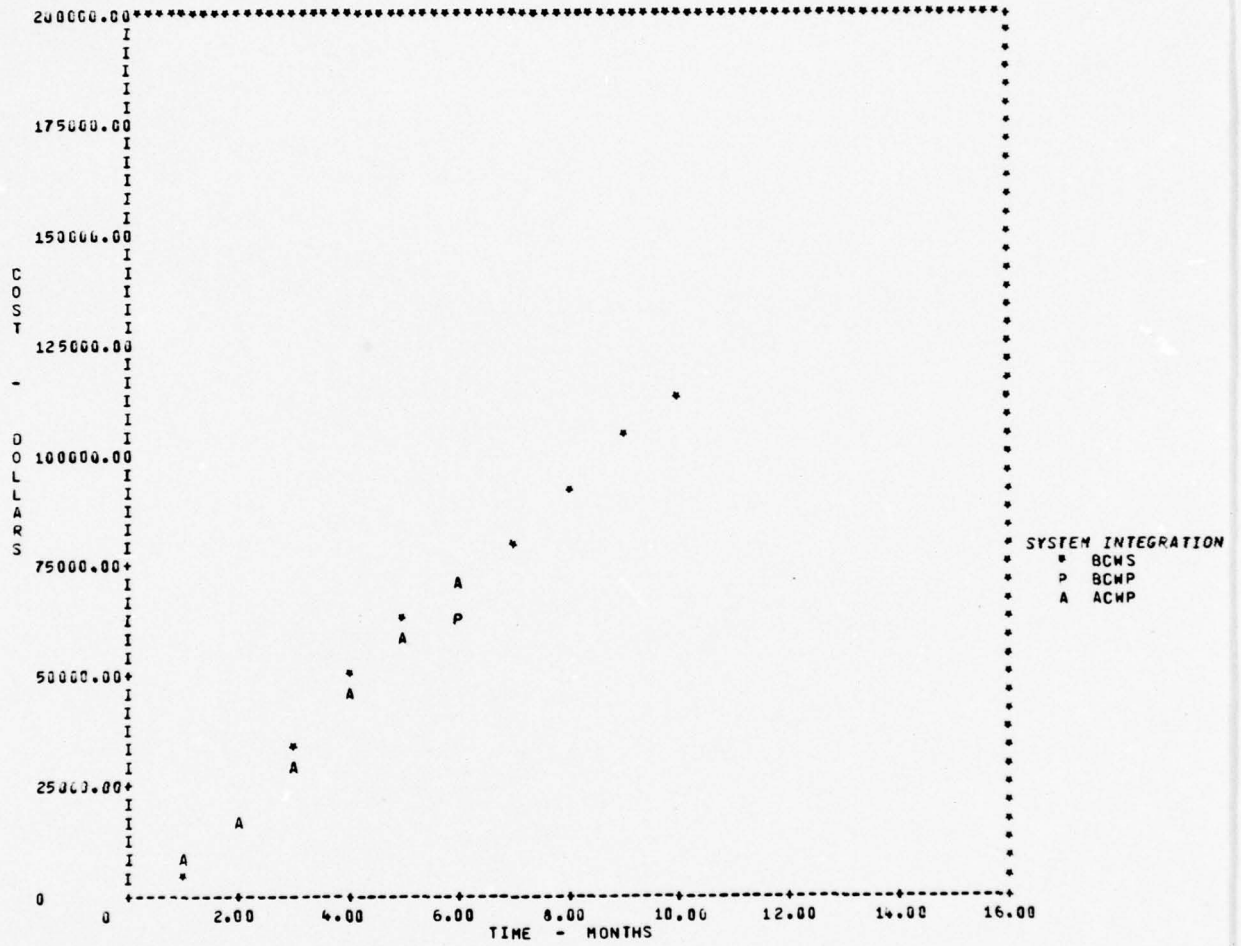
COST PERFORMANCE INDEX
SYSTEM INTEGRATION



3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 SYSTEM INTEGRATION

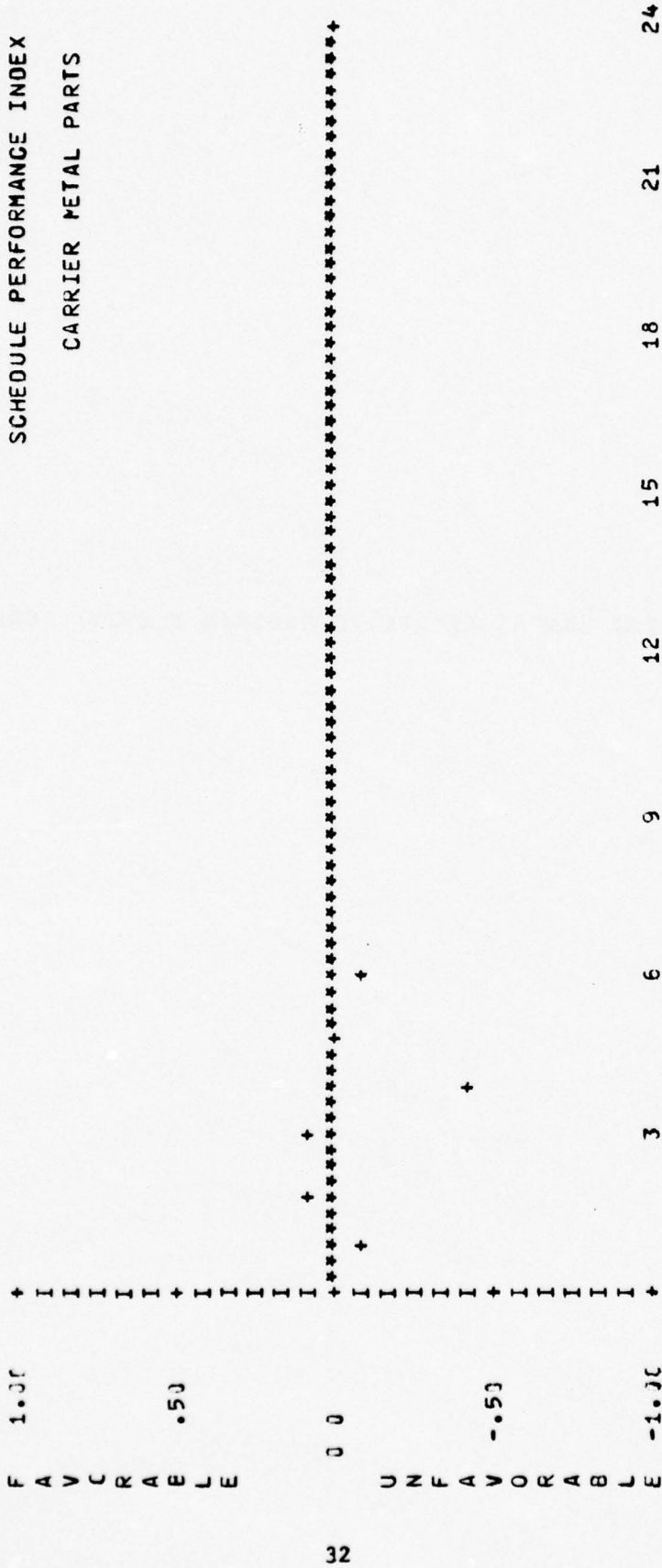


F A V O R A B L E



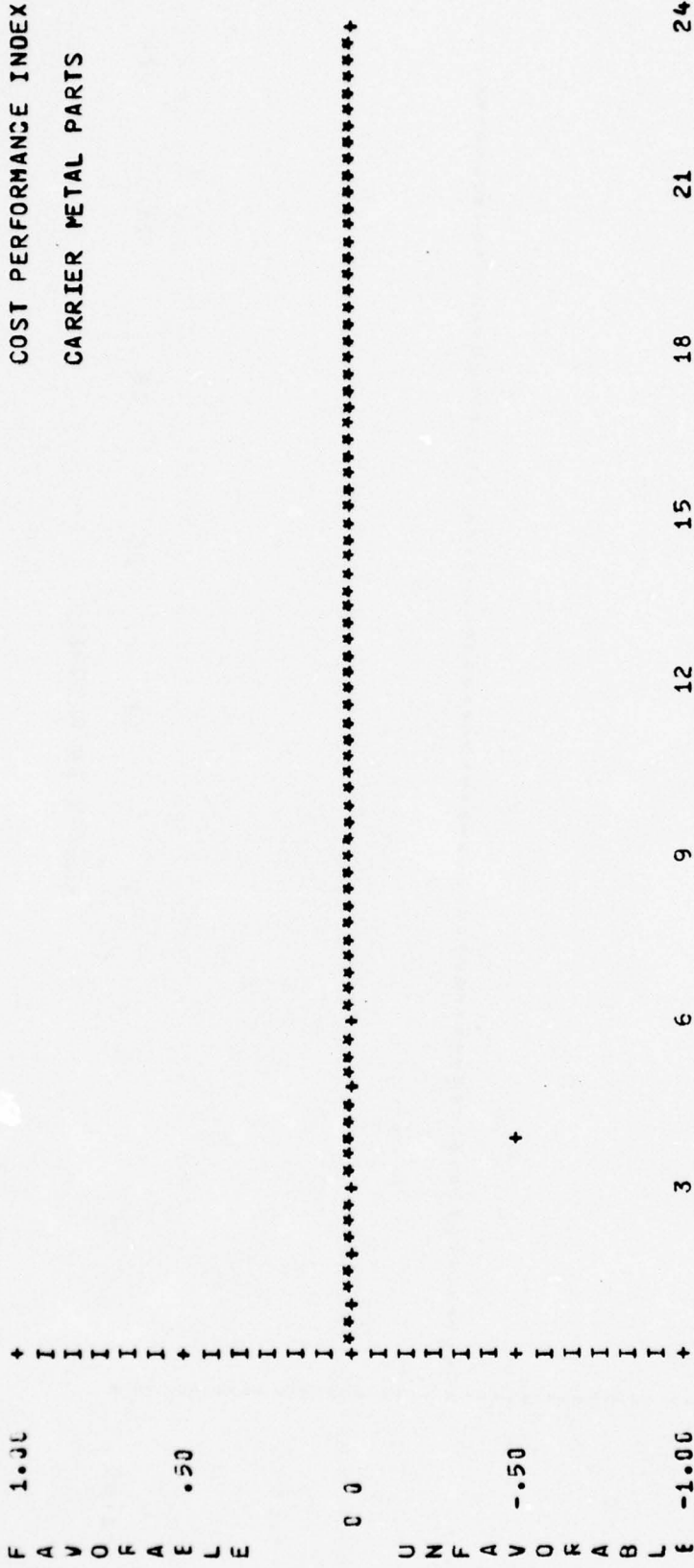
THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT CARRIER METAL PARTS

SCHEDULE PERFORMANCE INDEX
CARRIER METAL PARTS



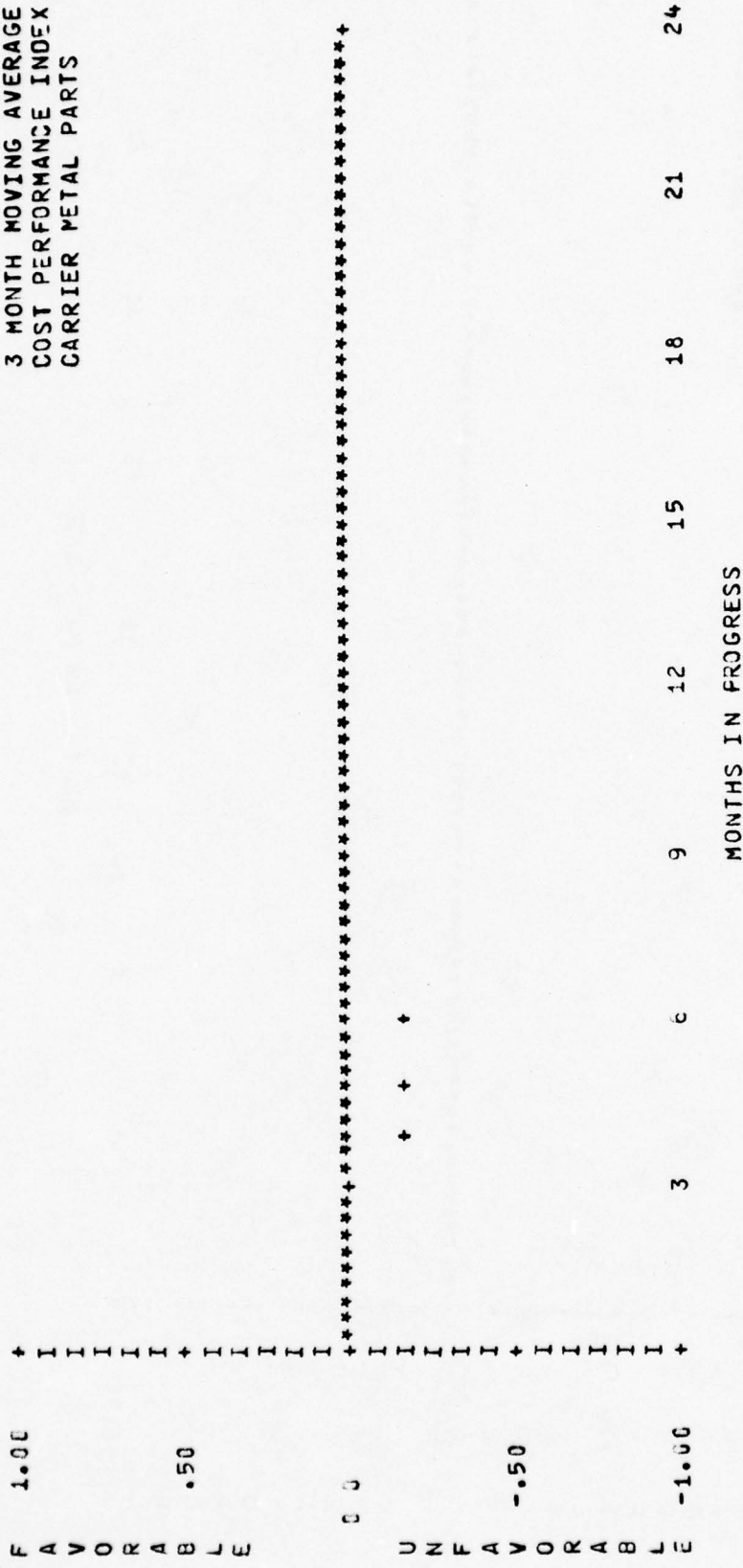
MONTHS IN PROGRESS

COST PERFORMANCE INDEX
CARRIER METAL PARTS



F A V O F A E L E 1.00
 + I I I I I I + I I I I I I +
 0 0
 U N F A V O R A B L E -.50
 + I I I I I I +

3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 CARRIER PETAL PARTS

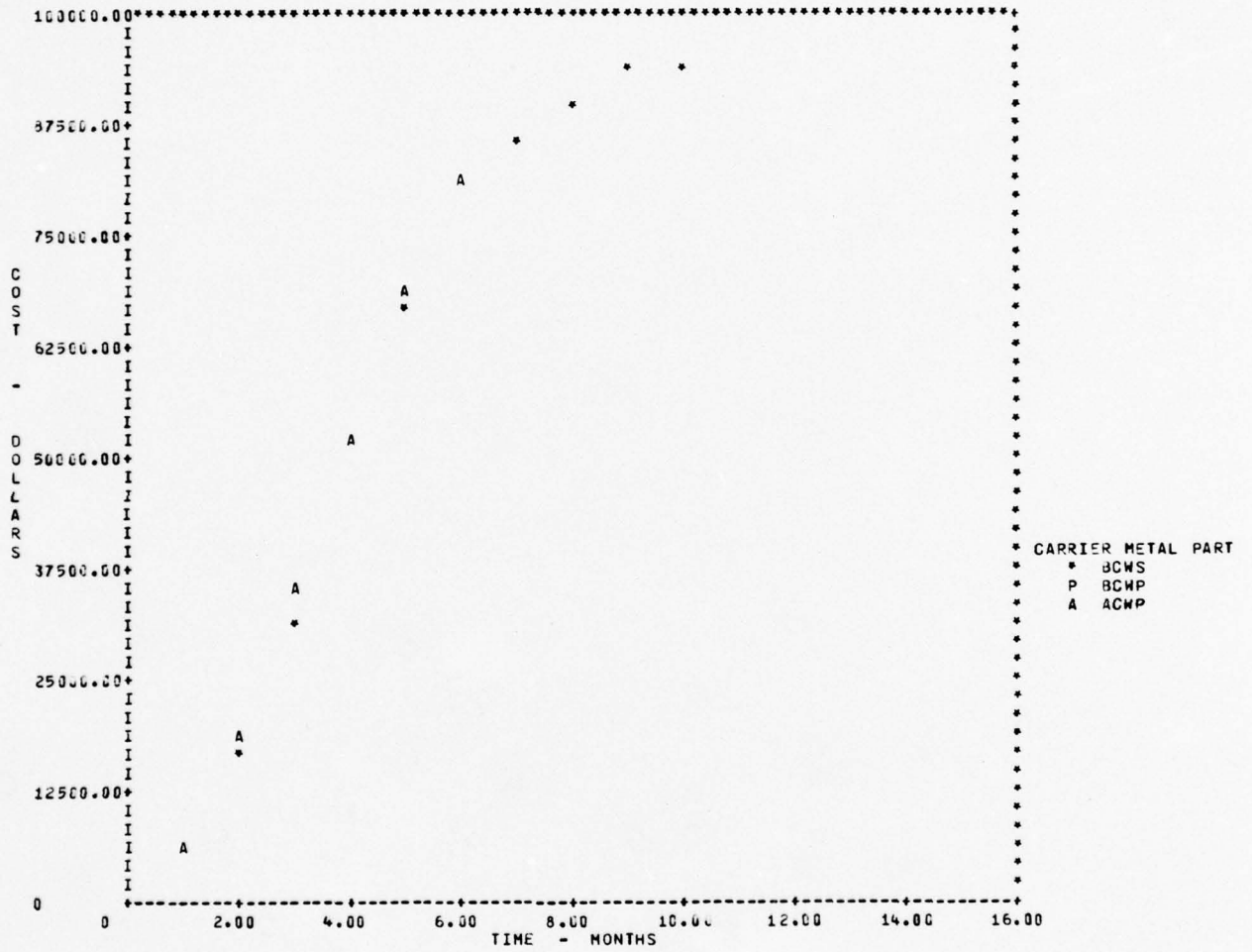


1.00
 F A V O R A B L E
 .50

34

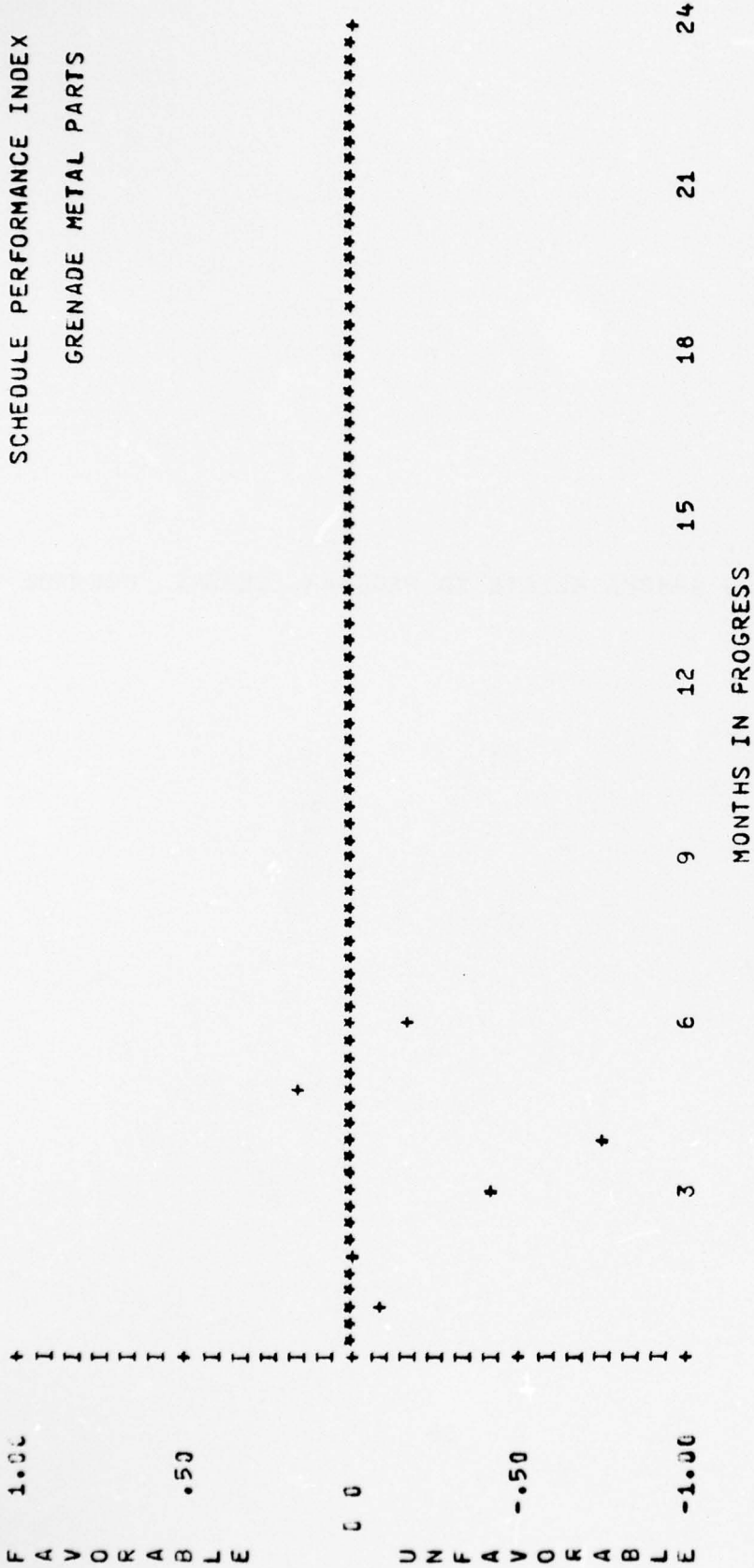
0.0
 U N F A V O R A B L E
 -.50
 -1.00

MONTHS IN PROGRESS



THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT GRENADE METAL PARTS

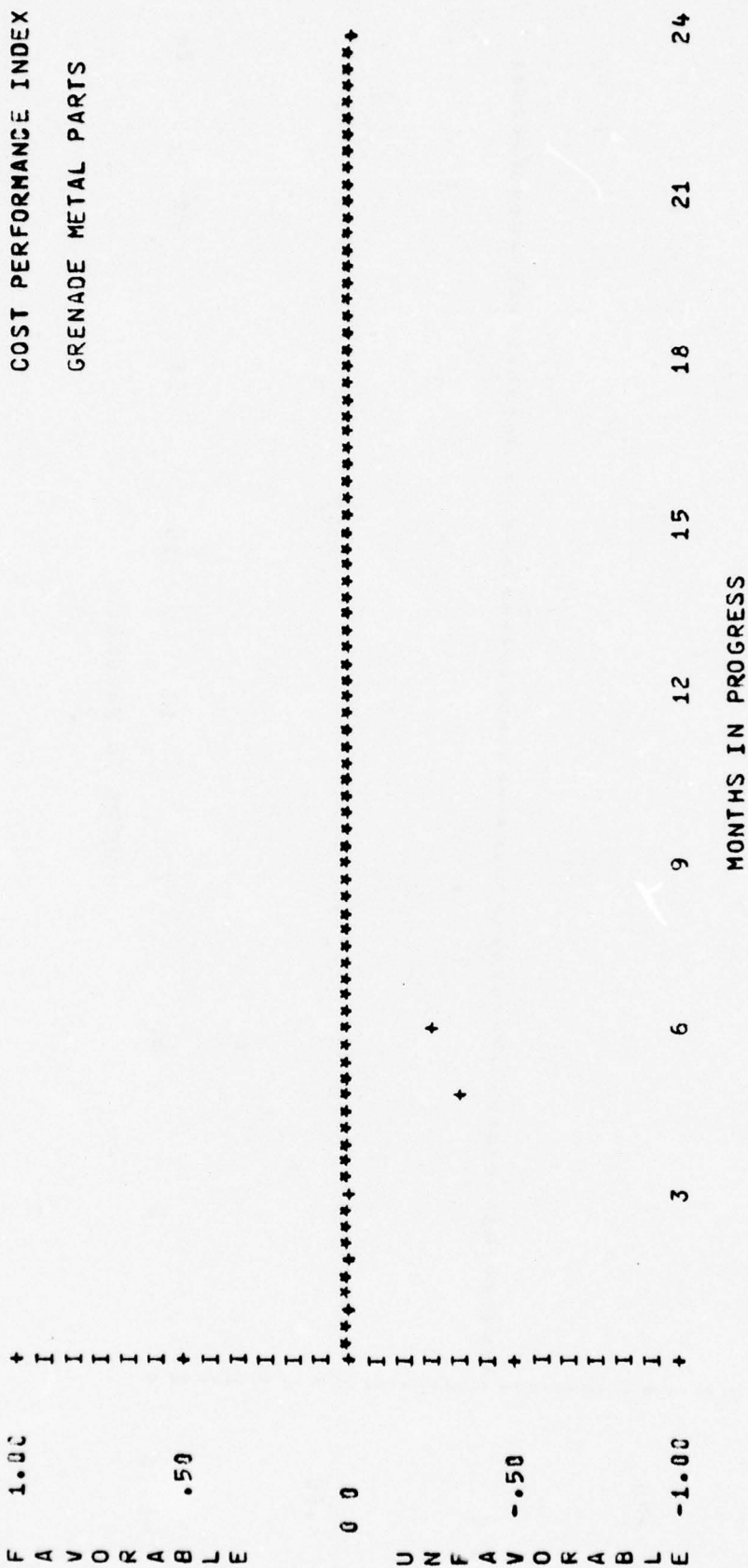
SCHEDULE PERFORMANCE INDEX
 GRENADE METAL PARTS



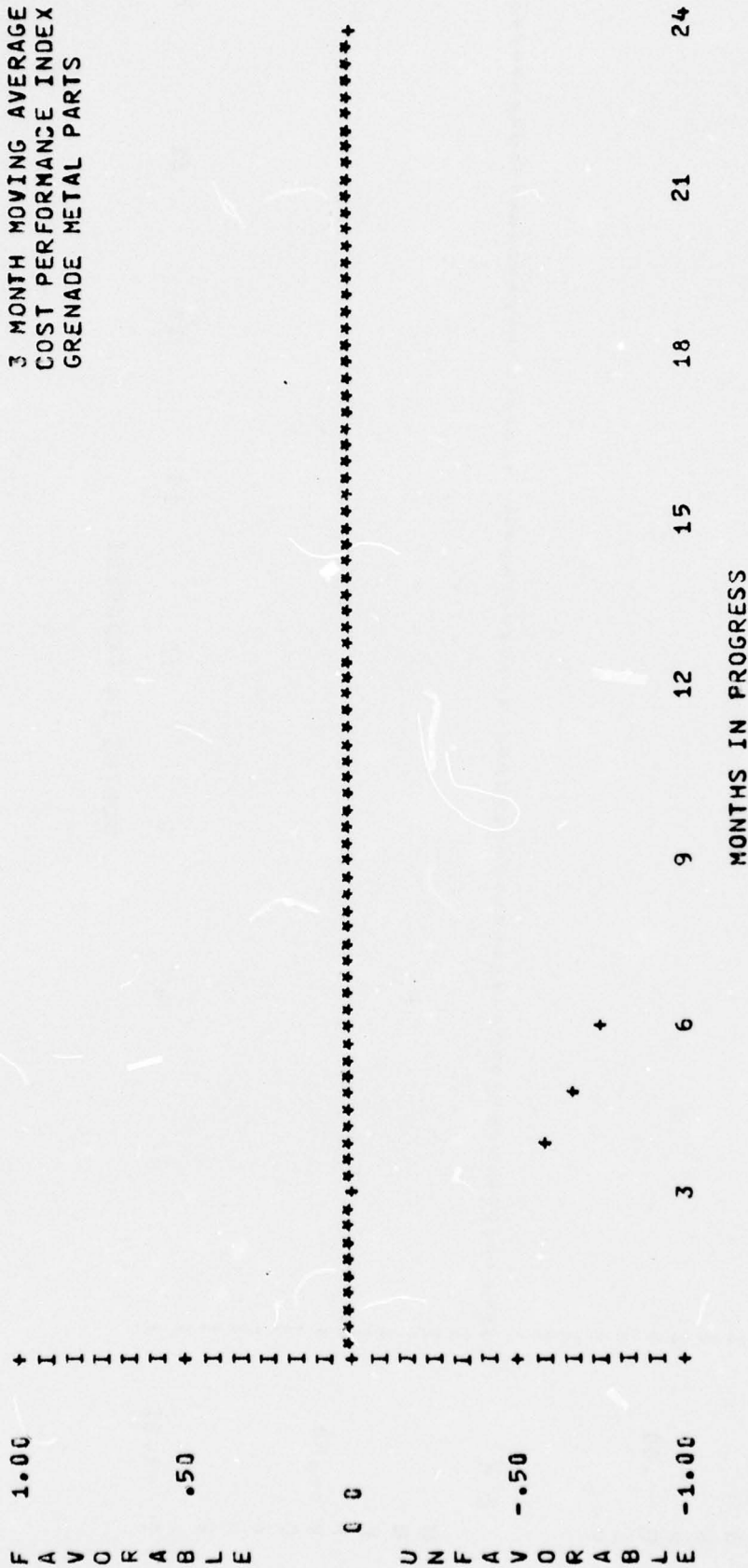
F A V O R A B L E
 1.00
 .50

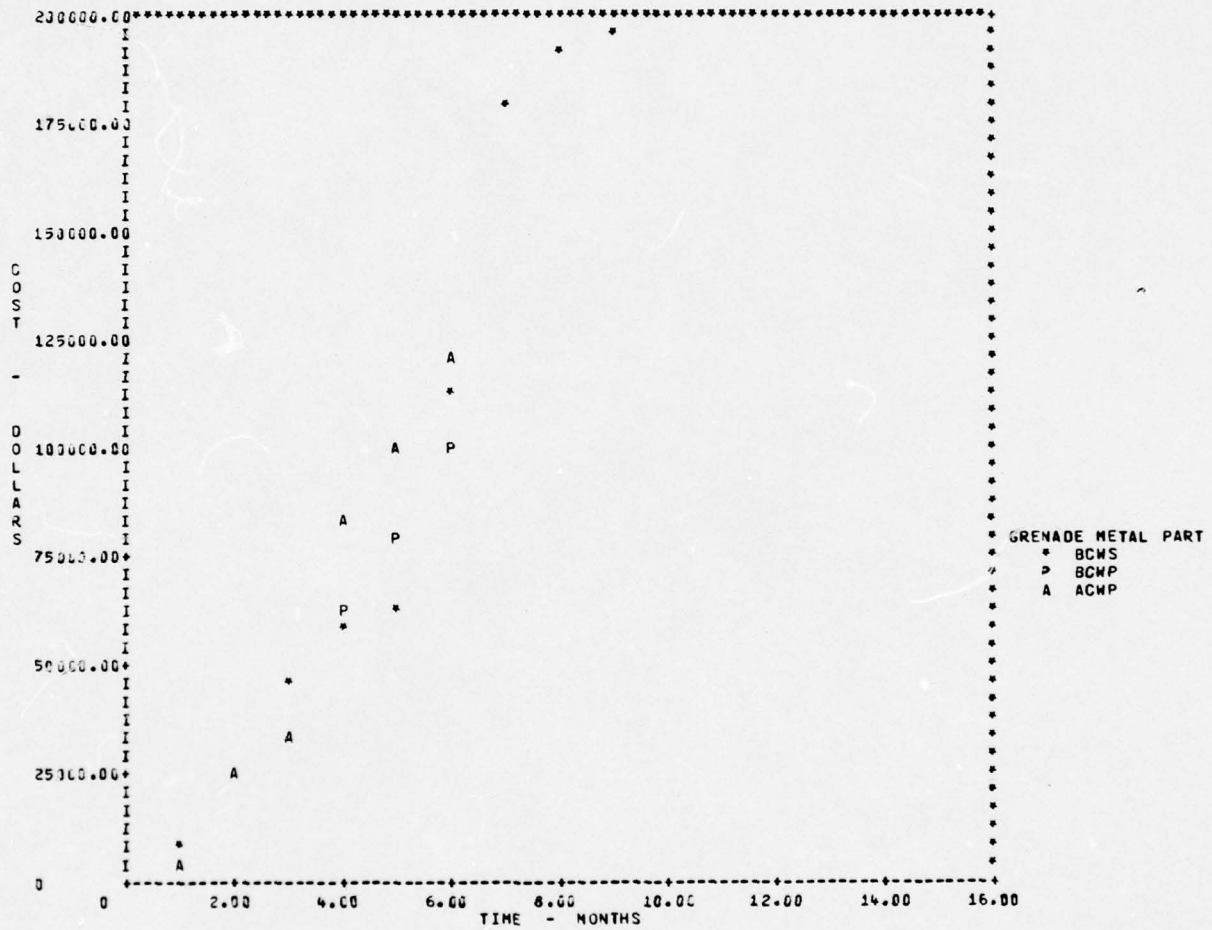
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 0
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 -1.00

COST PERFORMANCE INDEX
 GRENADE METAL PARTS



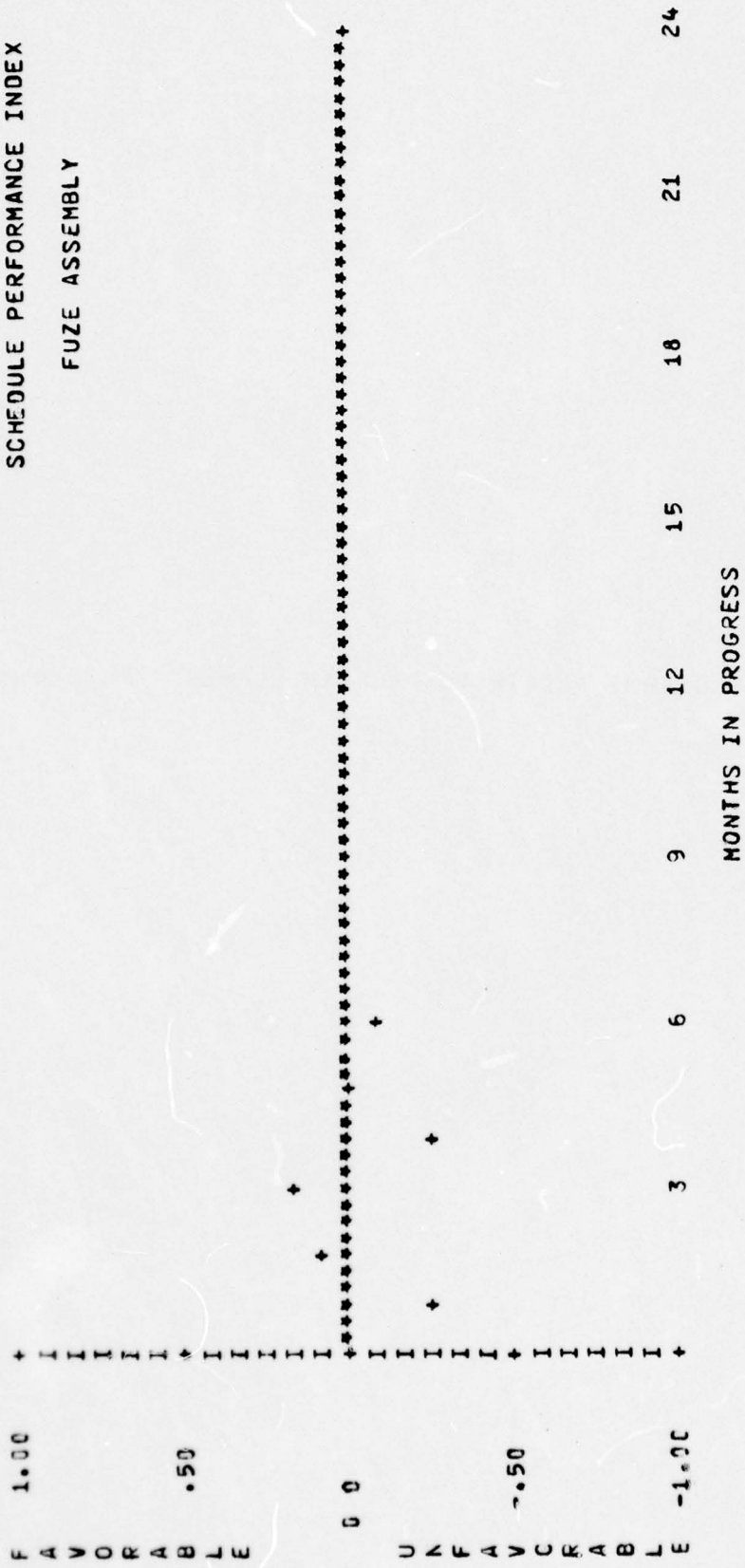
3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 GRENADE METAL PARTS





THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT FUZE ASSEMBLY

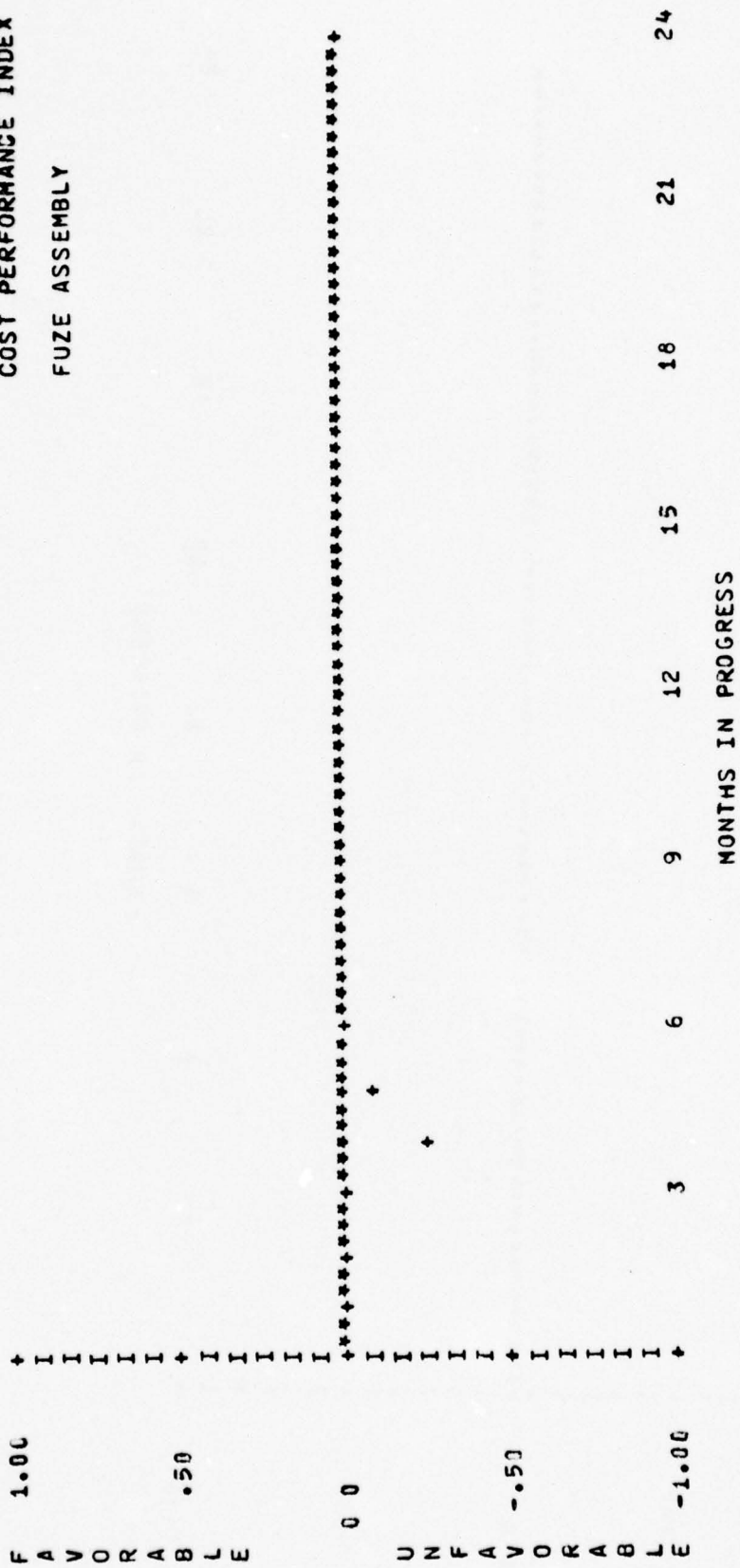
SCHEDULE PERFORMANCE INDEX
FUZE ASSEMBLY



1.00
F A V O R A B L E

0.00
U N F A V O R A B L E
-1.00

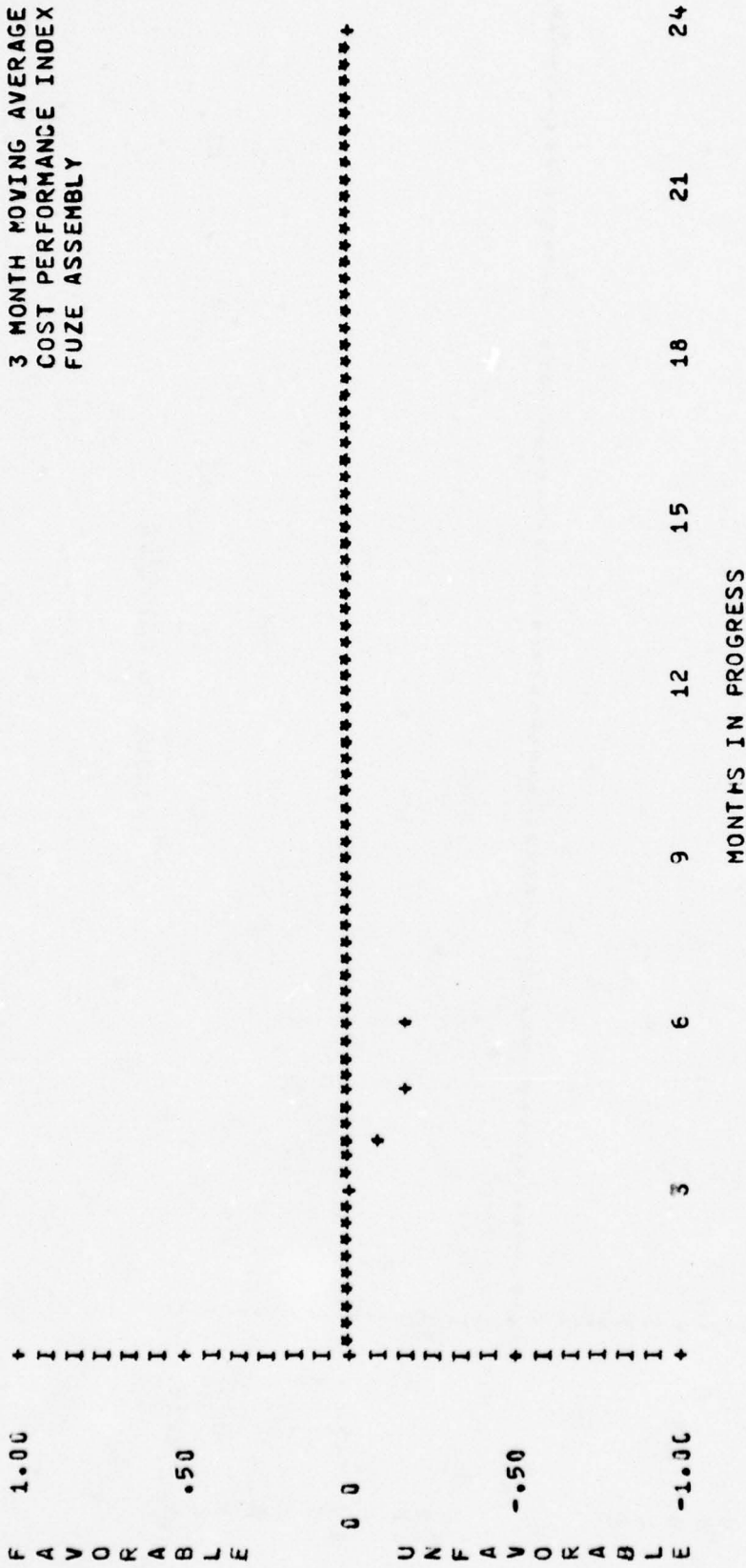
COST PERFORMANCE INDEX
FUZE ASSEMBLY



F A V O R A B L E
1.00
.50

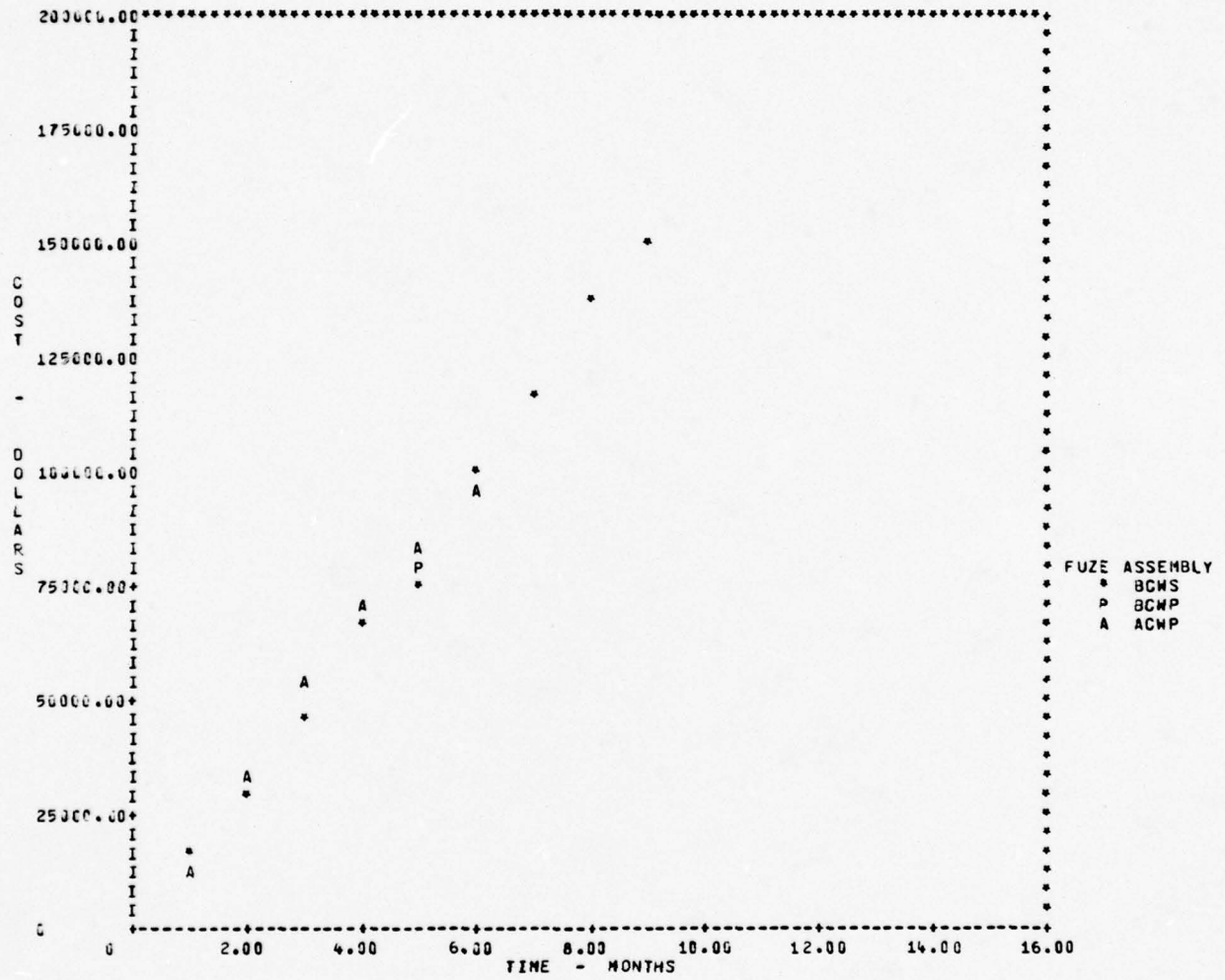
U N F A V O R A B L E
0 0
-.50
-1.00

3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 FUZE ASSEMBLY



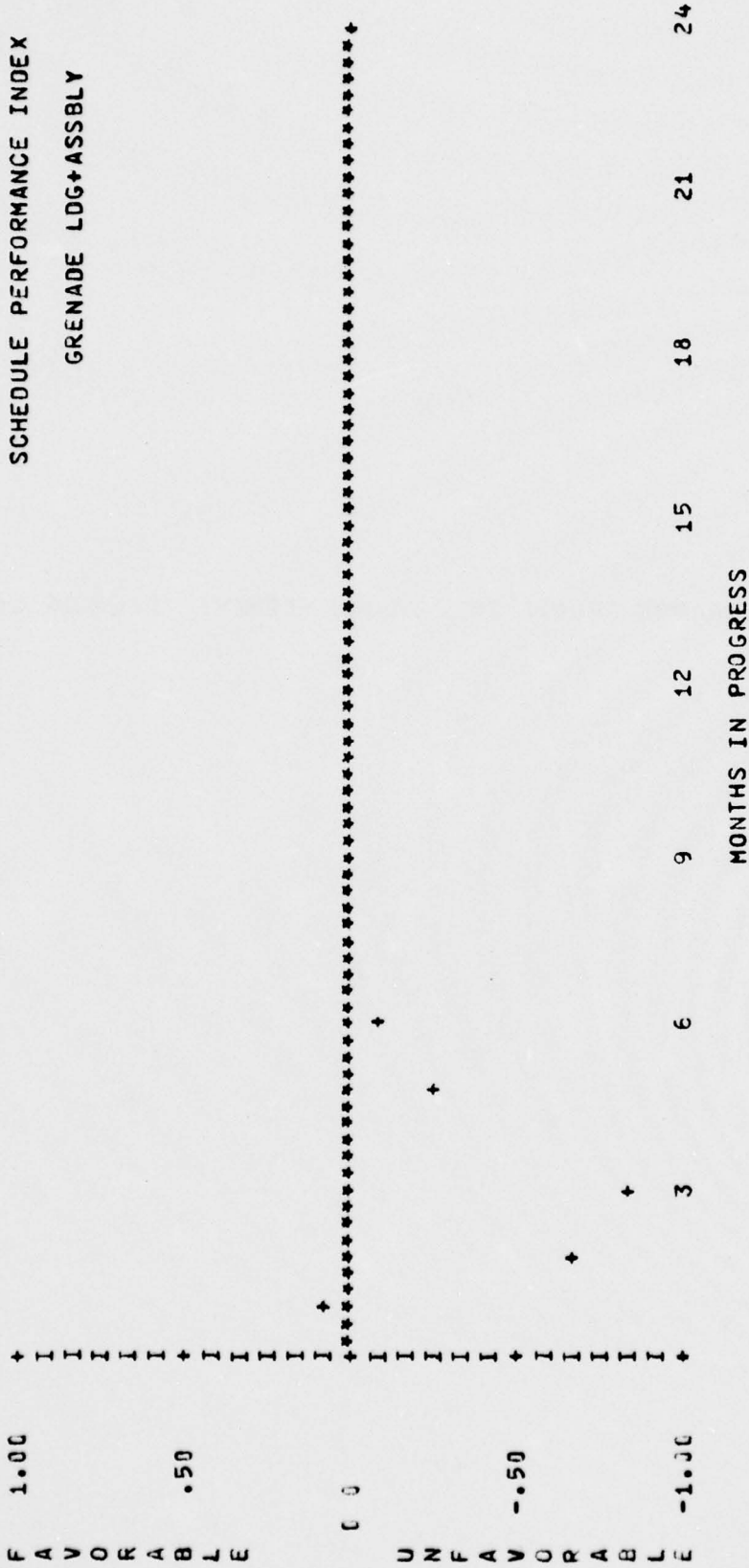
1.00
 FAVORABLE

0.0
 UNFAVORABLE
 -1.00

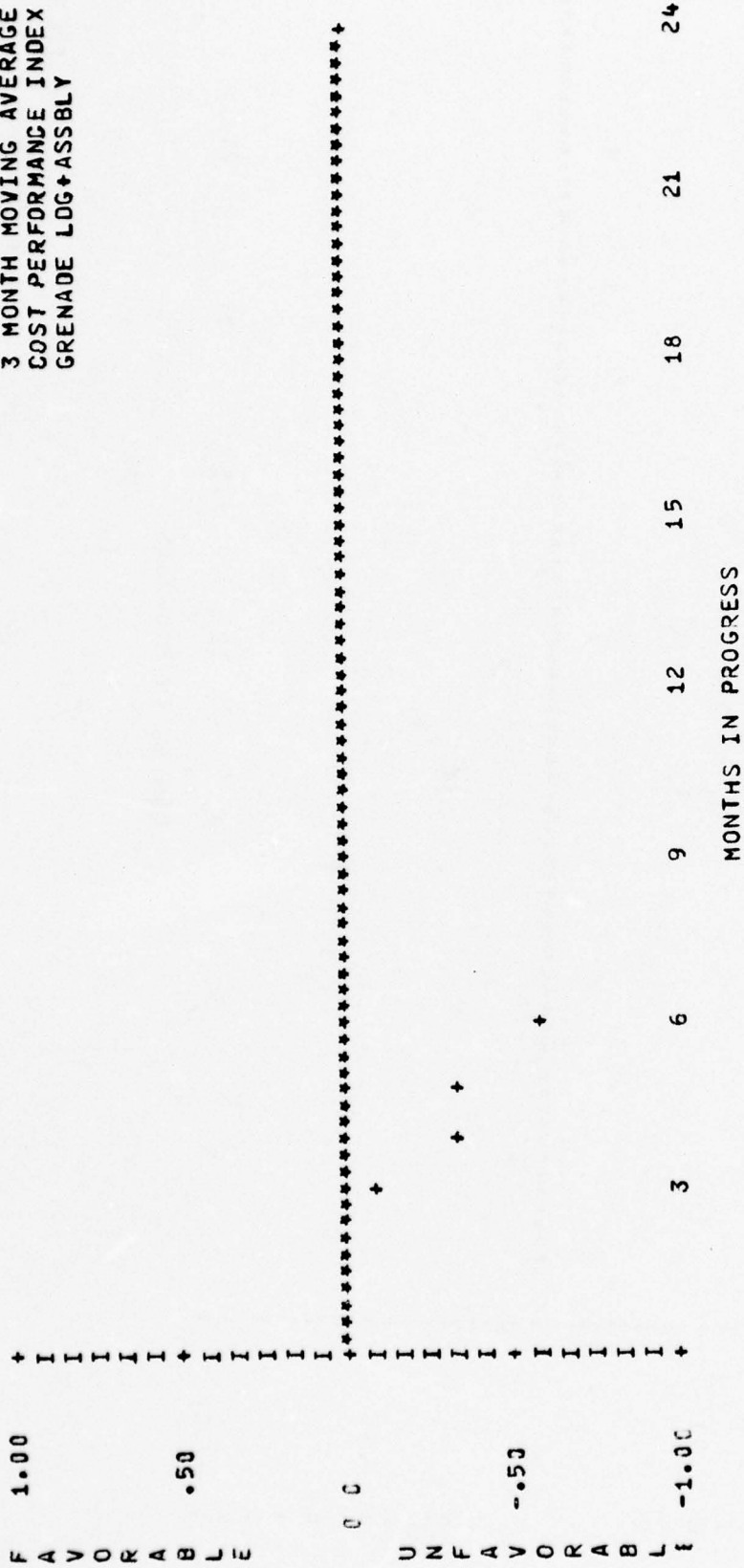


THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT GRENADE LOG+ASSBLY

SCHEDULE PERFORMANCE INDEX
 GRENADE LDG+ASSBLY



3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 GRENADE LOG+ASSBLY



F A V O R A B L E

1.00

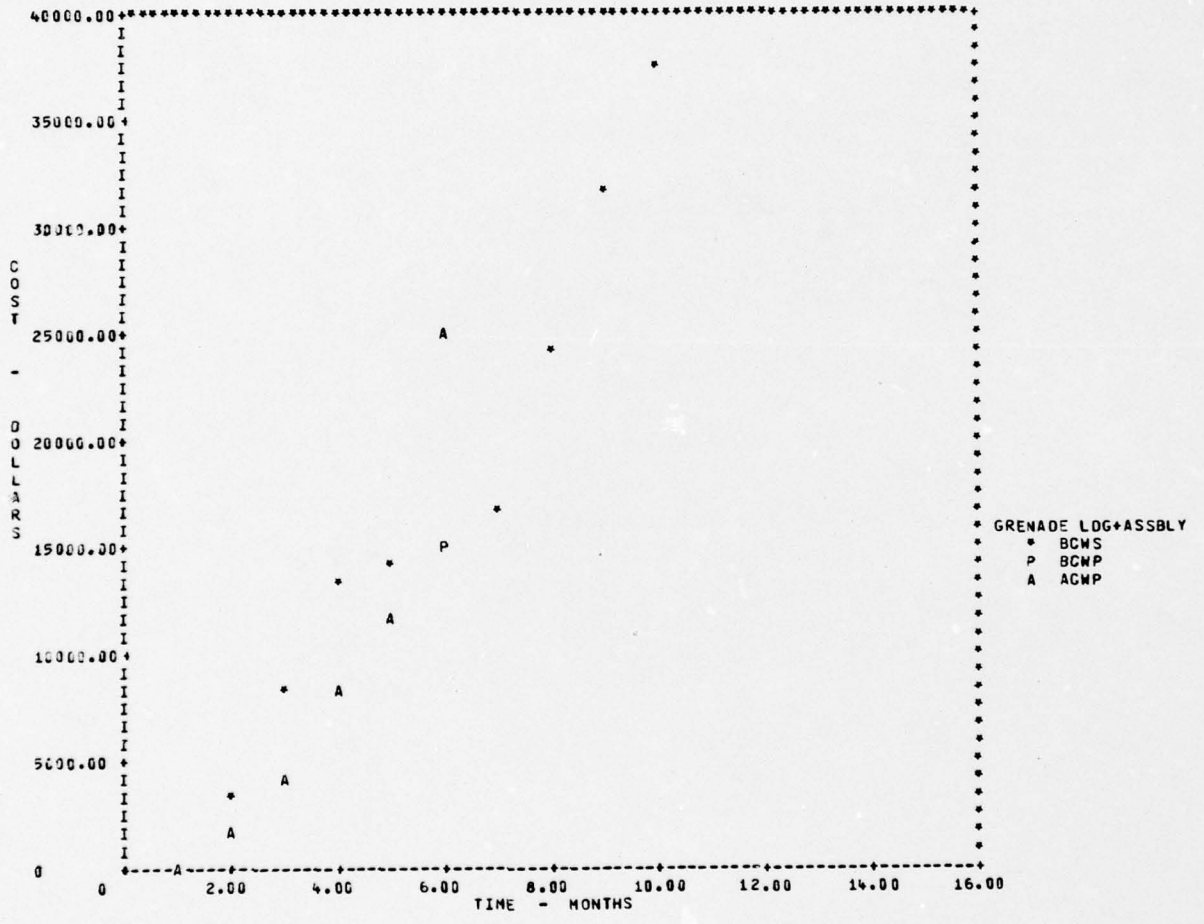
.50

0 0

U N F A V O R A B L E

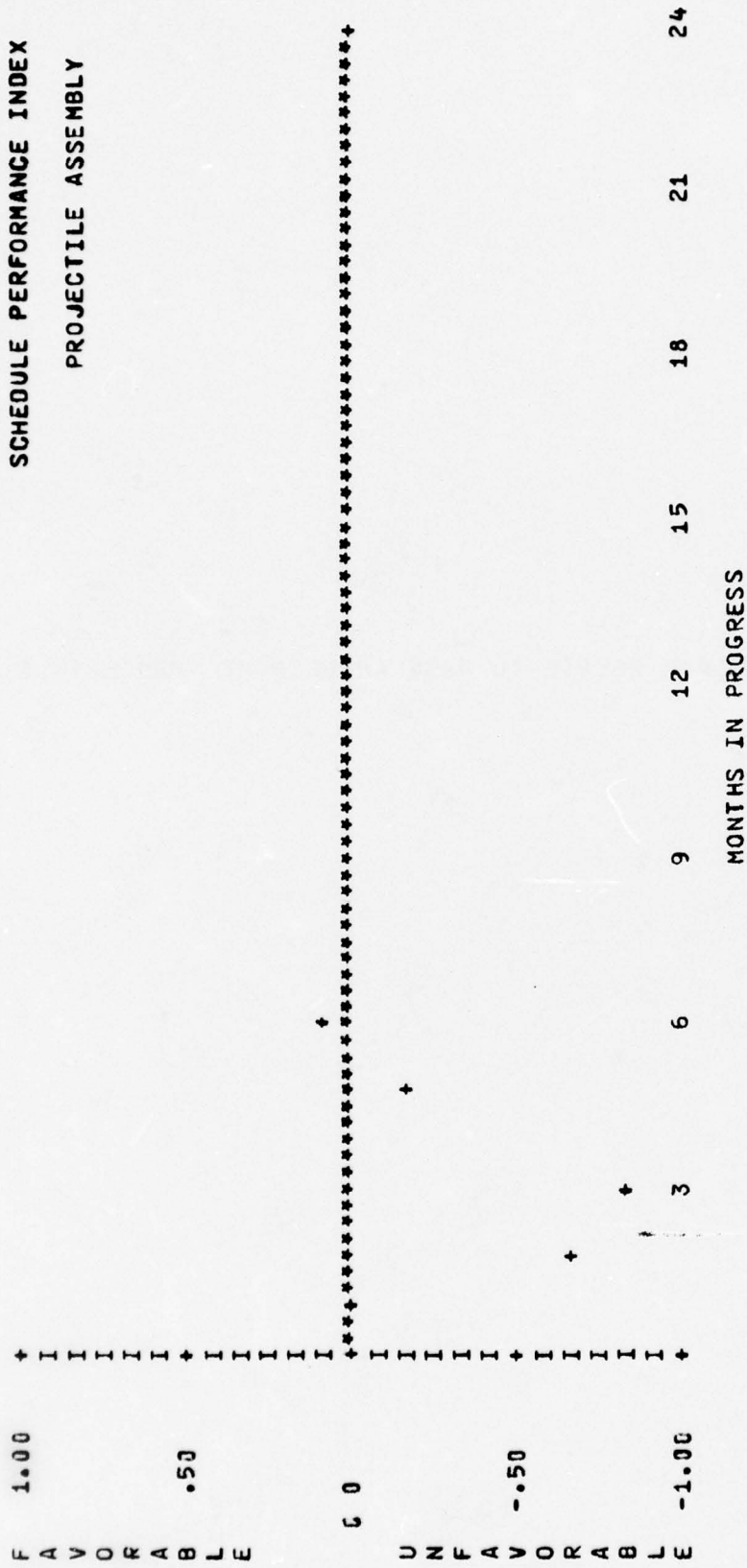
-.50

-1.00

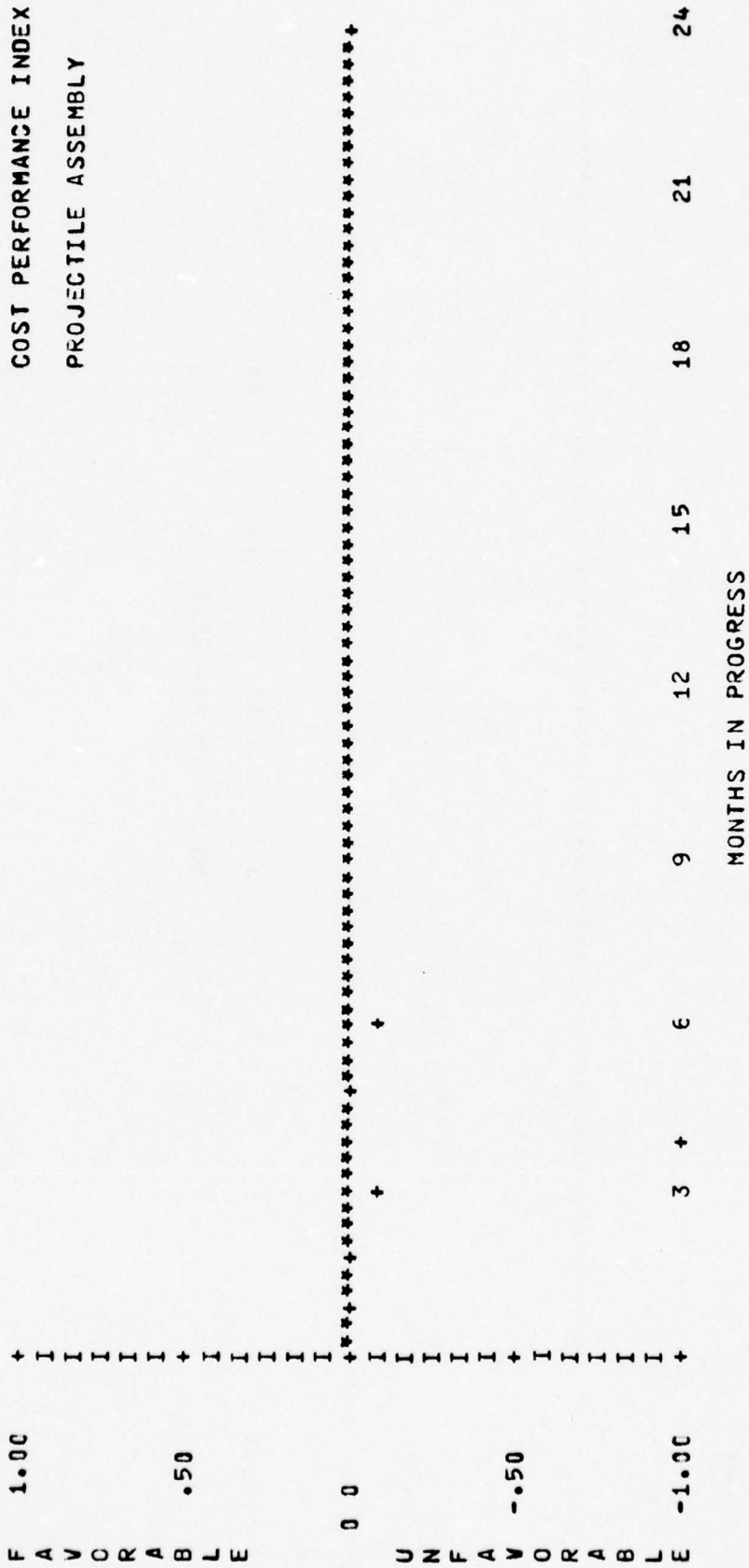


THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT PROJECTILE ASSEMBLY

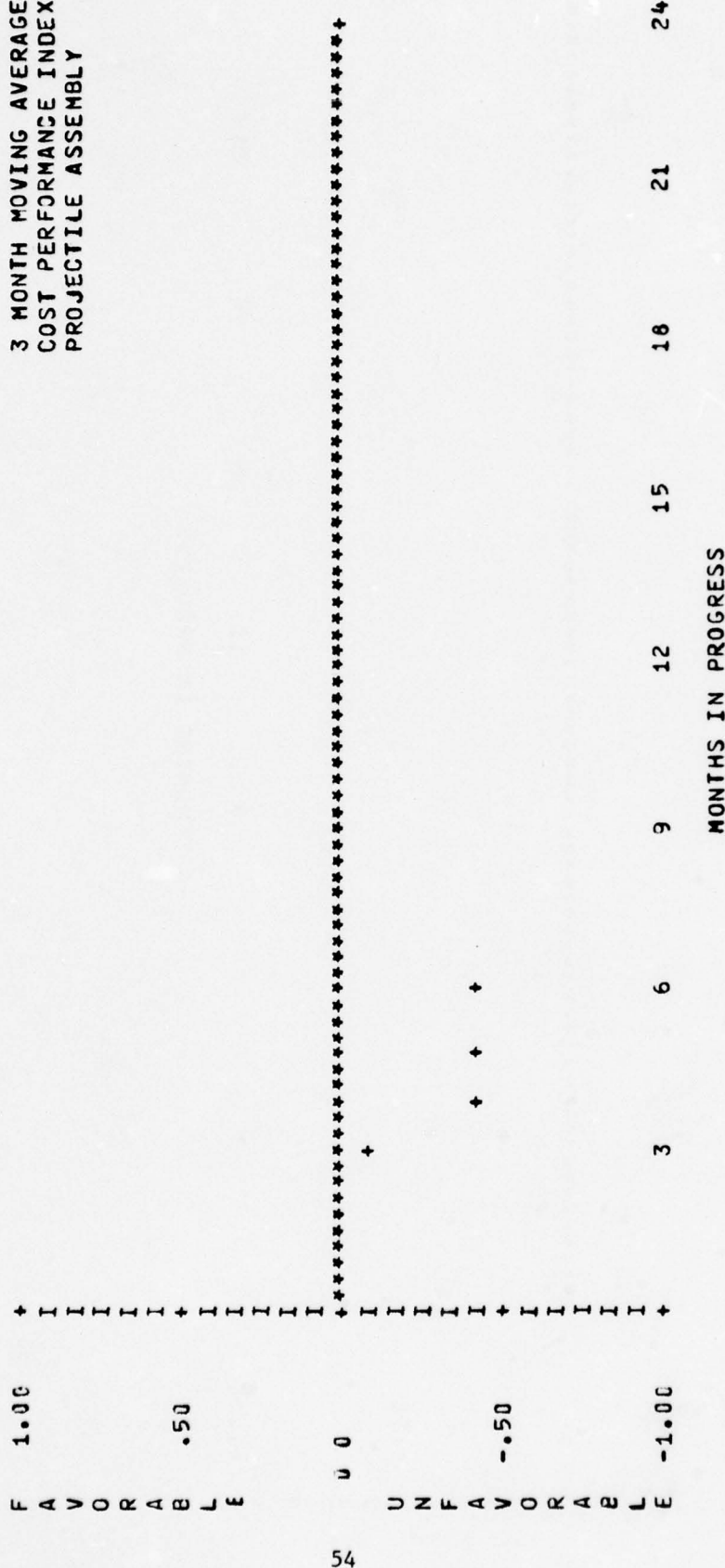
SCHEDULE PERFORMANCE INDEX
PROJECTILE ASSEMBLY



COST PERFORMANCE INDEX
PROJECTILE ASSEMBLY



3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 PROJECTILE ASSEMBLY

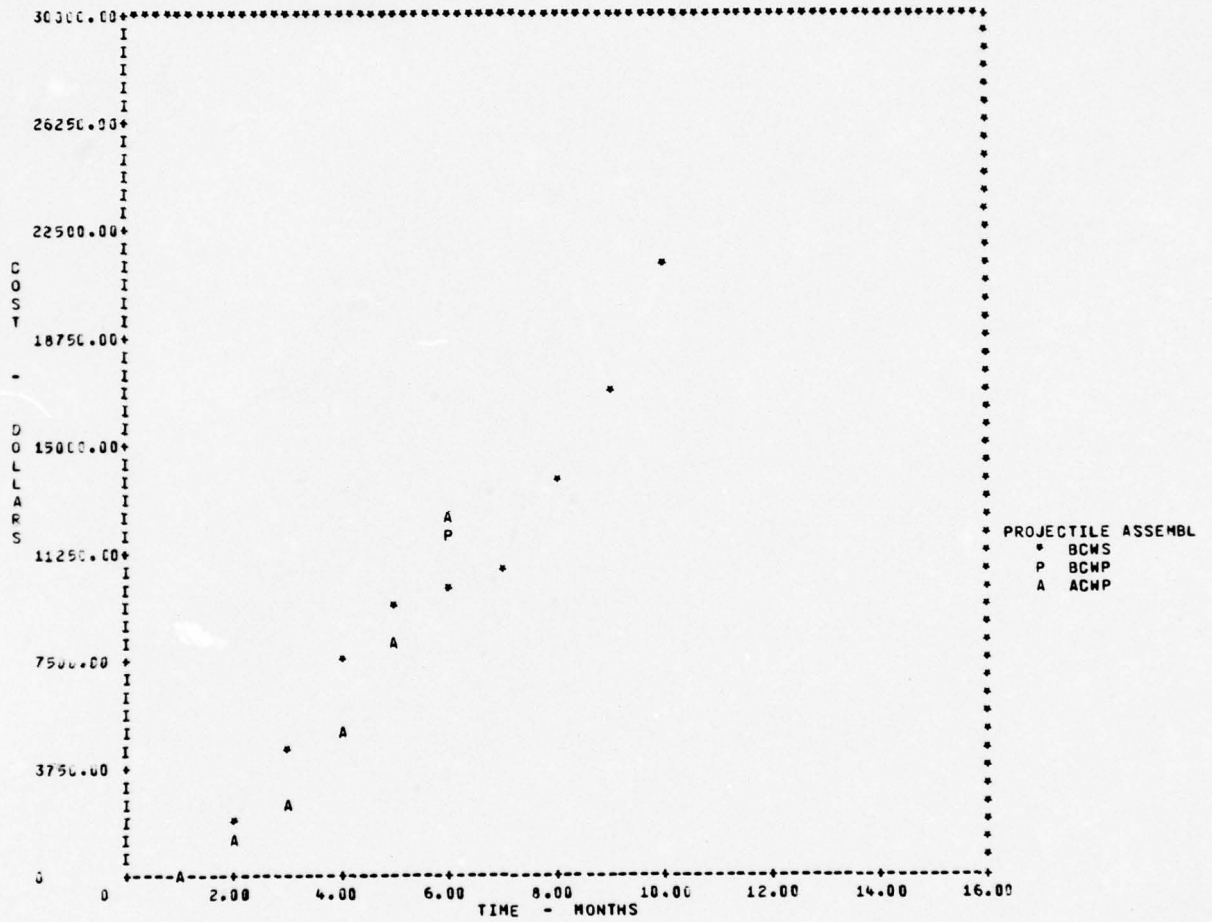


F A V O R A B L E

54

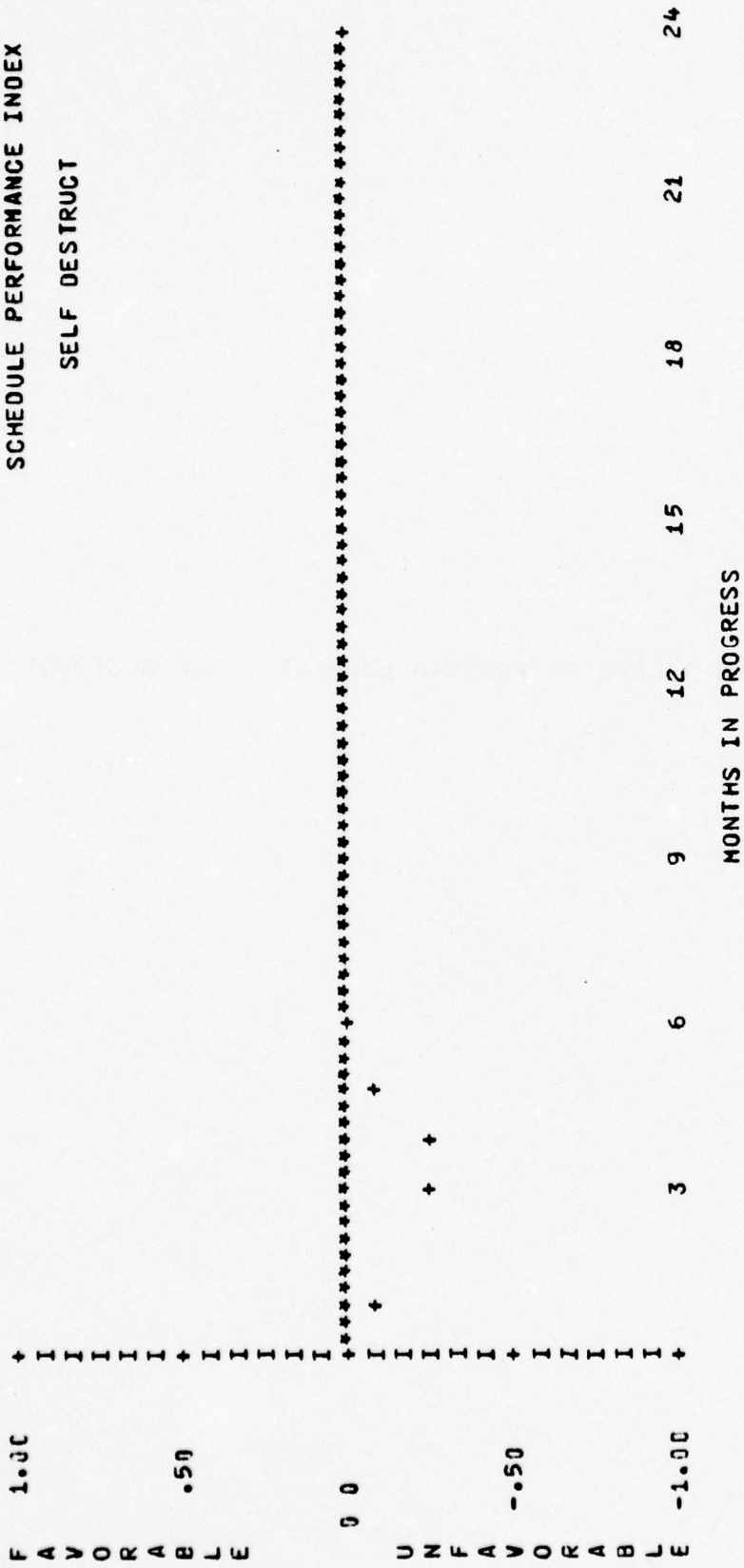
U N F A V O R A B L E

MONTHS IN PROGRESS



THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT SELF DESTRUCT

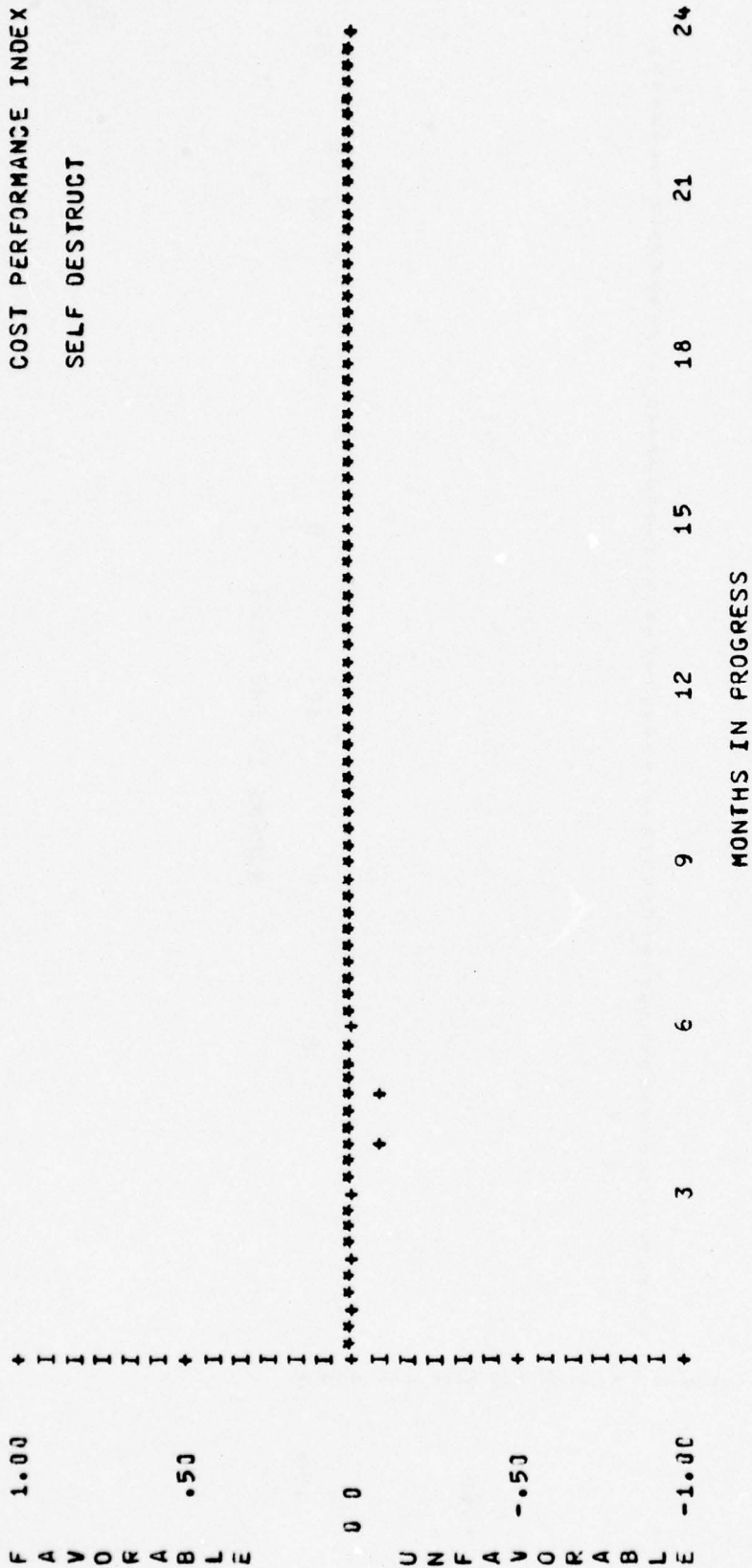
SCHEDULE PERFORMANCE INDEX
 SELF DESTRUCT



F A V O R A B L E
 1.00
 .50

0 0
 U N F A V O R A B L E
 -.50
 -1.00

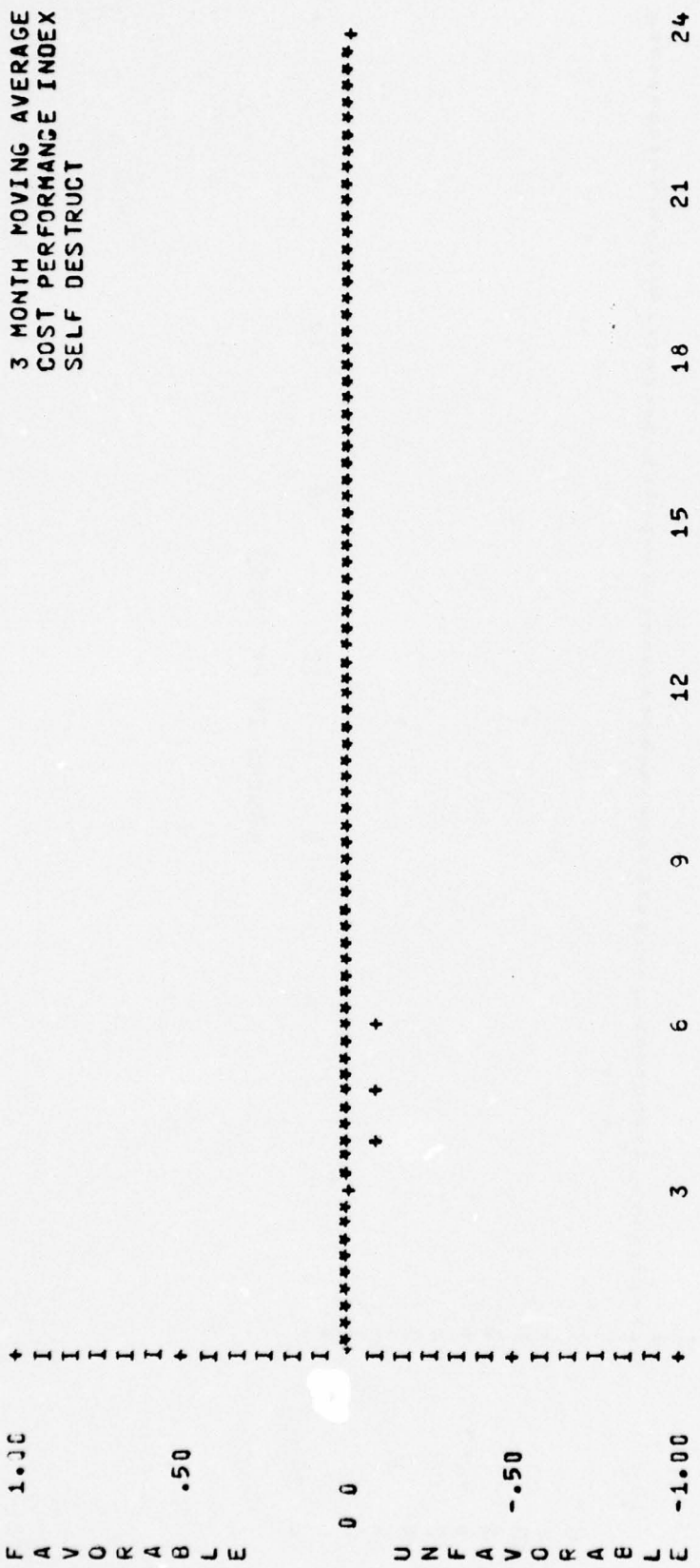
COST PERFORMANCE INDEX
 SELF DESTRUCT



F A V O R A B L E
 1.00
 .50

U N F A V O R A B L E
 0 0
 -.50
 -1.00

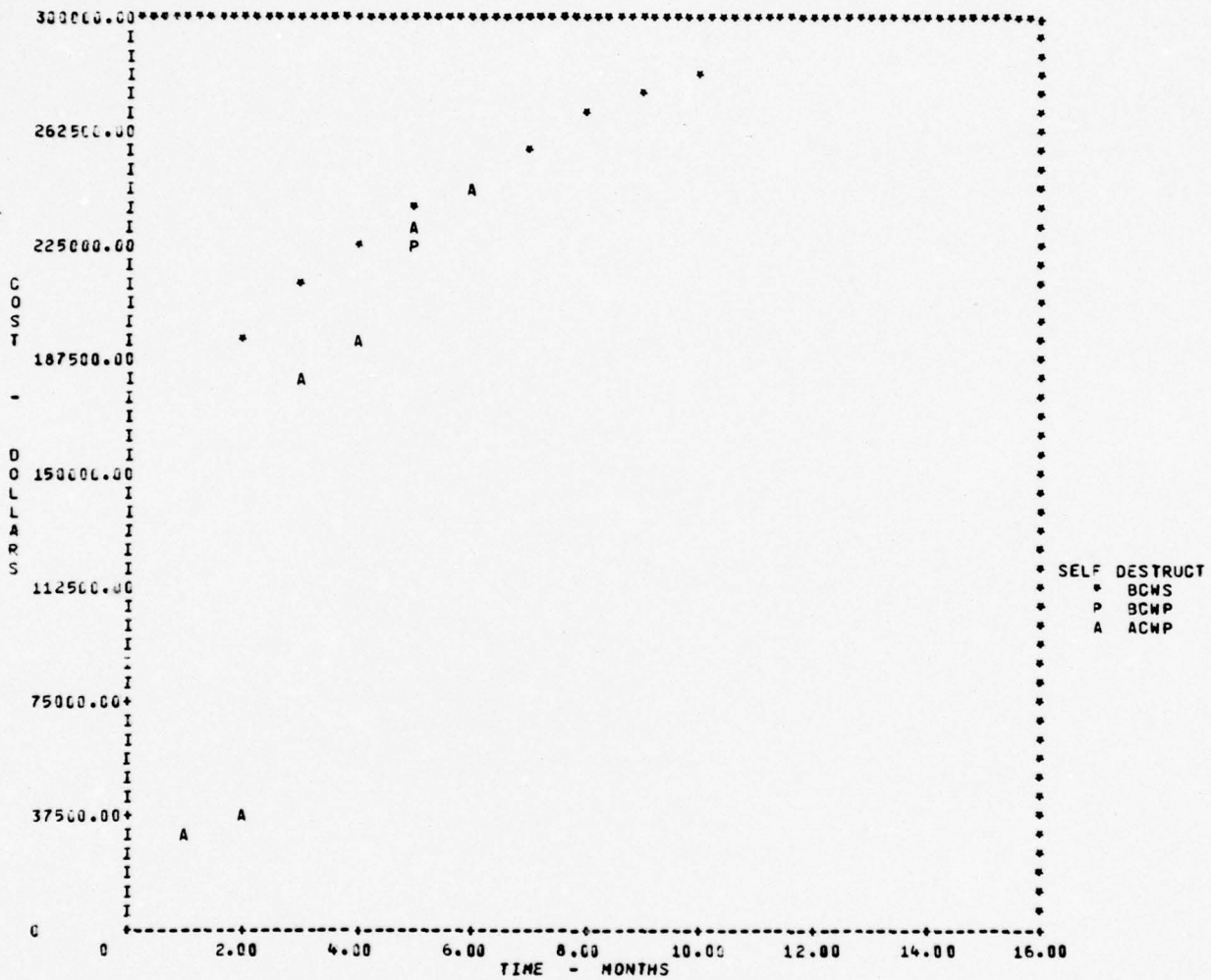
3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 SELF DESTRUCT



F A V O R A B L E
 1.00
 .50

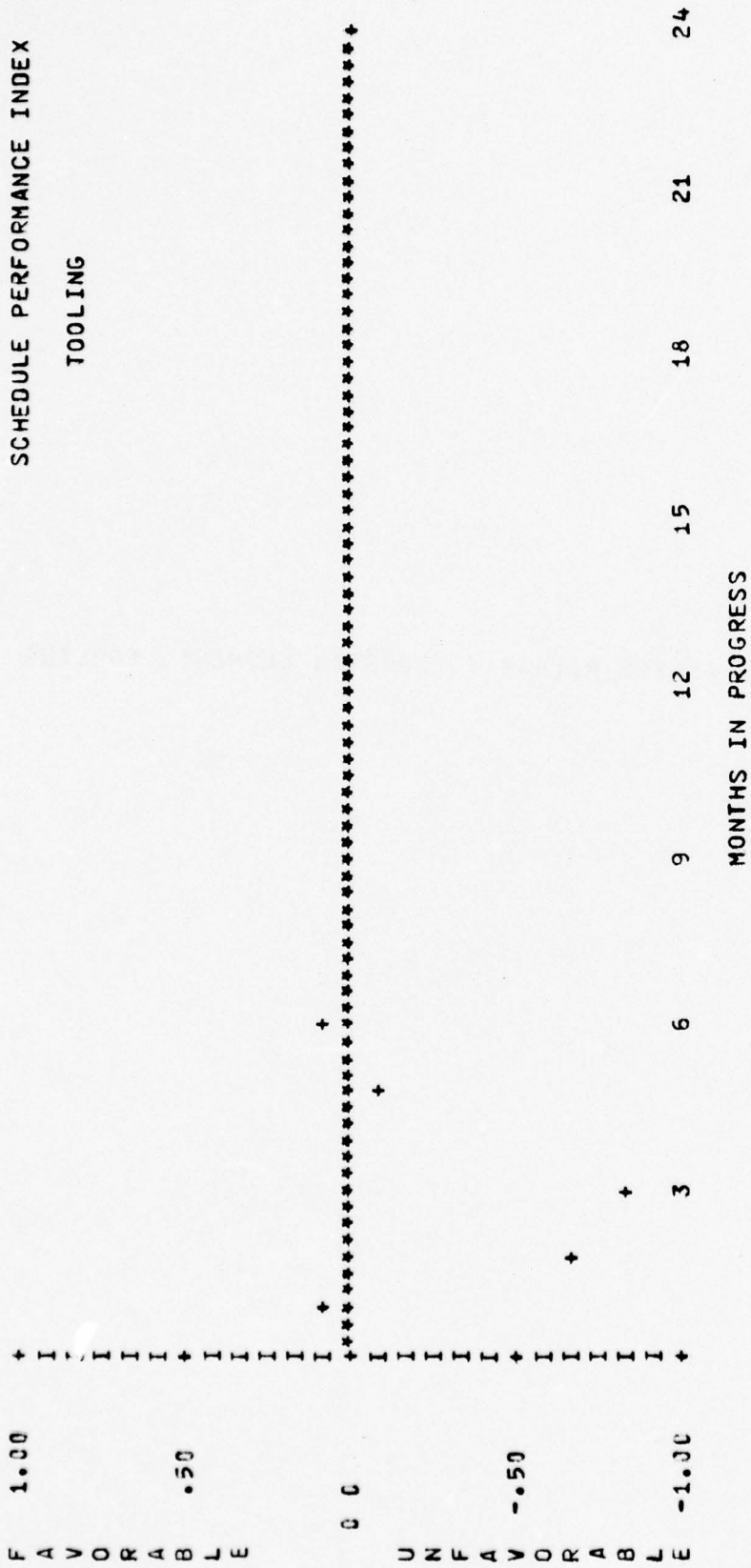
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 0 0
 -.50
 -1.00

MONTHS IN PROGRESS



THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT TOOLING

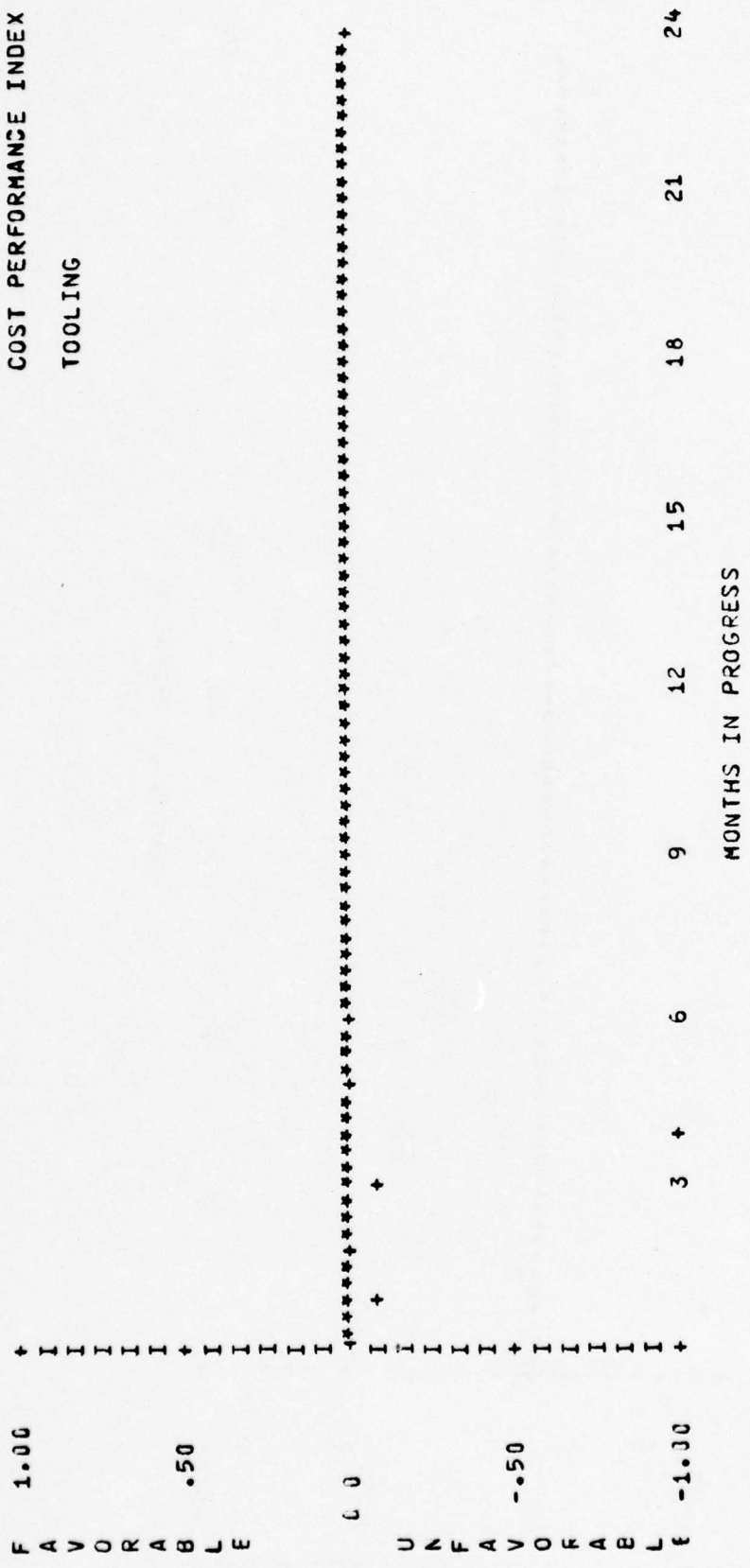
SCHEDULE PERFORMANCE INDEX
TOOLING



F A V O R A B L E

U N F A V O R A B L E

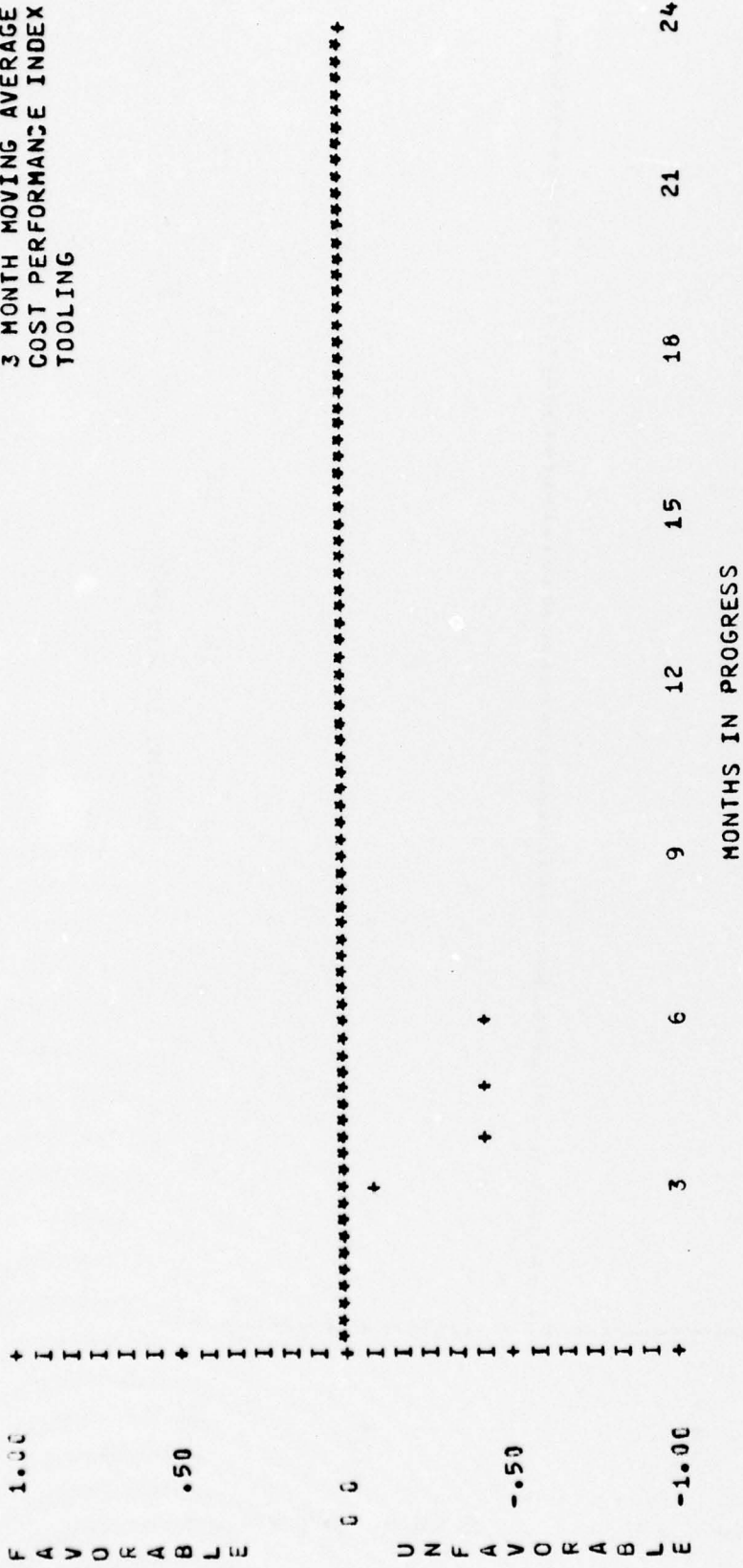
COST PERFORMANCE INDEX
TOOLING



F A V O R A B L E
1.00
0.50

U N F A V O R A B L E
-0.50
-1.00

3 MONTH MOVING AVERAGE
COST PERFORMANCE INDEX
TOOLING

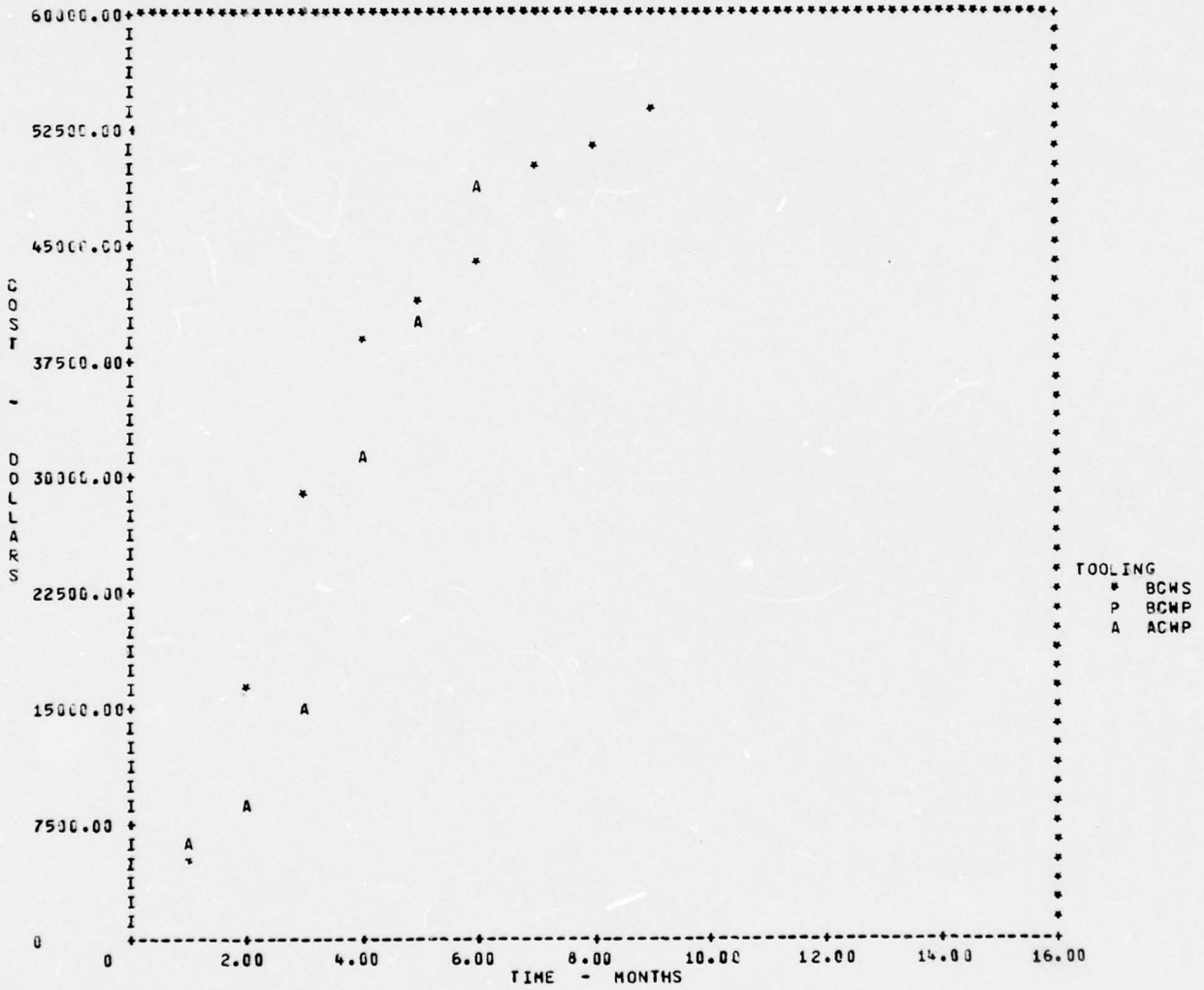


1.00
F A V O R A B L E
0.50

64

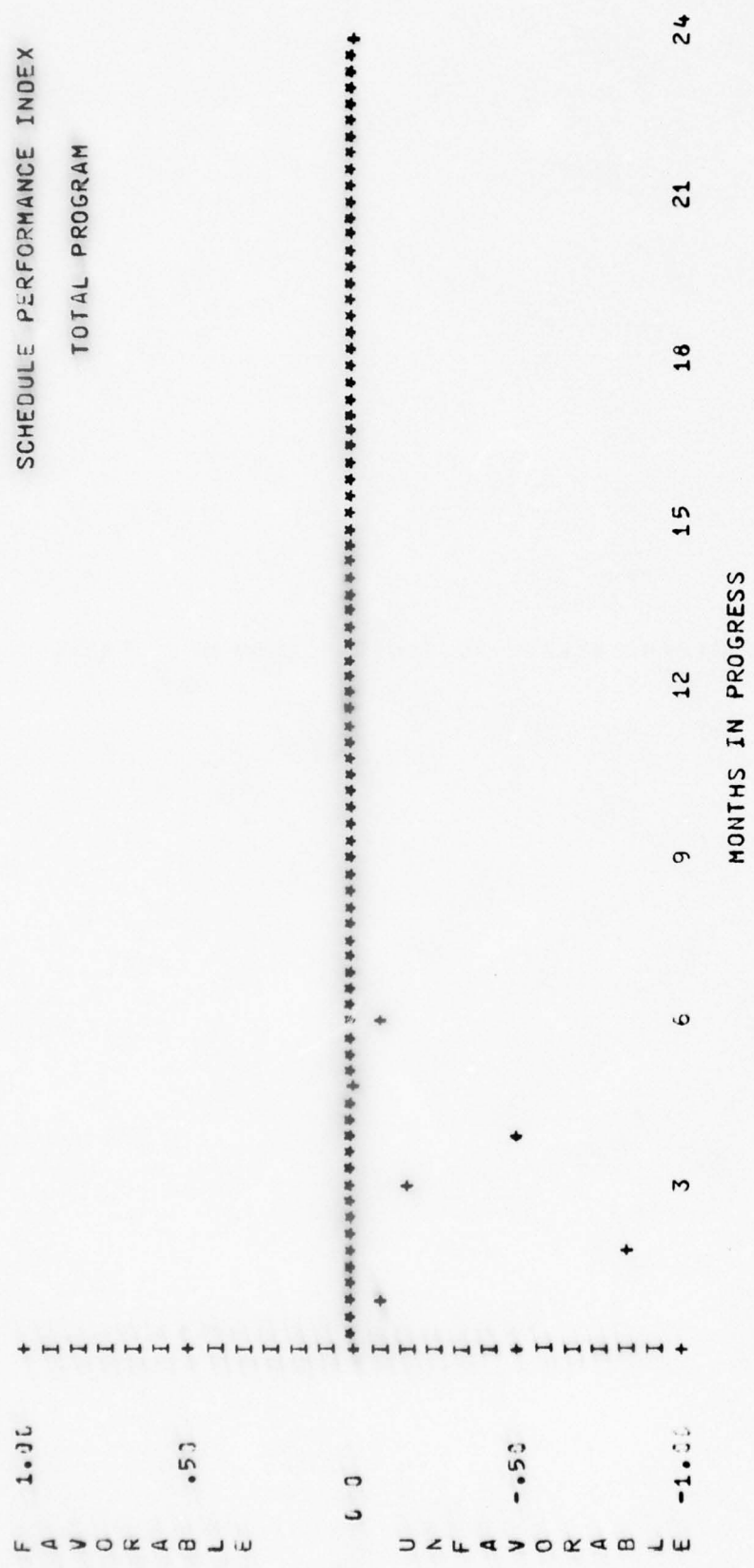
0.0
U N F A V O R A B L E
-0.50
-1.00

MONTHS IN PROGRESS

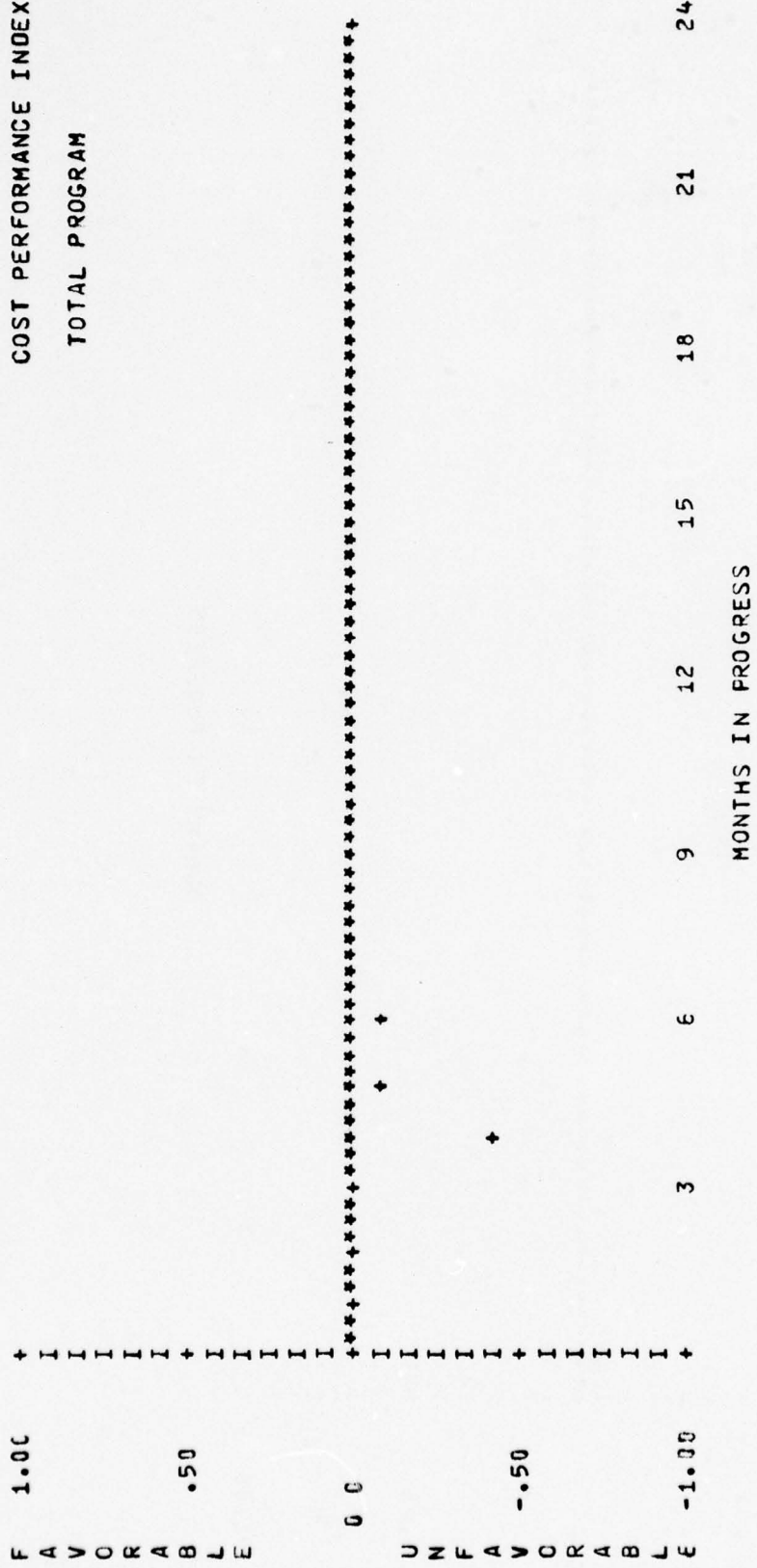


THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT TOTAL PROGRAM

SCHEDULE PERFORMANCE INDEX
TOTAL PROGRAM



COST PERFORMANCE INDEX
TOTAL PROGRAM



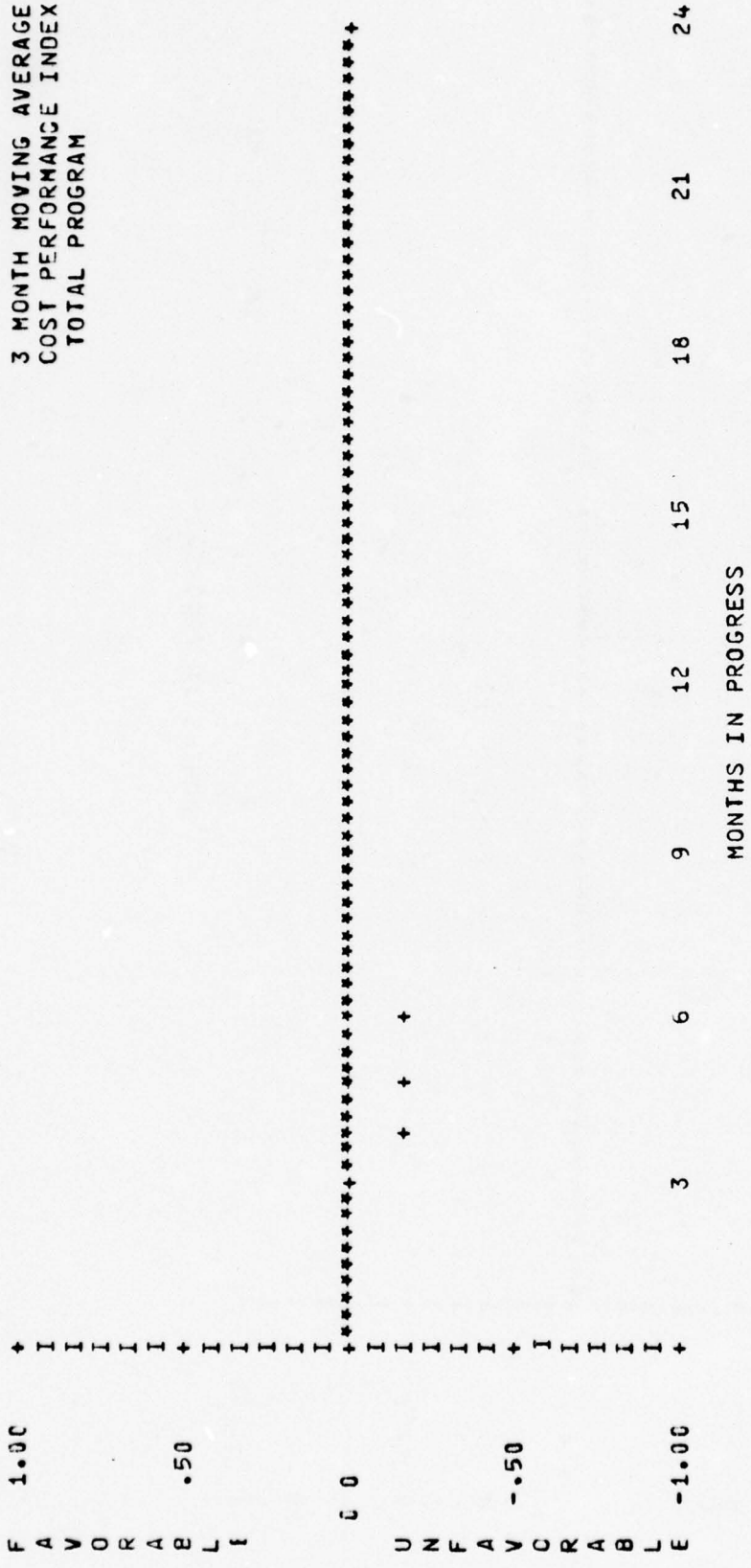
F A V O R A B L E
1.00
0.50

68

U N F A V O R A B L E
-0.50
-1.00

MONTHS IN PROGRESS

3 MONTH MOVING AVERAGE
 COST PERFORMANCE INDEX
 TOTAL PROGRAM



F A V O R A B L E

U N F A V O R A B L E

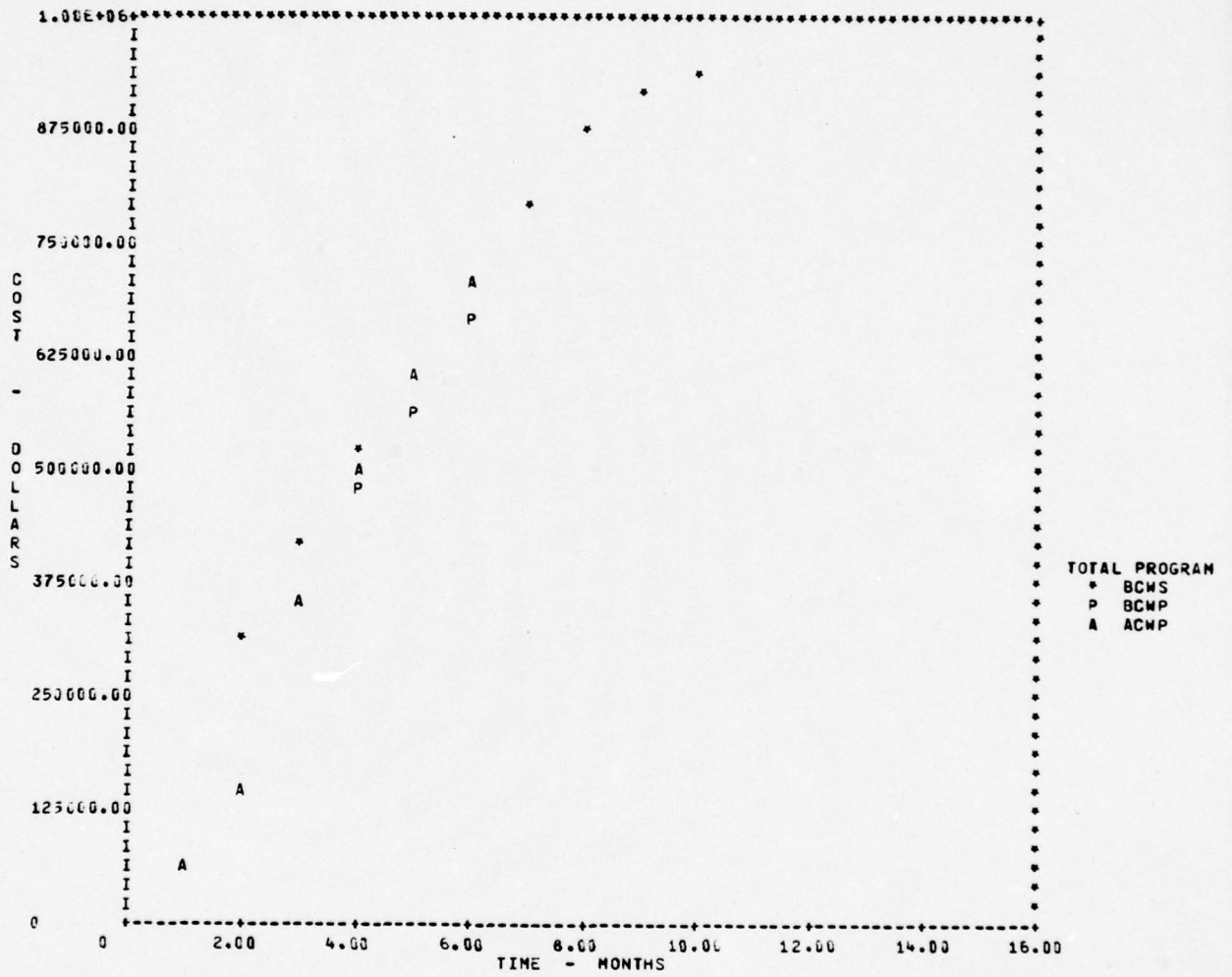


TABLE 1. CUMULATIVE DATA, PROGRAM WHOSOMEVER ED CONTRACT 76-C-0214 CART,
 XM185E1 FOR 31 SEP 1977

ELEMENT NAME	BCWS	BCWP	ACWP	PCT. COST	VARIANCE SCHEDULE	DOLLAR COST	VARIANCE SCHEDULE
SYSTEM INTEGRATION	71713.	63400.	73400.	-15.77	-11.59	-10000.	-8313.
CARRIER METAL PARTS	81413.	81200.	81200.	0.00	-.26	0.	-213.
GRENADE METAL PARTS	114377.	102200.	124200.	-21.53	-10.65	-22000.	-12177.
FUZE ASSEMBLY	102106.	98600.	98600.	0.00	-3.43	0.	-3506.
GRENADE LOG+ASSEMBLY	15053.	15000.	25000.	-66.67	-.35	-10000.	-53.
PROJECTILE ASSEMBLY	10279.	12100.	12635.	-4.42	17.72	-535.	1621.
SELF DESTRUCT	245700.	246000.	246000.	0.00	.12	0.	300.
TOOLING	44872.	49900.	49900.	0.00	11.21	0.	5028.
ALL ELEMENTS	685513.	668400.	710935.	-6.36	-2.50	-42535.	-17113.

MANAGEMENT RESERVE DATA

CURRENT MONTH APPLICATION	\$ 0
TOTAL APPLICATION TO DATE	\$ 0
CURRENT MONTH BALANCE	\$310347

TABLE 2. FLAGGED MONTHLY CUMULATIVE COST/SCHEDULE VARIANCES FOR PROGRAM
 WHOSOMEVER ED CONTRACT 76-C-0214 CART, XM185E1 31 SEP 1977

ELEMENT NAME	COST VARIANCE PCT.	SCHEDULE VARIANCE PCT.	EAC/BUDGET CONTRACTOR	VARIANCE PCT. GOVERNMENT
SYSTEM INTEGRATION	-15.77	-11.59	-1.42	-4.55
GRENADE METAL PARTS	-21.53	-10.65	.08	-2.44
GRENADE LOG+ASSBLY	-66.67	-.35	.03	-7.25
PROJECTILE ASSEMBLY	-4.42	17.72	.23	-1.22
TOOLING	0.00	11.21	.11	.00

TABLE 3. COST AT COMPLETION ESTIMATES FOR PROGRAM
 WOSOMEVEVER ED CONTRACT 76-C-0214 CART, XM185E1 31 SEP 1977

ELEMENT NAME	TOTAL BUDGET	CONTRACTOR	ESTIMATED COSTS AT COMPLETION AS DERIVED FROM											
			COST VARIANCE	SCHEDULE VARIANCE	COST+SCHED. VARIANCES	TREND OF COST VAR.	AVERAGE OF VARIANCES	BAYESIAN						
SYSTEM INTEGRATION	116113.	117764.	134427.	131338.	152053.	140434.	139563.	121392.						
CARRIER METAL PARTS	95413.	95181.	95413.	95663.	95663.	106166.	98226.	95413.						
GRENADE METAL PARTS	197377.	197216.	239865.	220894.	268445.	294892.	256024.	282195.						
FUZE ASSEMBLY	151106.	151649.	151106.	156479.	156479.	163101.	156791.	151106.						
GRENADE LOG+ASSBLY	37933.	37923.	63222.	38067.	63445.	53223.	54489.	40685.						
PROJECTILE ASSEMBLY	21559.	21509.	22512.	18314.	19124.	26324.	21569.	21822.						
SELF DESTRUCT	283500.	283834.	283500.	283154.	283154.	292952.	285690.	283500.						
TOOLING	54232.	54175.	54232.	48768.	48768.	65185.	54213.	54232.						
UNDISTRIBUTED BUDGET GEN./ADMIN.	0.	0.	0.	0.	0.	0.	0.	0.						
TOTAL PROGRAM	1845236.	2035671.	2151078.	2080896.	2201328.	2302921.	2184056.	2057269.						
MANAGEMENT RESERVE	310347.	310347.	310347.	310347.	310347.	310347.	310347.	310347.						
GRAND TOTALS	2155583.	2346018.	2461425.	2391243.	2511675.	2613268.	2494403.	2367616.						

ESTIMATES OF \$0. REPRESENT PROGRAM ELEMENTS THAT HAVE LESS THAN 3 MOS. PROGRESS OR HAVE VARIANCES THAT ARE SO LARGE THAT THE EAC BECOMES MEANINGLESS (>400% OF THE ELEMENT BUDGET).

APPENDIX B
PROGRAM LISTING

```

PROGRAM COST(INPUT,OUTPUT)
COMMON/A/BCWS(20,20),BCWP(20,20),ACWP(20,20),EAC(20,20),KEY1,KEY2
COMMON/B/LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/C/SVD(20,20),SVP(20,20),CVD(20,20),CVP(20,20)
COMMON/D/X(20),X1(20),YS(20),YA(20),YP(20)
COMMON/E/NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
COMMON/F/FCCT(20,20),FCCV(20,20),FCSV(20,20),FCSC(20,20)
COMMON/G/CPI(20,20),SPI(20,20),PLOTA(20,20),TREND(20,20),
+OCTC,NAME(4,20),PLOTS(20,20),PLOTG(20,20)
COMMON/H/BAY(20,20),CEAC(20,20),ECT
COMMON/I/UE(20),PC(20),FACT(20),DUMMY(20)
COMMON/J/CBCWS,CBCWP,CACWP,CCV,CSV,CGTB,CEST,KEY3
C
C KEY3 IS VARIABLE TO SIGNIFY EXISTENCE OF RELATED EFFORT DATA.
C IF RELATED EFFORT EXISTS SET KEY3=1. OTHERWISE, KEY3=0.
  READ 4,KEY3
  4   FORMAT(I1)
C
  IF(KEY3.EQ.0)GOTO 18
C READ CONTRACTOR REPORT DATA FOR INCLUSION IN IN-HOUSE SUMMARY.
C FOR CONTRACTOR CS2 RUN THESE VALUES ARE 0 (ZERO).
  READ 16,CBCWS,CBCWP,CACWP,CCV,CSV,CGTB,CEST
16   FORMAT(7F10.0)
C
C READ ORIGINAL CONTRACT TARGET COST
18   READ 17,OCTC
17   FORMAT(F10.0)
C
C KEY TO PREVENT PRINT OF GRAPHS. SET KEY1=0 TO AVERT PERFORM-
C ANCE GRAPHS. SET KEY2=3 TO AVERT CS2 DATA GRAPHS.
  READ 15,KEY1,KEY2
15   FORMAT(2I5)
C
C INITIALIZE VARIABLES
  AV=CB=CC=CS=CT=0.
  DO 1 IX=1,20
  DO 1 IY=1,20
  BCWS(IX,IY)=BCWP(IX,IY)=ACWP(IX,IY)=EAC(IX,IY)=M(IX)=0.
  CPI(IX,IY)=SPI(IX,IY)=BAY(IX,IY)=CEAC(IX,IY)=TCE(IX,IY)=0.
1   FCCT(IX,IY)=FCCV(IX,IY)=FCSV(IX,IY)=FCSC(IX,IY)=GTB=J.
C
C READ DATE OF REPORT AND NO. OF WEEKS IN THE
C CURRENT + 2 PREVIOUS REPORT PERIODS.
  READ 2,DA1,DA2,WKS
  2   FORMAT(2A10,F5.0)
C
C READ NUMBER OF PROGRAM ELEMENTS AS OF ABOVE DATE
  READ 3,NK
  3   FORMAT(I3)
C
C READ 1ST MONTH AND YEAR OF PROGRAM (EX. JANUARY 1975)
  READ 12,HTN,IYR
12   FORMAT(A10,I4)

```

```

      IYR1=IYR+1
      IYR2=IYR+2
C
C SET VARIABLE AND NAME FOR TOTAL PROGRAM
      NT=NK+1
      NAME(1,NT)=10H TOTAL PRO
      NAME(2,NT)=4HGRAM
C
C READ PROGRAM NAME (TO 40 CHARACTERS)
      READ 6,(NAME(IQ,NT+1),IQ=1,5)
6      FORMAT(5A10)
C
C READ UNDISTRIBUTED BUDGET, G AND A.
      READ 14,UB,G A,GA1
14     FORMAT(3F10.0)
C
C READ ORIGINAL, PREVIOUS AND CURRENT MONTH MANAGEMENT
      C RESERVE BALANCES.
      READ 13,MRO,MRP,MRC
13     FORMAT(3I10)
      MA=MRP-MRC
      MTU=MRO-MRC
C
C LOOP OVER EACH PROGRAM ELEMENT
      DO 7 NP=1,NK
C
C INITIALIZE GRAPH VARIABLES
      IC=0
      DO 11 IX=1,20
      X(IX)=0.
      YA(IX)=0.
      YP(IX)=0.
11     YS(IX)=0.
C
C READ THE NAME OF PROGRAM ELEMENT (20 CHARACTERS MAX.)
      READ 5,NAME(1,NP),NAME(2,NP)
5      FORMAT(2A10)
C
C READ MONTHS IN PROGRESS, 1ST MONTH, LAST MONTH, BUDGET
      READ 8,M(NP),IFM(NP),LM(NP),TB(NP)
8      FORMAT(3I5,F10.0)
C
C SET ELEMENT VARIABLES
      MONTH=M(NP)
      NOW=IFM(NP)+M(NP)-1
      IFIRST=IFM(NP)
      LAST=LM(NP)
      GTB=GTB+TB(NP)
C
C LOOP OVER EACH MONTH FOR ELEMENT NP
      DO 9 M1=IFIRST, LAST
      IC=IC+1
C

```

```

C READ COST DATA
  READ 10,BCWS(NP,M1),BCWP(NP,M1),ACWP(NP,M1),CEAC(NP,M1)
10  FORMAT(4F8.0)
C
C SET PLOT POINTS AND COMPUTE TOTAL CONTRACTOR ESTIMATE
  X(IC)=FLOAT(IC)
  YS(IC)=BCWS(NP,M1)
C
C SKIP TO NEXT MONTH IF BEYOND CURRENT MONTH
  IF(M1.GT.NOW)GOTO 9
C
C COMPUTE $/% COST AND SCHEDULE VARIANCES.
  SVD(NP,M1)=BCWP(NP,M1)-BCWS(NP,M1)
  SVP(NP,M1)=SVD(NP,M1)/BCWS(NP,M1)
  CVD(NP,M1)=BCWP(NP,M1)-ACWP(NP,M1)
  CVP(NP,M1)=CVD(NP,M1)/BCWP(NP,M1)
C
C SET INDEXES
  CALL INDEX(M1,IFIRST,LAST,IC)
C
C COMPUTE FINAL COST ESTIMATES EVERY MONTH
  CALL FINAL(M1,IFIRST,AV,CB,CC,CS,CT)
C
C SET FINAL ESTIM. VARIABLES EACH MONTH
  FCCT(NP,M1)=CT
  FCCV(NP,M1)=CC
  FGSV(NP,M1)=CS
  FCSC(NP,M1)=CB
  EAC(NP,M1)=AV
C
C SET PLOT POINTS FOR COSTS GRAPH
  YP(IC)=BCWP(NP,M1)
  YA(IC)=ACWP(NP,M1)
  NC=IC
  X1(IC)=FLOAT(IC)
C
C LOOP BACK TO NEXT MONTHS DATA
9  CONTINUE
C
C DRAW COSTS GRAPH FOR THIS ELEMENT
  CALL GRAPH(IC)
C
C LOOP BACK TO NEXT PROGRAM ELEMENT.
7  CONTINUE
C
C COMPUTE TOTAL PROGRAM VALUES.
  CALL ALLEL(NK,SVW)
C
C COMPUTE BAYESIAN ESTIMATE FOR ALL ELEMENTS AND TOTAL PROGRAM.
  CALL BAYES
C
C COMPUTE AND GRAPH VARIANCE TRENDS
  CALL TRENDS(SVW)
C
C PRINT TABULAR DATA
  CALL TABLES
C
  END

```

```

OUTLINE ALLEL(NK, SVW)
ON/A/BCWS(20,20),BCWP(20,20),ACWP(20,20),EAC(20,20),KEY1,KEY2
ON/B/LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
ON/C/SVD(20,20),SVP(20,20),CVD(20,20),CVP(20,20)
ON/D/X(20),X1(20),YS(20),YA(20),YP(20)
ON/E/NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
ON/F/FCCT(20,20),FCCV(20,20),FCSV(20,20),FCSC(20,20)
ON/G/CPI(20,20),SPI(20,20),PLOTA(20,20),TREND(20,20),
,NAME(4,20),PLOTS(20,20),PLOTG(20,20)
ON/H/BAY(20,20),CEAC(20,20),ECT

```

```
GTB+UB+GA
```

```
IGEST ELEMENT AND OLDEST ELEMENT
```

```

J=L M(1)
J=M(1)
L IX=2,NK
L(IX).LE.JBIG)GOTO 4
J=M(IX)
L M(IX).LE.IBIG)GOTO 1
J=L M(IX)
FINUE

```

```
OF PLOT POINTS
```

```

I)=JBIG
NT)=IBIG
THLY COST ELEMENTS
2 IY=1,IBIG
IC+1
C)=FLOAT(IC)
3 IX=1,NK
IY.LE.LM(IX))GOTO 5
S(IX,IY)=BCWS(IX,LM(IX))
P(IX,IY)=BCWP(IX,LM(IX))
P(IX,IY)=ACWP(IX,LM(IX))
C(IX,IY)=ACWP(IX,LM(IX))
S(NT,IY)=BCWS(NT,IY)+BCWS(IX,IY)
P(NT,IY)=BCWP(NT,IY)+BCWP(IX,IY)
P(NT,IY)=ACWP(NT,IY)+ACWP(IX,IY)
(NT,IY)=TCE(NT,IY)+CEAC(IX,IY)
FINUE

```

```
T POINTS FOR COST GRAPH
```

```
IC)=BCWS(NT,IY)
```

```
NEXT MONTH IF BEYOND CURRENT MONTH.
```

```
IY,GT,NOW)GOTO 2
```

```
T POINTS FOR COST GRAPH
```

```
IC)=BCWP(NT,IY)
```

```
IC)=ACWP(NT,IY)
```

```
IC)
```

```
IC)=FLOAT(IC)
```

```

C
C COMPUTE DOLLAR AND % COST/SCHEDULE VARIANCES
  SVD(NT,IY)=BCWP(NT,IY)-BCWS(NT,IY)
  SVP(NT,IY)=SVD(NT,IY)/BCWS(NT,IY)
  CVD(NT,IY)=BCWP(NT,IY)-ACWP(NT,IY)
  CVP(NT,IY)=CVD(NT,IY)/BCWP(NT,IY)

C
C SET NP INDEX FOR TCTAL PROGRAM
  NP=NT
  TB(NT)=GTB

C
C COMPUTE INDEXES.
  CALL INDEX(IY,1,IBIG,IC)
C COMPUTE FINAL COST ESTIMATES
  CALL FINAL(IY,1,AV,CB,CC,CS,CT)
  FCCT(NT,IY)=CT
  FCCV(NT,IY)=CC
  FCSV(NT,IY)=CS
  FCSC(NT,IY)=CB
  EAC(NT,IY)=AV

C
  2 CONTINUE
  CALL GRAPH(IC)

C
C COMPUTE SCHEDULE VARIANCE IN WEEKS
  VPW=(BCWP(NT,NOW)-BCWP(NT,NOW-3))/WKS
  SVW=(BCWP(NT,NOW)-BCWS(NT,NOW))/VPW
  RETURN
  END

```

```

SUBROUTINE BAYES
COMMON/A/S(20,20),P(20,20),A(20,20),E(20,20),KEY1,KEY2
COMMON/B/L(20),M(20),I(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/E/NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
COMMON/F/FCC(20,20),FCCV(20,20),FCSV(20,20),FCSC(20,20)
COMMON/G/CPI(20,20),SPI(20,20),PLOT(20,20),TREND(20,20),
+OCTC,NAME(4,20),PLOTS(20,20),PLOT(20,20)
COMMON/H/BAY(20,20),CEAC(20,20),ECT
DIMENSION F(20,20)

```

```

C
C INITIALIZE VARIABLE FRACO,FRACA
FRACO=FRACA=0.

C
C SET INDEX FOR LAST 3 MOS.
IZ=NOW-2
C LOOP OVER EACH ELEMENT AND THE TOTAL PROGRAM
DO 1 IX=1,NT
C IF ELEMENT IS NOT 3 MOS. OLD SKIP TO NEXT ELEMENT
IF(M(IX).LE.2)GOTO 1
C INITIALIZE SUMS
SUM1=SUM2=0.
C LOOP OVER LAST 3 MOS.
DO 2 IY=IZ,NOW
IF(IX.NE.NT)GOTO 5
TCE(IX,IY)=TCE(IX,IY)+UB+GA
IF(TCE(IX,IY).EQ.UB+GA)TCE(IX,IY)=0.
CEAC(IX,IY)=TCE(IX,IY)
C IF CONTRACTOR DOES NOT SUPPLY EAC-USE AVERAGE VALUE FROM FINAL
5 F(IX,IY)=CEAC(IX,IY)
IF(CEAC(IX,IY).EQ.FCCV(IX,IY).OR.CEAC(IX,IY).EQ.FCSV(IX,IY).OR.
+CEAC(IX,IY).EQ.0.)F(IX,IY)=E(IX,IY)
C BAYES COMPUTATIONS START
SUM1=SUM1+ABS(PLOT(IX,IY))**2.
2 SUM2=SUM2+ABS(((TB(IX)-F(IX,IY))/TB(IX)))**2.
IF(SUM1.LE.0.)GOTO 3
FRACA=SQRT(SUM1/3.)
3 IF(SUM2.LE.0.)GOTO 4
FRACO=SQRT(SUM2/3.)
C LIMIT ESTIMATE IN 1ST 3 MOS. TO 5% OF BUDGET
4 IF(M(IX).EQ.3.AND.FRACO.LT..05)FRACO=.05
CSQ=(TB(IX)/P(IX,NOW))**2.
SIGA2=(FRACA*A(IX,NOW))**2.
SIGO2=(FRACO*TB(IX))**2.
C BAYESIAN FINAL ESTIMATED COST NOW COMPUTED
BAY(IX,NOW)=((SQRT(CSQ)*A(IX,NOW)*SIGO2)+
+(TB(IX)*CSQ*SIGA2))/(SIGO2+CSQ*SIGA2)
C LOOP TO NEXT ELEMENT
1 CONTINUE
RETURN
END

```

```
SUBROUTINE FINAL(I,J,AV,CB,CC,CS,CT)
COMMON/E/NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
COMMON/G/CPI(20,20),SPI(20,20),PLOT(20,20),TREND(20,20),
+OCTC,NAME(4,20),PLOTS(20,20),PLOT(20,20)
```

```
C
  IF(NP.EQ.NT)TB(NP)=GTB
C INITIALIZE VARIABLES
  KEY=CB=CC=CS=CT=0.
C
C SET KEY IF AVER. EST DEPENDS ON 4 VALUES.
  IF(I-J.GE.2)KEY=1
  IF(KEY.EQ.0)GOTO 7
C
C COMPUTE COST TREND IF ELEMENT IS OLDER THAN 2 MOS.
  CT=TB(NP)/TREND(NP,I)
C
C COMPUTE OTHER FINAL ESTIMATES
7  CC=TB(NP)/CPI(NP,I)
  CS=TB(NP)/SPI(NP,I)
  CB=TB(NP)/(SPI(NP,I)*CPI(NP,I))
C
C COMPUTE AVERAGE OF ESTIMATES
  IF(KEY.EQ.0)AV=(CB+CC+CS)/3.
  IF(KEY.EQ.1)AV=(CB+CC+CS+CT)/4.
  RETURN
  END
```

```

SUBROUTINE GRAPH(IC)
COMMON/A/S(20,20),P(20,20),A(20,20),E(20,20),KEY1,KEY2
COMMON/B/LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/D/X(20),X1(20),YS(20),YA(20),YP(20)
COMMON/E/NC,NP,NT,NOW,GTB,DUM4(27)
COMMON/G/DUM(1600),OCTC,NAME(4,20),DUM5(800)
IF(KEY2.EQ.0) RETURN
BIG=S(NP,LM(NP))
IF(P(NP,NOW).GT.BIG) BIG=P(NP,NOW)
IF(A(NP,NOW).GT.BIG) BIG=A(NP,NOW)
IF(BIG.LE.100) IG=IFIX(BIG/10.)*10+10
IF(BIG.GT.100..AND.BIG.LE.1000.) IG=IFIX(BIG/100.)*100+100
IF(BIG.GT.1000..AND.BIG.LE.10000.) IG=IFIX(BIG/1000.)*1000+1000
IF(BIG.GT.10000..AND.BIG.LE.100000.)
+IG=IFIX(BIG/10000.)*10000+10000
IF(BIG.GT.100000..AND.BIG.LE.1000000.)
+IG=IFIX(BIG/100000.)*100000+100000
IF(BIG.GT.1000000..AND.BIG.LE.10000000.)
+IG=IFIX(BIG/1000000.)*1000000+1000000
DY=FLOAT(IG)
DX=0.
IF(IC/8*8.EQ.IC) GOTO 13
IM=IC+4
IF(IM/8*8.EQ.IM) GOTO 14
IF(IM.LT.8) DX=8.
IF(IM.GT.8.AND.IM.LT.16) DX=16.
IF(IM.GT.16.AND.IM.LT.24) DX=24.
IF(IM.GT.24.AND.IM.LT.32) DX=32.
GOTO 15
14 DX=FLOAT(IM)
GOTO 15
13 DX=FLOAT(IC)
15 DY=DY/8.
DX=DX/8.
CALL PLOT(2.,1.5,-43)
CALL SCALE(X,IC,1,8.,0.,DX,1)
CALL SCALE(X1,NC,1,8.,0.,DX,1)
CALL SCALE(YS,IC,1,8.,0.,DY,1)
CALL SCALE(YP,NC,1,8.,0.,DY,1)
CALL SCALE(YA,NC,1,8.,0.,DY,1)
CALL AXIS(0.,0.,15HTIME - MONTHS,15,8.,0.,0.,DX)
CALL AXIS(0.,0.,16HCOST - DOLLARS,16,8.,90.,0.,DY)
CALL LINE(X,YS,IC,1,54,.07,1)
CALL LINE(X1,YP,NC,1,47,.07,1)
CALL LINE(X1,YA,NC,1,21,.07,1)
CALL SYMBOL(8.,8.,1H+,1,.07,0.)
CALL SYMBOL(8.5,3.,7H* BCWS,7,.07,0.)
CALL SYMBOL(8.5,2.9,7HP BCWP,7,.07,0.)
CALL SYMBOL(8.5,2.8,7HA ACWP,7,.07,0.)
CALL SYMBOL(8.25,3.25,NAME(1,NP),10,.07,0.)
CALL SYMBOL(9.25,3.25,NAME(2,NP),10,.07,0.)
CALL PLOT(8.,0.,3)
CALL PLOT(8.,8.,2)
CALL PLOT(0.,8.,2)
CALL PLOT(0.,0.,-3)
RETURN
END

```

```

SUBROUTINE INDEX(I,J,K,IC)
COMMON/A/S(20,20),P(20,20),A(20,20),E(20,20),KEY1,KEY2
COMMON/B/LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/E/NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
COMMON/G/CPI(20,20),SPI(20,20),PLOTA(20,20),TREND(20,20),
+OCTC,NAME(4,20),PLOTS(20,20),PLOTG(20,20)
DIMENSION W(20,20),Y(20),X(20),
+YC(20),YS(20),X1(20),XZ(2),YZ(2)
C
C INITIALIZE X VALUES.
IF(I.NE.J)GOTO 8
ID=0
DO 9 IX=1,20
Y(IX)=0.
9 X(IX)=0.
C
C ELEMENTS SHORTER THAN 7 MOS. TOTAL OR OLDER
C THAN 4 MONTHS DURATION WILL NOT HAVE ADJUSTED INDEXES.
8 IF(K-J+1.LE.6)GOTO 1
IF(I-J.GE.4)GOTO 1
C
C LOOP TO SET BCWS OR BCWP TO NEW VARIABLE (W)
DO 2 IX=1,2
IF(P(NP,I).EQ.0.)GOTO 2
W(NP,I)=S(NP,I)
IF(IX.EQ.2)W(NP,I)=A(NP,I)
IF(I.EQ.J)PP=.3*W(NP,I)+.7*P(NP,I)
IF(I.EQ.J+1)PP=.1*W(NP,I)+.9*P(NP,I)
IF(I.EQ.J+2)PP=.05*W(NP,I)+.95*P(NP,I)
IF(PP.EQ.0.)GOTO 2
C
C COMPUTE SPI, CPI AND SET PLOT POINTS FOR GRAPH (1ST 4 MOS.)
GOTO(3,4)IX
3 SPI(NP,I)=PP/W(NP,I)
PLOTS(NP,I)=(PP-W(NP,I))/PP
YS(IC)=PLOTS(NP,I)
GOTO 2
4 CPI(NP,I)=PP/W(NP,I)
PLOTG(NP,I)=(PP-W(NP,I))/PP
YC(IC)=PLOTG(NP,I)
C
C LOOP BACK TO IX=2
2 CONTINUE
C
C COMPUTE 3 MO. CPI TREND AND SET PLOT POINTS (1ST 4 MOS.)
IF(I-J.LT.2)GOTO 5
ID=ID+1
PLOTA(NP,I)=(PLOTG(NP,I-2)+PLOTG(NP,I-1)+PLOTG(NP,I))/3.
TREND(NP,I)=(CPI(NP,I-2)+CPI(NP,I-1)+CPI(NP,I))/3.
Y(ID)=PLOTA(NP,I)
X(ID)=FLOAT(IC)
5 X1(IC)=FLOAT(IC)
GOTO 6

```

```

C
C COMPUTE INDEXES AND SET PLOT POINTS FOR GRAPH (STARTING 5TH MO.)
1  SPI(NP,I)=P(NP,I)/S(NP,I)
   PLOTS(NP,I)=(P(NP,I)-S(NP,I))/P(NP,I)
   YS(IC)=PLOTS(NP,I)
   CPI(NP,I)=P(NP,I)/A(NP,I)
   PLOTC(NP,I)=(P(NP,I)-A(NP,I))/P(NP,I)
   YC(IC)=PLOTC(NP,I)
   PLOTA(NP,I)=(PLOTC(NP,I-2)+PLOTC(NP,I-1)+PLOTC(NP,I))/3.
   TREND(NP,I)=(CPI(NP,I-2)+CPI(NP,I-1)+CPI(NP,I))/3.
   ID=ID+1
   Y(ID)=PLOTA(NP,I)
   X(ID)=FLOAT(IC)
   X1(IC)=FLOAT(IC)

C
C PLOT GRAPHS WHEN NOW MONTH IS REACHED
6  IF(I.NE.NOW)RETURN
   IF(KEY1.EQ.0)RETURN
   XZ(1)=YZ(1)=YZ(2)=0.
   XZ(2)=24.
   PRINT 14,NAME(1,NP),NAME(2,NP)
14  FORMAT(1H1,//////////33X,
+*THE FOLLOWING GRAPHS RELATE TO PROGRAM ELEMENT *,2A10)
   DO 12 IX=1,3
   CALL PLOT(2.,2.5,-43)
   IF(IX.GT.1)GOTO 13
   CALL SCALE(X,IC,1,8.,0.,3.,1)
   CALL SCALE(X1,IC,1,8.,0.,3.,1)
   CALL SCALE(XZ,2,1,8.,0.,3.,1)
   CALL SCALE(YZ,2,1,4.,-1.,0.5,1)
   CALL SCALE(Y,IC,1,4.,-1.,0.5,1)
   CALL SCALE(YS,IC,1,4.,-1.,0.5,1)
   CALL SCALE(YC,IC,1,4.,-1.,0.5,1)
13  CALL LINE(XZ,YZ,2,1,20.,.07,0)
   CALL AXIS(0.,0.,0.,0.,4.,90.,-1.,.5)
   CALL SYMBOL(1.,0.,1H3,1,.07,0.)
   CALL SYMBOL(2.,0.,1H6,1,.07,0.)
   CALL SYMBOL(3.,0.,1H9,1,.07,0.)
   CALL SYMBOL(4.,0.,2H12,2,.07,0.)
   CALL SYMBOL(5.,0.,2H15,2,.07,0.)
   CALL SYMBOL(6.,0.,2H18,2,.07,0.)
   CALL SYMBOL(7.,0.,2H21,2,.07,0.)
   CALL SYMBOL(8.,0.,2H24,2,.07,0.)
   CALL SYMBOL(-1.25,2.7,9HFAVORABLE,9,.07,90.)
   CALL SYMBOL(-1.25,1,11HUNFAVORABLE,11,.07,90.)
   CALL SYMBOL(3.,-.,18HMONTHS IN PROGRESS,18,.07,0.)
   GOTO(10,11,7)IX
7  CALL LINE(X,Y,IC,1,20.,.07,1)
   CALL SYMBOL(6.,4.,22H3 MONTH MOVING AVERAGE,22,.07,0.)
   CALL SYMBOL(6.,3.,22HCOST PERFORMANCE INDEX,22,.07,0.)
   CALL SYMBOL(6.,3.3,NAME(1,NP),10,.07,0.)
   CALL SYMBOL(7.,3.3,NAME(2,NP),10,.07,0.)
   CALL PLOT(3.,0.,-0)

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```
      GOTO 12
10    CALL LINE(X1,YS,IC,1,20,.07,1)
      CALL SYMBOL(5.4,4.0,26HSCHEDULE PERFORMANCE INDEX,26,.07,0.)
      CALL SYMBOL(6.,3.8,NAME(1,NP),10,.07,0.)
      CALL SYMBOL(7.,3.8,NAME(2,NP),10,.07,0.)
      CALL PLOT(0.,0.,-3)
      GOTO 12
11    CALL LINE(X1,YC,IC,1,20,.07,1)
      CALL SYMBOL(6.,4.0,22HCOST PERFORMANCE INDEX,22,.07,0.)
      CALL SYMBOL(6.,3.8,NAME(1,NP),10,.07,0.)
      CALL SYMBOL(7.,3.8,NAME(2,NP),10,.07,0.)
      CALL PLOT(0.,0.,-3)
12    CONTINUE
      RETURN
      END
```

```

SUBROUTINE TABLES
COMMON/A/BCWS(20,20),BCWP(20,20),ACWP(20,20),EAC(20,20),KEY1,KEY2
COMMON/B/LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/C/SVD(20,20),SVP(20,20),CVD(20,20),CVP(20,20)
COMMON/E/NC,NP,IT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GAI
COMMON/F/FCCT(20,20),FCCV(20,20),FCSV(20,20),FCSC(20,20)
COMMON/G/DUM2(1600),OCTC,NAME(4,20),DUM3(800)
COMMON/H/BAY(20,20),CEAC(20,20),ECT
COMMON/J/CBCWS,CBCWP,CACWP,CCV,CSV,CGTB,CEST,KEY3
DIMENSION N1(20),CPCT(20),GPCT(20)
C PRINT TABLES OF INFORMATION.
PRINT 50,(NAME(1,NT+1),IQ=1,5),DA1,DA2
50 FORMAT(1H1,////24X,*TABLE 1. CUMULATIVE DATA, PROGRAM *,
+4A10,/34X,A10,*GR*/2A10////////17X,*ELEMENT*,45X,*PCT. *,
+*VARIANCE*,7X,*DOLLAR VARIANCE*/19X,*NAME*,15X,*BCWS*,
+6X,*3CWP*,6X,*ACWP*,6X,*COST SCHEDULE*,6X,
+*COST SCHEDULE*/)
IF(KEY3.EQ.0)GOTO 40
CWS=CBCWS+BCWS(IT,NOW)
CWP=CBCWP+BCWP(IT,NOW)
CAW=CACWP+ACWP(IT,NOW)
CV=CCV+CVD(IT,NOW)
SV=CSV+SVD(IT,NOW)
CE=CEST+TCE(IT,NOW)
40 DO 51 N=1,NP
CVP(N,NOW)=CVP(N,NOW)*100.
SVP(N,NOW)=SVP(N,NOW)*100.
IF(N.EQ.NP)GOTO 51
PRINT 52,NAME(1,N),NAME(2,N),BCWS(N,NOW),BCWP(N,NOW),ACWP(N,NOW),
+CVP(N,NOW),SVP(N,NOW),CVD(N,NOW),SVD(N,NOW)
52 FORMAT(11X,2A10,3X,3F10.0,F8.2,F9.2,F13.0,F10.0/)
51 CONTINUE
PRINT 3,BCWS(IT,NOW),BCWP(IT,NOW),
+ACWP(IT,NOW),CVP(IT,NOW),SVP(IT,NOW),
+CVD(IT,NOW),SVD(IT,NOW)
3 FORMAT(/12X,*ALL ELEMENTS*,10X,3F10.0,F8.2,F9.2,F13.0,F10.0)
IF(KEY3.EQ.0)GOTO 41
PRINT 42,CBCWS,CBCWP,CACWP,CCV,CSV,
+CWS,CWP,CAW,CV,S/
42 FORMAT(11X,*CONTRACTOR EFFORT*,6X,3F10.0,20X,2F10.0,/
+11X,*COMBINED TOTAL*,9X,3F10.0,20X,2F10.0)
41 PRINT 8,MA,MTU,MRC
8 FORMAT(////52X,*MANAGEMENT RESERVE DATA*,//44X,
+*CURRENT MONTH APPLICATION*,10X,*$,I6//44X,*TOTAL*,
+*APPLICATION TO DATE*,10X,*$,I6//44X,*CURRENT*,
+*MONTH BALANCE*,14X,*$,I6)
IFLAG=0
DO 60 N=1,NT
IF(CEAC(N,NOW).NE.0.)GOTO 1
CPCT(N)=0.
GOTO 2
1 CPCT(N)=(TB(N)-CEAC(N,NOW))/TB(N)*100.
2 GPCT(N)=(TB(N)-BAY(N,NOW))/TB(N)*100.

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```

IF (GPC (N) .EQ. 100. .AND. NOW .LE. 2) GPCT(N)=0.
IF (CVP (N, NOW) .LT. 10. .AND. CVP (N, NOW) .GT. -10. .AND.
+SVP (N, NOW) .LT. 10. .AND. SVP (N, NOW) .GT. -10. .AND. CPCT (N)
+.LT. 10. .AND. GPCT (N) .GT. -10. .AND. GPCT (N) .LT. 10.
+.AND. GFCT (N) .GT. -10.) GOTO 60
IFLAG=IFLAG+1
N1(IFL/G)=N
60 CONTINUE
IF (IFLAG .EQ. 0) GOTO 64
PRINT 61, (NAME (IQ, NT+1), IQ=1, 5), DA1, DA2
61 FORMAT (1H1, //19X, *TABLE 2. FLAGGED MONTHLY *,
+*CUMULATIVE COST/SCHEDULE VARIANCES FOR PROGRAM*/
+29X, 5A10, 3X, 2A10, //141X, *COST*, 12X, *SCHEDULE*,
+11X, *EAC*/BUDGET VARIANCE PCT.* /12X, *ELEMENT NAME*, 13X,
+*VARIANCE PCT.* , 5X, *VARIANCE PCT.* , 8X, *CONTRACTOR * ,
+*GOVERNMENT*//)
DO 62 N=1, IFLAG
IF (N1(N) .NE. NT) GOTO 5
PRINT 61, NAME (1, NT), NAME (2, NT), CVP (NT, NOW), SVP (NT, NOW),
+CPCT (NT), GPCT (NT)
66 FORMAT (/ 3X, 2A10, F16.2, F18.2, F20.2, F14.2)
GOTO 62
5 PRINT 61, NAME (1, N1 (N)), NAME (2, N1 (N)), CVP (N1 (N), NOW),
+SVP (N1 (N), NOW), CPCT (N1 (N)), GPCT (N1 (N))
63 FORMAT (/ 9X, 2A10, F16.2, F18.2, F20.2, F14.2)
62 CONTINUE
GOTO 70
64 PRINT 61, (NAME (IQ, NT+1), IQ=1, 5), DA1, DA2
PRINT 61
65 FORMAT (//139X, *NO VARIANCES ARE *,
+*GREATER THAN +10 PCT. OR -10 PCT.*)
70 PRINT 71, (NAME (IQ, NT+1), IQ=1, 5), DA1, DA2
71 FORMAT (1H1, //35X, *TABLE 3. COST AT COMPLETION*,
+* ESTIMATES FOR PROGRAM*/45X, 5A10, 3X, 2A10 //141X,
+64X, *ESTIMATED COSTS AT COMPLETION AS DERIVED *,
+*FROM */ 37X, 90 (1H*) /4X, *ELEMENT*, 16X, *TOTAL*,
+22X, *COST*, 7X, *SCHEDULE*, 3X, *COST+SCHED.* ,
+3X, *TREND OF*, 5X, *AVERAGE OF*/
+6X, *NAME*, 17X, *BUDGET*, 4X, *CONTRACTOR*, 2(5X,
+*VARIANCE*), 4X, *VARIANCES*, 4X, *COST VAR.* , 4X,
+*VARIANCES*, 4X, *BAYESIAN*//)
DO 72 N=1, NP
IF (N .EQ. NP) GOTO 72
IF (FCCV (N, NOW) .GE. 5. *TB (N)) FCCV (N, NOW) = 0.
IF (FCSV (N, NOW) .GE. 5. *TB (N)) FCSV (N, NOW) = 0.
IF (FCSC (N, NOW) .GE. 5. *TB (N)) FCSC (N, NOW) = 0.
IF (FCCT (N, NOW) .GE. 5. *TB (N)) FCCT (N, NOW) = 0.
IF (EAC (N, NOW) .GE. 5. *TB (N)) EAC (N, NOW) = 0.
PRINT 73, NAME (1, N), NAME (2, N), TB (N), CEAC (N, NOW), FCCV (N, NOW),
+FCSC (N, NOW), FCCT (N, NOW), EAC (N, NOW),
+*BAY (N, NOW)
73 FORMAT (3X, 2A10, F10.0, 7F13.0, /)
72 CONTINUE

```

```

76 PRINT 76,UB,UB,UB,UB,UB,UB,UB,UB,UB,GA,GA1,GA1,GA1,GA1,GA1,GA1,GA1
   FORMAT(3X,*UNDISTRIBUTED BUDGET*,F10.0,7(F13.0),/3X,
   +*GEN./ADMIN.*,F10.0,7(F13.0))
   XMRC=FLOAT(MRC)
   IF (NOW.LE.2) TCE(NT,NOW)=TCE(NT,NOW)+UB+GA
   TCE(NT,NOW)=TCE(NT,NOW)+GA1-GA
   FCCV(NT,NOW)=FCCV(NT,NOW)+GA1-GA
   FCSV(NT,NOW)=FCSV(NT,NOW)+GA1-GA
   FCSC(NT,NOW)=FCSC(NT,NOW)+GA1-GA
   FCCT(NT,NOW)=FCCT(NT,NOW)+GA1-GA
   EAC(NT,NOW)=EAC(NT,NOW)+GA1-GA
   BAY(NT,NOW)=BAY(NT,NOW)+GA1-GA
   PRINT 7,NAME(1,NT),NAME(2,NT),GTB,TCE(NT,NOW),FCCV(NT,NOW),
   +FCSV(NT,NOW),FCSC(NT,NOW),FCCT(NT,NOW),EAC(NT,NOW),
   +BAY(NT,NOW)
7   FORMAT(/3X,2A10,10.0,7F13.0)
   TCV=FCCV(NT,NOW)*XMRC
   TSV=FCSV(NT,NOW)*XMRC
   TSC=FCSC(NT,NOW)*XMRC
   TCT=FCCT(NT,NOW)*XMRC
   TAV=EAC(NT,NOW)*XMRC
   ECT=TCE(NT,NOW)*XMRC
   IF (TCE(NT,NOW).EQ.0.) ECT=0.
   GTB=GTB+XMRC
   TBAY=BAY(NT,NOW)*XMRC
   IF (NOW.LE.2) TBAY=0.
   XMRC5=XMRC
   IF (NOW.LE.2) XMRC5=0.
   TBUD=CGTB+GTB
   PRINT 74, XMRC, XMRC, XMRC, XMRC, XMRC, XMRC, XMRC, XMRC5
74  FORMAT(4X,*MANAGEMENT RESERVE*,F11.0,7F13.0)
   PRINT 75,GTB,ECT,TCV,TSV,TSC,TCT,TAV,TBAY
75  FORMAT(4X,*GRAND TOTALS*,4X,8F13.0)
   IF (KEY3.EQ.0) GOTO 43
   PRINT 44,CGTB,CES,TBUD,CE
44  FORMAT(/5X,*CONTRACTOR EFFORT*,F11.0,F13.0/
   +5X,*COMBINED TOTAL*,F14.0,F13.0)
43  PRINT 10
10  FORMAT(/////35X,*ESTIMATES OF $0. REPRESENT PROGRAM ELEMENTS*,
   +* THAT HAVE LESS THAN 3 MOS.*/35X,*PROGRESS OR HAVE VARIANCES*,
   +* THAT ARE SO LARGE THAT THE EAC BECOMES*/
   +35X,*MEANINGLESS (>400% OF THE ELEMENT BUDGET).*)
   RETURN
   END

```

```

SUBROUTINE TRENDS(SVM)
COMMON/ /LM(20),M(20),IFM(20),TCE(20,20),DA1,DA2,MA,MTU,MRC,WKS
COMMON/ /SVD(20,20),SVP(20,20),CVD(20,20),CVP(20,20)
COMMON/ /NC,NP,NT,NOW,GTB,TB(20),HTN,IYR,IYR1,IYR2,UB,GA,GA1
COMMON/ /DUM6(1600),OCTC,NAME(4,20),DUM7(800)
COMMON/ /BAY(20,20),CEAC(20,20),ECT
DIMENSION B(27),XZ(2),YZ(2),X(20),YC(20),YS(20)
DATA B(1),B(6),B(7),B(13),B(18),B(19),B(25)/7*1HJ/
DATA B(2),B(14),B(26)/3*1HF/
DATA B(3),B(5),B(15),B(17),B(27)/5*1HM/
DATA B(4),B(8),B(16),B(20)/4*1HA/
DATA B(9),B(21)/2*1HS/
DATA B(10),B(22)/2*1HO/
DATA B(11),B(23)/2*1HN/
DATA B(12),B(24)/2*1HD/

```

```

C
C REALIGN B VARIABLE I/A/W 1ST MONTH OF PROGRAM
L1=1
IF(HTN.EQ.7HJANUARY)GOTO 51
IF(HTN.EQ.8HFEBRUARY)L1=2
IF(HTN.EQ.5HMARCH)L1=3
IF(HTN.EQ.5HAPRIL)L1=4
IF(HTN.EQ.3HMAY)L1=5
IF(HTN.EQ.4HJUNE)L1=6
IF(HTN.EQ.4HJULY)L1=7
IF(HTN.EQ.6HAUGUST)L1=8
IF(HTN.EQ.9HSEPTEMBER)L1=9
IF(HTN.EQ.7HOCTOBER)L1=10
IF(HTN.EQ.8HNOVEMBER)L1=11
IF(HTN.EQ.8HDECEMBER)L1=12
L2=L1+15
ID=0
DO 64 IX=L1,L2
ID=ID+1
64 B(ID)=B(IX)
C FIND LARGEST AND SMALLEST VALUES OF COST/SCHED DOLLAR VARIANCES.
51 BIG=SVD(NT,1)
DO 1 IX=L,NOW
IF(ABS(S/D(NT,IX)).GT.BIG)BIG=ABS(SVD(NT,IX))
IF(ABS(C/D(NT,IX)).GT.BIG)BIG=ABS(CVD(NT,IX))
C LOOP TO NEXT MONTH
1 CONTINUE
C
C COMPUTE SIZE OF Y AXIS
IF(BIG.LE.10)IG=30
IF(BIG.GT.10..AND.BIG.LE.100.)GOTO 5
IF(BIG.GT.100..AND.BIG.LE.1000.)GOTO 6
IF(BIG.GT.1000..AND.BIG.LE.10000.)GOTO 7
IF(BIG.GT.10000..AND.BIG.LE.100000.)GOTO 8
IF(BIG.GT.100000..AND.BIG.LE.1000000.)GOTO 9
IF(BIG.GT.1000000..AND.BIG.LE.10000000.)GOTO 17
IF(IG.EQ.30)GOTO 11
C SET MULT. FACTORS

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5     IG=IFIX(BIG/10..)*10+1
      IFAC=10
      GOTO 10
6     IG=IFIX(BIG/100.)*100+1
      IFAC=100
      GOTO 10
7     IG=IFIX(BIG/1000.)*1000+1
      IFAC=1000
      GOTO 10
8     IG=IFIX(BIG/10000.)*10000+1
      IFAC=10000
      GOTO 10
9     IG=IFIX(BIG/100000.)*100000+1
      IFAC=100000
      GOTO 10
17    IG=IFIX(BIG/1000000.)*1000000+1
      IFAC=1000000
10    IF(IG.LE.3*IFAC)IG=3*IFAC
      IF(IG.GT.3*IFAC.AND.IG.LE.6*IFAC)IG=6*IFAC
      IF(IG.GT.6*IFAC.AND.IG.LE.9*IFAC)IG=9*IFAC
      IF(BIG.GT.FLOAT(9*IFAC))IG=12*IFAC
C SET Y AXIS DIMENSIONS
11    D=FLOAT(IG)
      YSTART=-D
      DY=D/3.
C SET UP ZERO LINE
      XZ(1)=YZ(1)=YZ(2)=IC=0.
      XZ(2)=16.
      DO 14 IX=1,NOW
      IC=IC+1
      YC(IC)=CVD(NT,IX)
      YS(IC)=SVD(NT,IX)
      X(IC)=FLOAT(IC)
14    CONTINUE
      XN=FLOAT(NOW+1)/2.
      SY=SVD(NT,NOW)/Y+3.
      IS=IFIX(SVD(NT,NOW))
      CY=CVD(NT,NOW)/Y+3.
      IY=IFIX(CVD(NT,NOW))
      XY=FLOAT(NOW+3)/2.
      X1=XY+.5
      X2=XN-.1
C GRAPH ROUTINES
      CALL PLOT(2.,1.5,-43)
      CALL SCALE(XZ,2,1,8.,0.,2.,1)
      CALL SCALE(YZ,2,1,6.,YSTART,DY,1)
      CALL SCALE(X,IC,1,8.,0.,2.,1)
      CALL SCALE(YC,IC,1,6.,YSTART,DY,1)
      CALL SCALE(YS,IC,1,6.,YSTART,DY,1)
      CALL LINE(XZ,YZ,2,1,20.,07,0)
      CALL AXIS(0.,0.,7HDOLLARS,7,6.,90.,YSTART,DY)
      DO 13 IX=1,16
      SX=FLOAT(IX)/2.

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DX= SX-.4
13 CALL SYMBOL(DX,0.,4H----,4,.07,0.)
CALL SYMBOL(SX,0.,8(IX),1,.07,0.)
CALL SYMBOL(X1,SY,1H%,1,.07,0.)
CALL SYMBOL(X1,CY,1H$,1,.07,0.)
CALL SYMBOL(X2,SY,1H$,1,.07,0.)
CALL SYMBOL(X2,CY,1H$,1,.07,0.)
CALL SYMBOL(-1.25,4.,9HFAVORABLE,9,.07,90.)
CALL LINE(X,Y,S,IC,1,62,.07,1)
CALL SYMBOL(-1.25,.2,11HUNFAVORABLE,11,.07,90.)
OCTC1=OCTC/1000.
GTB1=(GTB+FLOAT(MRC))/1000.
BAY1=(BAY(NT,NOW)+GA1-GA+FLOAT(MRC))/1000.
TCE1=(TCE(NT,NOW)+GA1-GA+FLOAT(MRC))/1000.
CALL SYMBOL(.25,6.7,23HORIG CONTR TGT COST - $,23,.07,0.)
CALL NUMBER(2.5,6.7,OCTC1,3,.07,0.)
CALL SYMBOL(3.6,6.7,8H(THOUS.),8,.07,0.)
CALL SYMBOL(.25,6.6,23HCURR CONTR TGT COST - $,23,.07,0.)
CALL NUMBER(2.5,6.6,GTB1,3,.07,0.)
CALL SYMBOL(3.6,6.6,8H(THOUS.),8,.07,0.)
CALL SYMBOL(.25,6.4,23HGOVT ESTIM AT COMPL - $,23,.07,0.)
CALL NUMBER(2.5,6.4,BAY1,3,.07,0.)
CALL SYMBOL(3.6,6.4,8H(THOUS.),8,.07,0.)
CALL SYMBOL(.25,6.3,23HCONT ESTIM AT COMPL - $,23,.07,0.)
CALL NUMBER(2.5,6.3,TCE1,3,.07,0.)
CALL SYMBOL(3.6,6.3,8H(THOUS.),8,.07,0.)
CALL LINE(X,YC,IC,1,23,.07,1)
CALL SYMBOL(.7,7.2,21HVARIANCE ANALYSIS FOR,21,.07,0.)
CALL SYMBOL(3.0,7.2,NAME(1,NT+1),10,.07,0.)
CALL SYMBOL(4.0,7.2,NAME(2,NT+1),10,.07,0.)
CALL SYMBOL(5.0,7.2,NAME(3,NT+1),10,.07,0.)
CALL SYMBOL(6.0,7.2,NAME(4,NT+1),10,.07,0.)
CALL SYMBOL(7.0,7.2,NAME(5,NT+1),10,.07,0.)
CALL SYMBOL(3.,6.,1H+,1,.07,0.)
CALL SYMBOL(6.,6.5,18HC $ COST VARIANCE,18,.07,0.)
CALL SYMBOL(6.,6.4,22HS $ SCHEDULE VARIANCE,22,.07,0.)
CALL NUMBER(XN,SY,IS,0,.07,0.)
CALL NUMBER(XN,CY,IY,0,.07,0.)
SP=SVP(NT,NOW)*100.
CP=CVP(NT,NOW)*100.
CALL NUMBER(XY,SY,SP,2,.07,0.)
CALL NUMBER(XY,CY,CP,2,.07,0.)
IF(L1.GE.1.AND.L1.LE.11)XD=.5
IF(L1.EQ.1)XD1=XD+.6.
IF(L1.EQ.2)XD1=XD+.5.5
IF(L1.EQ.3)XD1=XD+.5.
IF(L1.EQ.4)XD1=XD+.4.5
IF(L1.EQ.5)XD1=XD+.4.
IF(L1.EQ.6)XD1=XD+.3.5
IF(L1.EQ.7)XD1=XD+.3.
IF(L1.EQ.8)XD1=XD+.2.5
IF(L1.EQ.9)XD1=XD+.2.
IF(L1.EQ.10)XD1=XD+.1.5

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OFFICE OF THE PROJECT MANAGER SELECTED AMMUNITION DO--ETC F/G 14/1
A COMPUTER PROGRAM FOR TRACKING COST/SCHEDULE CONTROL SYSTEMS C--ETC(U)
JUN 77 L M SMITH
PMSA-2-5

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IF (L1.EQ.11)XD1=XD+1.
IF (L1.EQ.11)XD2=XD+7.
IF (L1.NE.12)GOTC 15
XD=0.
XD1=XD+1.
XD2=XD+7.
15 YD=-0.5
CALL NUMBER(XD,0,IYR,0,.07,0.)
CALL NUMBER(XD1,YD,IYR1,0,.07,0.)
IF (L1.LT.11)GOTO 16
CALL NUMBER(XD2,YD,IYR2,0,.07,0.)
16 CALL PLOT(8.,0.,3)
CALL PLOT(8.,6.,?)
CALL PLOT(0.,6.,?)
CALL SYMBOL(2.,-1.5,26HSCHEDULE VARIANCE IN WEEKS,26,.07,0.)
CALL NUMBER(5.,-1.5,SVW,1,.07,0.)
CALL PLOT(0.,0.,-3)
RETURN
END
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Report describes a computer program that provides a means for tracking contractor's performance where Cost/Schedule Control Systems Criteria are utilized. The program was specifically designed for the CDC 6500/6600 computer at USA Armament Research and Development Command, Dover, NJ. Input data are those normally found in a contractor's Cost Performance Report. Program output is a series of Cost and Schedule Performance Index graphs, a summary variance graph, and a set of tables. X		

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