NASA Technical Memorandum **86339**

NASA-TM-86339 19850005357

Project Resources Planning and Control

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NOVEMBER 1984

National Aeronautics and
Space Administration

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I. INTRODUCTION

A. Purpose/Intended Audience

The purpose of this document is to identify and discuss the principal functions performed by a Program Analyst in support of a major research and development (R&D) project in the area of resources planning, control, and reporting. In some cases the "Analyst" supporting a certain project will not perform all of the functions discussed or will use methods which differ from those identified. This is appropriate and desirable to the extent that such deviation is based on the unique requirements of a particular project and provides effective resources planning, control, and reporting. The material in this manual should be thought of as instructional guidelines rather than a comprehensive set of fixed requirements.

This manual has been written primarily to serve as a practical guide and reference for those personnel of NASA's Langley Research Center (LaRC) who perform resources planning, analysis, control, and reporting functions on major (R&D) projects. Its contents, plus the referenced material, should provide a body of information suitable for the basic training of a person who has not had experience in this field of work. Possibly the word "introduction" is more apt than the term "basic training," as it is beyond the scope of this document to provide a step-by-step description of each function performed by the Analyst.

The author has tried to present the subject material in a way that would also be meaningful to other NASA personnel who are directly or indirectly involved in or affected by the above stated functions, especially project technical managers whose responsibilities include resources management. And lastly, it is possible that one or more sections might be of interest to contractor personnel; i.e., personnel who are involved in resources functions on major R&D contracts with NASA. The section entitled, "Contract Cost Management," in particular, should help such personnel to understand what information is needed and what use is made of it.

B. Applicability

As noted above, this material addresses the functions performed by an Analyst in support of a major R&D project. However, many of these functions are applicable to small R&D projects and other types of projects, such as Construction of Facilities, or even non-project activities. For example, the resources management of support service contracts involve several of the functions discussed in sections of this manual.

C. Organization

Basically, Section II addresses who is responsible for resources planning and control functions on a project and the relationships between these individuals. Sections III through VI address the functions typically performed by an Analyst in support of a major R&D project. These functions have been categorized under four main headings: Planning, Analysis/ Control, Administrative, and Reporting. However, it should be realized that there are many interrelationships among the individual functions. In many cases one function could not be performed unless another function(s) was performed. For example, the report known as a Program Operating Plan (POP) could not be prepared properly for a major project unless a comprehensive plan was developed and the amount of resources allocated and expended were known. In practice, these three tasks are often performed together, the end result being a detailed operating plan and a summary level POP. The four main headings are used to emphasize the four general areas of work performed by an Analyst on a project.

Figures appear as separate pages positioned immediately after the first mention of the figure in the main text. A list of all figures appears at the end of the Table of Contents.

A list of applicable Acronyms is contained in Appendix A.

D. Editorial Comments and Acknowledgements

Wherever in this document "man," "men," or their related pronouns appear, either as words or parts of words, they have been used for literary purposes and are meant in their generic sense.

All names of individuals, contractors, and projects have been either omitted or replaced by a fictional substitute.

Many Langley Research Center employees are deserving of thanks for their assistance in the preparation of this manual. In addition, special thanks are due two individuals, Mr. Jack A. Horton, NASA/Goddard Space Flight Center (GSFC), and Mr. Hugh A. Langford, Langford and Associates, Pasadena, CA. Much of the narrative and a number of figures in the sections entitled, "Contract Cost Management" and "Earned Value Analysis" were derived from material Mr. Langford has presented at GSFC and LaRC in courses relating to the effective use of a Performance Measurement System (PMS) on R&D contracts. Mr. Horton has provided information regarding the PMS used by GSFC, including the methods used to analyze earned value data and special management reports which have been developed to show the results of analyses. Notwithstanding these contributions, the author alone is responsible for any mistake of fact or judgment which the document may contain.

II. RESPONSIBILITIES

Prior to discussing what functions the Analyst performs, it will be useful to understand the responsibilities of the other individuals who have responsibilities related to project resources planning, analysis/control, and reporting. At a minimum, these include the Project Manager (PM) and the Head, Project Support Branch (PSB), Programs and Resources Division (PRD). A Deputy Manager for Management (DMM) is often assigned to very large projects with responsibilities which include resources functions. Other individuals on the project staff who are often involved include the Technical Representative(s) of the Contracting Officer (TRCO) or managers of the subelements of the total project.

A. Project Manager (PM)

The PM is responsible for establishing and controlling an overall project resources plan (manpower and dollars) which supports the Project Plan, and for providing higher management with appropriate reports regarding the project's resources status, outlook, and problems, if applicable.

B. Deputy Manager for Management (DMM)

In the event that a DMM is assigned to a project the PM will specify the authority to be delegated to the DMM pertaining to project resources planning, analysis/control, and reporting; the DMM will be responsible for these functional areas commensurate with the delegated authority.

C. Project Technical Staff

The PM may delegate authority for establishing and controlling a portion(s) of the overall project resources plan. The individual(s) delegated such authority is responsible for establishing and controlling lower level budgets that are consistent with the plan approved by the PM and for providing the PM with timely information regarding resources status, including actual versus plan, problems, and recommendations.

In the case of major contractual efforts, a TRCO is appointed by the Contracting Officer (CO) with the concurrence of the PM. The TRCO is responsible for the cost, as well as the technical management of the contract. His duties are discussed in detail in LHB 7121.1, Project Management and PROC/P-104, Guidelines for Technical Representatives- Cost Type Contracts. At this point it is important to note only his role with respect to cost management, viz, he must be knowledgeable as to the contractor's cost status and outlook and make decisions or recommendations which reflect due consideration of such

information. As a general rule a major contract will be a separate line item in the project's Operating Plan and the TRCO is held accountable for the validity of the data contained in this plan pertaining to "his" contract.

D. Head, PSB, Programs and Resources Division (PRD)

The Head, PSB, is responsible for reaching an agreement with the PM as to the resources planning, control, and reporting support to be provided to the project, and for ensuring that adequate support is provided.

The Head, PSB, will designate one person from the PSB staff as the Lead (Resources) Analyst for a given project. In some cases an Analyst will provide support to more than one project at a given time. If the support of more than one Analyst is required on a project, the Lead Analyst will apprise the Head, PSB, of the additional support requirements; the Head, PSB, will then take appropriate action in coordination with the PM or DMM.

E. Resources Analyst, PSB

As previously stated, it is not possible to identify any one set of functions related to resources planning, analysis/control, and reporting which is performed on all projects. The selection of functions to be performed depends on a number of factors, including the size, duration, and nature of the project. The following list identifies those functions or tasks which are typically performed in support of large projects.

1. Assist in development of Project Work Breakdown Structure (PWBS) and major Contract Work Breakdown Structure (CWBS), if applicable.

2. Development and maintenance of detailed time-phased Operating Plans (manpower and dollars) for the project consistent with the Project Plan.

3. Development/coordination of the resources sections of the project RTOP(s) and RTR's each fiscal year.

4. Development of time-phased Program Operating Plans (POP's) for commitments, obligations, and costs, as required.

5. Generation of official project resources records covering the lifetime of the project; i.e., a project resources history.

6. Development and maintenance of detailed budgets and and a resources control system for all procurements, grants, suballotments, and in-house efforts (i.e., purchase requests, job orders etc.).

7. Recurrent analyses and reporting of resources status to the PM, including variances between actuals and plan (POP).

8. Preparation of resources sections of MICS reports for submittal to NASA Headuarters.

9. Assist TRCO with the development of contractor financial reporting requirements.

10. Assessment of resources sections of contractor proposals with findings and recommendations to TRCO or Source Evaluation Board (SEB).

11. Initiation/control of all funding actions for major contracts.

12. Assist TRCO by performing recurrent analyses of contract(a) actual costs and manpower usage compared to contractor's plan.

13. Participation in joint (resources, schedules, technical) performance assessments on major contracts.

14. Assist in collection, review, consolidation, and compilation of data for special "one time" reports for LaRC management and NASA Headquarters.

15. Preparation of resources data for periodic reviews by project and LaRC management.

The selection of the principal tasks to be performed by the Analyst is agreed upon by the PM and the Head, PSB, and is reflected in the Analyst's Performance Appraisal Plan. In many instances the selection of tasks will change during the lifetime of a project, in which case the Analyst's appraisal plan should be amended.

III. PLANNING FUNCTIONS

A. Project Resources Management System

Every project has a resources management system. It might not be recognized as such or might not be documented at all but there is always such a system. The Project Manager decides by one means or another what if any delegations will be made regarding responsibilities for performance in the area of resources, principally the dollars and manpower authorized to complete certain work. Typically, the total project will be broken down into its component parts; i.e., the work efforts required to complete the total project. This is called a Project Work Breakdown Structure (PWBS), which is the subject of the next section of this document. Delegations of responsibility and authority are made in accordance with the PWBS.

Decisions are also made as to the types of resources plans which will be developed and maintained, the types of reports which will be generated, the types of analyses and reviews which will be made, the frequency of such plans and reports and other related activities. In addition, decisions are made as to how the resources of the project are to be controlled; i.e., who is permitted to commit or expend what resources in what time period, and what procedures are to be used to ensure that project management has the resources allocated to the project under control. And of course personnel assignments must be made for the performance of the above functions.

The above paragraph indicates the wide scope of activities that comprise a project resources management system. All of the above-mentioned activities or functions will be commented on in subsequent sections of this document. A Project Manager usually does not attempt to document the total resources management system; however, selected procedures should be documented, by referral to existing documents whenever possible. For example, it is useful to have a document providing the guidelines and procedures for changing budgets, or requirements for special approvals for initiating procurements.

The Analyst is responsible for providing support to the Project Manager to ensure that an adequate resources management system is developed and maintained.

B. Project Work Breakdown Structure (PWBS)

A Work Breakdown Structure (WBS) is a family tree subdivision of the effort required to achieve an end objective. The NASA Handbook, NHB 5610.1, provides broad policy guidelines for use in the development of Work Breakdown Structures for NASA projects and contracts. As stated therein, "there is no single

best way to prepare a Project Work Breakdown Structure (PWBS) or Contract Work Breakdown Structure (CWBS)." Nevertheless, there are some general principles relative to WBS's which are recognized by NASA based on many years of experience using them. NHB 5610.1 contains a considerable amount of information about the development of both PWBS's and CWBS's as do portions of NHB 9510.2A, "Procedures for Contractor Reporting of Correlated Cost and Performance Data," and NHB 2340.2, "OSSA/OART Project Management Information and Control System (MICS)." All three of these documents should be consulted for information regarding PWBS's and CWBS's. The Analyst should be knowledgeable regarding these subjects and provide guidance to project management, as required, to ensure that the PWBS and any CWBS's adopted are adequate to meet the anticipated requirements for resources planning, analysis/control, and reporting.

The hierarchy and structure of a WBS must suit the objectives and management plans/practices of a particular project. Provision should be made for the collection of data in a manner that will not only meet the needs of project management but also provide the information required by other organizations and higher management.

The PWBS should be developed at the very outset of a project effort. There are several reasons why this is highly desirable. From the standpoint of resources plannning and control, it provides a fixed structure for developing plans and maintaining records in a consistent, appropriate manner for use during the entire life of the project. If at all possible the PWBS should not be changed. If changes are made, there should be an understanding as to the cause and effect relationship(s) of the change(s); e.g., if a portion of the costs of a work element is to be included in a new element the amount which was removed from the old element should be identified. The before-and-after picture, or "cross-walk," should be documented to facilitate later use of this resources data.

It is important that the project management staff understands the PWBS; i.e., what work is to be done under each work element of the PWBS. It is also important that the PWBS is consistent with the way the project is organized with respect to organizational responsibilities and management assignments. At some level of the PWBS the subdivisions of work (or work elements) should relate to the Project Plan. The PWBS should identify the work to be performed down to or below the lowest level at which project management intends to control its resources, which is typically at the system or subsystem level. It is usually impractical for the Project Manager to attempt to establish controls at a lower level. However, having lower level detail in the PWBS ensures that the task scopes are clear and responsibilities are not ambiquous. It also facilitates the identification of subareas which have significant variances from

plan, i.e., subareas on which actual dollar or manpower charges are much higher or lower than were anticipated when the plan was developed. Each level of the PWBS should correspond to the project's management structure, and at every level there should be one individual solely responsible for each of the work elements. This does not necessarily mean that only one organization will perform the work comprising any given element of the PWBS. Figure 3-B.1 contains an example of a PWBS and its relationship to the technical managers who have responsibility for specific subdivisions of work.

When projects involve major contractual efforts a CWBS is also used. It is really an extension of one or more work elements of the PWBS. (See Section IV-F.1 for further comments regarding the CWBS.)

C. Development and Control of Plans

C-1 Initial Plan

A Project Plan, when approved, represents an agreement between an NASA Headquarters Program Office and a Center as to how a particular project will be accomplished and the level of resources to be provided for its accomplishment. The Project Manager needs a fairly comprehensive resources plan at this point in time in order to give NASA Headquarters assurance that the resources requirements in the plan are realistic. In addition, a well thought out, coordinated plan is necessary for the project to start out on the right foot; e.g., initiating long lead procurements in a timely manner with adequate resources and providing other organizations with the resources required to perform early activities in accordance with the overall project schedule. The Analyst should ensure that the Project Manager and Subelement Managers, if applicable, are in agreement as to the data comprising the Initial Plan.

C-2 Baseline Plan

A Baseline Plan should be established as early as possible after a project receives Headquarters approval to proceed. It should be structured in accordance with the PWBS and identify the resources requirements and planned resources application (usage) by Government fiscal year of each agency, major organization, and contractor involved in the project effort. The first Baseline Plan is an expansion of the plan reflected in the Project Plan, which is typically at a summary level. Such a plan cannot be established until project management has agreed to an integrated plan for the project, including technical, schedule, and cost performance. Once established, the Baseline Plan becomes the document of agreement among the participating organizations and agencies as to the amounts and timing of the resources which will be allocated to each participant.

PROJECT HIJ RESOURCES ACCOUNTING SYSTEM

(FY-1983)

DESCRIPTION	*See Note RESPONSIBILITY	RTOP	RTR	JOB ORDER	COMPUTER ACCT	PERT
SCIENCE		678-14-03				
Software and Data Mgmt.			-01	R8919	102810	A11
Science Team			-02	R8920	-	A21
Science Studies			-03	R8921	102809	A31
XYZ INSTRUMENT		678-12-03				
Project Management			-02	R10055		021
Electronic Subsystem			-03	*R10056 Subsystem R10057 IETS R10058 Fab		031 032 033
Optics Subsystem			-04	R10059	102805	041
Sun Sensor Subsystem			-05	R10060		051
Pointer/Tracker Subsystem			-06	R10061		061
Gas Cells			-07	R8918	102808	071
Special Electro Optical Facilities & Components			-08	R10062 Facilities *R10063 Components R10064 Fab		081 082 083
Instrument Integration and Test			-09	R10076 Test *R10077 Integration	102806	092 091
Spacecraft Operations			-10	R10078		101
Product Assurance			-11	*R10065 PA Other R10066 Fab		111 112
Mechanical Subsystem			-12	*R10067 Subsystems	102807	121
Systems Analysis & Engineering			-13+	R10068 Fab		122

NOTE: All names of projects and individuals have been omitted from figures
* Preferred job order for collection of program support benefits
+ For documentation numbering only

Figure 3-B.1

The Baseline Plan of a project is extremely important. Changes to it should only be made when it becomes unrealistic for the purposes of project planning and control. . The principal reasons for making changes to the Baseline Plan are (1) major changes in the time-phasing of efforts; (2) programmatic changes impacting the effort to be performed by a participant(s), and (3) major unanticipated problems. Changes to the Baseline Plan should always be approved by the Project Manager and documented for future reference.

The Baseline Plan should contain an amount of reserve which is held by the Project Manager to cope with major unforeseen problems.

C-3 Operating Plan

In addition to a Baseline Plan, a project should have an Operating Plan. In practice this normally takes the form of a set of plans. The only difference between this plan and the Baseline Plan is the level of detail. The Baseline Plan can be as simple as to contain only the total funding requirements by fiscal year, whereas the Operating Plan typically addresses commitments, obligations, costs, more than one fund source, and detailed time-phasing. Two sample formats for Operating Plans are shown in Figures 3-C.1 and 3-C.2. The format in Figure 3-C.1 provides for time-phased data for reserve, identification of suballotments by NASA Center and a bottom-line breakout by Net R&D and Program Support. It also provides monthly data for the near term, quarterly data for the ensuing period, and then fiscal year data to the end of the project. Note that this format does not segregate data by program year authority; this breakout is incorporated in some Operating Plans.

C-4 Revised Plans

As previously discussed, the basic control document between the Center and NASA Headquarters for project activity is a Project Plan. In addition, as a general rule, information regarding the project's resources status and plans vis-a-vis the baseline are required annually as part of the RTOP(s) assigned to a project. If RTOP's are not required each year by NASA Headquarters for certain projects, they are nevertheless prepared each year on an informal basis. RTOP's are reviewed by Center management and are used as a source of data for Center-wide resources planning, control, and reporting functions. RTR's provide the lowest level of detail required by the Center-wide system.

The POP's for a project show current status and plans for the obligation and costing of actual (i.e., received) and planned program authority (consistent with the RTOP) either two or three times during the year. The extent of data required to be shown for future fiscal years is dependent on the cognizant Headquarters office.

PROJECT ABC OPERATING PLAN FORMAT

LINE ITEMS

RTR			
06	ABC Management		
11	Aero Tools		
13	Cruise Noise		
14	Airfoil Expt.		
	Experiment		
	Contractor A Panels		R8206
21	Syst Eval.		
	Contractor A	NAS1-14632	
	Contractor B	NAS1-14631	
	Contractor C	NAS1-14630	
	Contractor D		R5370
	Contractor E	NAS1-14739	
22	Concept Eval.		R5851
23	Surface Matls.		R5371
24	Mfg. Processes		R5816
25	WSSD		
	Contractor B	NAS1-16235	
	Contractor A	NAS1-16234	
26	LEFT		
	Contractor D	NAS1-16219	
	Compressor Mod		
	Contractor B	NAS1-16220	
	NASA S/A		R7535
	Chamber Valve Mat		
	Chamber Valve Test		
	Plumbing Hardware & Flowmeters		
	Control Syst. Matl.		
	NASA Containment Shield		
	Follow-on Contract		
	Reserve		
	Contractor B Ext.	NAS1-14631	
30	Validator Study		
	Contractor B	NAS1-14631	
	Contractor A	NAS1-14632	
	Ice Studies		
31	LE Flt. Test		
41	Wing Tunnel Mod.		

Figure 3-C.1

(POP 82-1)

LINE ITEMS

SUPPORT R&T

15	Aero Tools
28	High Lift Aero
29	Adv LFC Concepts
32	LE Syst. Tech. Integ.
33	SPF/DB
34	High Lift Model
35	Cloud Particles

RESERVE

SUBTOTAL

SUBTOTAL IMS

TOTAL LARC ABC

NASA (IMS ONLY)

TOTAL PROJ. ABC

NOTE: Same format used for Obligations and Costs

Data is shown under each of the column headings listed below for each line item shown above.

COLUMN HEADINGS

FY 79 & Prior

FY 80 Actuals

FY 81 Actuals

Cum thru 9/30/81

FY 82 Actuals thru 3/31/82

Actuals for
- Apr
- May
- Jun
- Jul
- Aug
- Sep

Total FY 82

Actuals for
- Oct
- Nov
- Dec
- Jan '83
- Feb
- Mar
- 3rd Qtr
- 4th Qtr
- FY 83
- FY 84
- Total

NOTE: The same format is used for Obligations and Costs

PROJECT BCD OPERATING PLAN FORMAT

RTR

-01 PROJECT MGT

PROGRAM SUPPORT
SUPPORT SERVICES
PROJ MGT - MISC EXPENSES

TOTAL 01

-10 SECONDARY STRUCTURES

DC-10 RUDDER (12954)
DC-10 RUDDER (14724)
TOTAL RUDDER
727 ELEVATOR (14952)
L-1011 AILERON (15069)

TOTAL 10

-20 MEDIUM SIZE PRIMARY STRUCTURES

L-1011 VERTICAL FIN (14000)
737 HORIZONTAL STABILIZER (15025)
DC-10 VERTICAL STABILIZER (14869)

TOTAL 20

RTOP TOTALS

NET R&D

RESERVE APPLICATION

NET R&D WITH RESERVE

PROGRAM SUPPORT

TOTAL RTOP

Figure 3-C.2

Unless NASA Headquarters changes the amount of Program Authority a project has or will receive, the project should try to avoid revising the Baseline Plan at anytime other than when a POP plan is being prepared. The notable exception to this guideline is the situation whereby the project's actual obligations and/or costs plus the anticipated activity in the near future are incompatible with the amount of Program Authority received to date or anticipated to be received from NASA Headquarters. Under such circumstances a project must replan in order to re-establish a viable plan.

It should be noted that replanning of either the Baseline or Operating Plan can cause some undesirable consequences including the expenditure of valuable manpower on "non-productive" activity and a lessening of cost control. That is, people may tend to place less emphasis on living within their budgets in the future. There is one other possible negative consequence--an increase in the amount of confusion or misunderstanding as to the budgets in affected areas or subareas. This can cause additional work as people change plans and records to agree with the revised baseline.

The above comments do not mean that a project should only change its Operating Plan in conjunction with the preparation of POP plans. To the contrary, it is important that a project have a viable Operating Plan at all times. The Budget Change System discussed in Section IV.B is designed to cope with changing budgetary needs. The way in which project management administers this system will largely determine whether the potentially undesirable consequences of making budget changes become a reality.

Revised Baseline Plans should be reviewed and approved in the same manner as the Initial Baseline Plan. Changes from the initial or previously revised plan should be documented by the Analyst. A summary of the changes should be included in his or her next Resources Status Report (discussed in Section VI.D). Details, including a tabulation of the corresponding data for the two plans and the dollar difference between these data, should be filed for future reference. A change(s) in the Baseline Plan will necessarily require a change(s) in the Operating Plan. This should be done as soon as possible to avoid confusion.

IV. ANALYSIS/CONTROL FUNCTIONS

A. Review of Status/Outlook by Subarea

As a standard procedure each month the Analyst reviews the status of all subareas of the project for which a resources plan exists. In many cases this will be at the RTR level, but more frequently subareas are delineated below the RTR level. Segregation of data by subarea below the RTR level is achieved by the use of unique job order numbers and/or contract numbers.

It is difficult to generalize as to the depth to which the Analyst examines status and outlook under each subarea. The Analyst typically looks at three types of financial transactions, Commitments, Obligations, and Costs, comparing the actual amounts for the current period and cumulative from start, with the corresponding plans. Further, the Analyst often has to consider actual transactions versus plans in terms of a specific year(s)' funding authorization. It is generally not feasible for the Analyst to examine regularly each subarea in terms of the actual expenditure of resources versus what was accomplished except in the case of major cost-type contracts. (This subject is discussed under Section IV-F.8.)

The Analyst will address each <u>significant</u> dollar variance at the lowest level in the Operating Plan; i.e., the positive or negative difference between actual commitments, obligations, and costs versus the corresponding plan. There is no absolute standard for determining whether a variance is "significant" - an "indicator" which might be helpful is "an actual or potential variance of at least (1) $50K, <u>or</u> (2) 20% and at least $10K." This is cited as a means of indicating the approximate range of variances which have been considered worthy of highlighting in an analysis. There are certainly exceptions which fall outside this range. The Analyst should use any guidelines provided by the Project Manager plus his or her own judgment in determining which variances are significant. Reasons for anticipated as well as incurred variances should be addressed if the amounts are considered significant. The Analyst should try to determine whether the cause of an incurred variance(s) will continue to affect future costs or whether the current variance is a one-time thing. For example, if three units were required for a test program and four had to be built before three were found acceptable, the additional costs for the fourth unit would represent a one-time cost variance. However, an increase in overhead rates would affect all future costs to which overhead applies and the Analyst should consider this future effect.

Under special circumstances it may be necessary for the Analyst to address special types of variances or activities affecting resources. For example, variance analyses addressing a

particular year(s)' funding authority are required from time to time. Another type of analysis warranting specific mention is the uncosted status and plans of major contracts; i.e., the amount of funding authority which has been obligated on a contract against which the contractor has not yet incurred costs. (This subject is discussed in Section IV-F.6.)

The results of the Analyst's review of the status and outlook by subarea should be discussed first with the project staff members responsible for the subareas reflecting significant variances and subsequently with the Project Manager. The results of the Analyst's review should be incorporated in his or her Project Resources Status Report. Examples of two formats used to present variance data are shown in Figure 4-A.1 and 4-A.2. The format in Figure 4-A.1 shows all subdivisions of the PWBS whereas the format in Figure 4-A.2 is designed to identify only significant variance data and applicable remarks.

LaRC Resource Management System (RMS) Reports

The Analyst must be knowledgeable as to the format and content of those RMS reports which contain data necessary for monitoring the status of project resources.

The principal standard financial management reports used by Analysts are Reports 9, 14 and the Suballotment Report. Each of these reports has a unique feature(s) which provides important data and/or minimizes the time required to obtain certain data needed by the Analyst. The LaRC Resource Management System Reports Manual contains descriptions of these as well as all other standard reports in the system.

Two special RMS reports which have been used effectively by Analysts are the Project Summary- 12A Report and the Summed RTOP's Report. Both of these reports have certain features which are well suited to project resources planning and control. Report 12A provides all-years data for each RTR in one location, and permits the generation of both project and PWBS Level 2 totals even if the project contains RTR's under different RTOP's. The Summed RTOP report provides all-years data under JO's, and also provides a project total as long as the project consists of one or more complete RTOP's.

B. Budget Control

It is strongly recommended that a project develop and maintain a Budget Plan. This plan should be consistent with the Operating Plan discussed in Section III-C. In order for a Budget Plan to be effective, project management must accept it and manage in accordance with it. At the same time it is important to realize there is a high probability that a Budget Plan will have to be changed many times during the life of a project and to be prepared to effect such changes in a timely manner.

ACTUAL VERSUS PLAN DATA

PROJECT DEF

POP 83-1

APRIL SUMMARY OF 999-99-99 OBLIGATIONS (PLAN vs ACTUALS)

		CURRENT MONTH			CUM THRU CURRENT MONTH		
RTR	DESCRIPTION	PLAN	ACTUAL	VARIANCE	PLAN	ACTUAL	VARIANCE
02	Project Management	4	0	4	1957	1969	(12)
03	Facility	0	4	(4)	594	599	(5)
04	Experiment Systems						
	R5440 Contractor A				183	183	0
	R6364 Contractor B				39	39	0
	R6365 University A				32	32	0
	R5439 University A				219	219	0
	R6363 Contractor C				49	49	0
	R6703 Contractor D	5	0	5	82	81.3	.7
	R6361 University B				61	61	0
	R6360 Contractor E	29	0	29	166	137	29
	R6362 University C				22	22	0
	R8616 NASA Center E				7	7	0
	R7041, R6667				69	69	0
	NASA Center A	0	14	(14)	710	724	(14)
	NASA Center B				461	461	0
	NASA Center C				701	701	0
	NASA Center D				63	63	0
	(Subtotals)	34	14	20	2864	2848.3	15.7
05	Flight Inst.	0	4	(4)	1635	1642	(7)
06	Ground Suppt. Equip.	0	.5	(.5)	333	335	(2)
07	Trays				67	67	0
08	Engineering & Anal.	9	0	9	200	208.8	(8.8)
09	Experiment Integ.	0	2.5	(2.5)	177	181.5	(4.5)
12	Struct. Test				67	67	0
	R&D Subtotals	47	25	22	7894	7917.6	(23.6)
	IMS Subtotals	88	90	(2)	4190	4210	(20)
	(Monthly actuals from RMS Rept.)						
	TOTAL	135	115	20	12084	12127.6	(43.6)

Figure 4-A.1

FORMAT

FOR

MONTHLY VARIANCE REPORT

PLAN DATA = POP 8__ - __ DATA AS OF _____

RTOP NO.: _____

		CURRENT MONTH: _____			CUMULATIVE THRU CURRENT MONTH*			
RTR #	DESCRIPTION	PLAN	ACTUAL	VARIANCE	PLAN	ACTUAL	VARIANCE	REMARKS

NOTES: 1. Cumulative data is from project start thru current month
2. Same format used for obligations, costs and commitments (optional)

Figure 4-A.2

The use of a standard method for making changes to the Budget Plan of a project has proven very beneficial on LaRC projects and adoption of a system such as the one described below is highly recommended.

Budget Change System

Introduction

Program Operating Plans (POP's) are submitted to NASA Headquarters at designated times during the fiscal year to provide time phased estimates of obligations and costs against the official funding authority guideline. A Project Budget Plan is then developed and maintained which supports the POP. Typically, this Budget Plan allocates resources to the project subtasks, identified as Research and Technology Resumes (RTR's). However, in some cases budget allocations are made to a level below that of an RTR; e.g., to each of several major contracts under a particular RTR.

The PSB Budget Change System (BCS) provides a system for the orderly development, review, and approval of all budget changes regardless of whether the project's total budget is affected. It provides approved, current budget data for use in preparing each POP. This reduces the amount of work which must be done after the POP Call is received, thereby permitting greater emphasis on critical areas during the limited time available. It also provides a means for maintaining a detailed budget which is recognized as a realistic plan, as well as a historical record of detailed budget changes, including management reserve.

BCS Process

The BCS uses the form in Figure 4-B.1 for the initiation, review, approval or disapproval, and documentation of all budget changes. Approved changes are immediately reflected in the official project budget. Approval of budget changes is a responsibility of the Project Manager. He or she may delegate authority for the approval of certain types or level of changes. The appropriate signature(s) must be affixed to the form prior to making a budget change.

[1]The POP is recognized as the basic document for monitoring project resources status versus plans and each POP should be based on a comprehensive review of each of the major items of expenditure which have not yet been completed.

PROJECT _____

BUDGET CHANGE

RTOP/RTR	TITLE	FS	FY AFFECTED	PREVIOUS BUDGET	BUDGET CHANGE	REVISED BUDGET	RTOP RTR MGR CONCURRENCE

REMARKS:

APPROVED _____

DATE _____

PREPARED BY: _____

BUDGET CHANGE NO. _____

CC:

Figure 4-B.1

Instructions for Use of the Budget Change Form

The Budget Change Form, as designed, will meet the needs of most projects. It can be modified if the particular requirements of a project cannot be met by use of the standard format.

RTOP/RTR - Numbers of all RTOP's or RTR's affected by the change should be shown. These numbers must be consistent with the NASA agency-wide coding structure and the PWBS.

Title - A description or title of the item identified by the number in the first column.

Fund Source (FS) - Identify Net R&D funds as FS-4. Contact PSB, PRD if in doubt regarding correct FS.

Fiscal Year (FY) Affected - The fiscal year in which the budget for a given line item is increased or decreased (see examples).

Previous Budget - The budget for a given line item before the subject change action.

Budget Change - The amount ($) of this change.

Revised Budget - The budget for a given line item after the subject change action.

RTOP/RTR Manager Concurrence - The signature of the RTOP/RTR manager showing concurrence with the change action on each line item.

EXAMPLE #1

RTOP/RTR	TITLE	FS	FY AFFECTED	PREVIOUS BUDGET	BUDGET CHANGE	REVISED BUDGET	RTOP/RTR MGR CONCURRENCE
123-01-02-02	RTR Title	4	82	450K	(50K)	400K	A. A. Jones
123-01-02-02	(same)	4	83	200K	50K	250K	A. A. Jones

Note that the amount being subtracted is shown in brackets.

EXAMPLE #2

If $200K is moved from management reserve to an existing RTR, the entries on the form would be

RTOP/RTR	TITLE	FS	FY AFFECTED	PREVIOUS BUDGET	BUDGET CHANGE	REVISED BUDGET	RTOP/RTR MGR CONCURRENCE
123-01-02-01	Mgt. Reserve	4	83	1000K	(200K)	800K	B. B. Smith
123-01-02-02	RTR Title	4	83	450K	200K	650K	A. A. Smith

Remarks - As a minimum, a description of the effort being changed and the reason for the change should be stated. Also, reference should be made to any funding guideline changes and/or effects of the budget change on the all-years project EAC when applicable.

Approved - The signature of the Project Manager or the designee having budget change approval authority. His/her name should be typed under the line.

Date - Date of budget change approval.

Disapproval - If a proposed change is disapproved, this should be indicated under remarks. The date of the disapproval should also be shown.

Prepared by- Name of Resource Analyst or other person designated to administer the BCS.

Budget Change # - Any numbering system initiated and controlled by the project, with one individual designated to assign and maintain a record of the numbers which have been assigned. Typically, consecutive numbers are assigned to budget changes until the next approved POP, at which time the numbering begins again and this process is repeated throughout the life of the project. If the suggested numbering scheme were used, the first three budget changes after adoption of POP 83-2 would be 83-2-1, 83-2-2, 83-2-3.

Distribution - Copies of the approved/disapproved change should be forwarded to each RTOP/RTR manager affected by the change.

C. Cost Concerns/Cost Offsets

This title may be unfamiliar to the reader. It is used to describe a management system whereby potential or actual cost problems, or areas in which costs can possibly be avoided are identified and reviewed in a systematic manner, culminating in a management decision.

A Cost Concerns/Cost Offsets (CC/CO) system can be set up at a total project level or at a subordinate level; e.g., for a specific contractual effort. The degree of formality of such a system can vary considerably. The following comments apply to a fairly formal system appropriate to a large project with a hierarchical structure. However, in principle they are also applicable to small projects with a simple organizational structure.

The effective use of a CC/CO system requires a management commitment to the system, agreed-upon roles and responsibilities, and standard procedures. If it is to be used at the total project level, the Project Manager should be an active participant in the process. If it is to be used at the contract level, both the NASA TRCO and the Contractor's Project Manager should be active participants.

The first step in the process is the initiation of the CC or CO. Any person working on a project or on a subordinate level employing an CC/CO system can initiate a CC or CO. The administration of the system is typically assigned to the Configuration Control and Data Management staff on a major effort or to someone on the Project Manager's or TRCO's staff in the case of a small effort. If the subject matter of a CC or CO involves a contractor it is important that the subject is properly coordinated with contractor personnel, including his Contract Administrator.

Figure 4-C.1 contains an example of a CO. Notice that the CO writeup includes an assessment of the cost and mission impacts of the proposed change. It also contain the recommendation of the initiator (as well as any intermediary reviewing authority, if applicable). CO's or CC's are reviewed by each manager responsible for an area which is affected and also by the Configuration Control Board. The latter organization ensures that the full impact of the proposed change is addressed, and that the necessary changes in control documents are made in the event that the proposed change is approved.

The importance of the cost offset discipline warrants emphasis. Figure 4-C.2 contains a cost offset program status report for a past LaRC project. The dollar amounts resulting

PROJECT EFG

PROPOSED COST OFFSET

79M
CONTRACTOR X LEVEL 3 MANAGER
#192M

CONTRACTOR X

ITEM TITLE: W.B.S. 7.6 ELIMINATE LDTM/ODTM STACKED TEST

- o CONCISE DESCRIPTION OF OFFSET CONSIDERED:

  ELIMINATE TESTS OF THE COUPLED LDTM/ODTM

- o ADVANTAGES AND DISADVANTAGES OF OFFSET:

  ADVANTAGE - DOLLAR SAVING AND ALLOW USE OF LDTM FOR OTHER PURPOSES TO ELIMINATE HARDWARE BUILD.

  DISADVANTAGE - SLIGHT DECREASE IN CONSERVATISM OF TEST

- o RECOMMENDATION:

  STUDY AND REPORT ON 12/18/82 INCLUDING THE ESTIMATED COST SAVING DETERMINED BY NASA CENTER A

- o COST IMPACT BY FISCAL YEAR (including implementation costs, if any):

WBS NO. AND TITLE	FY-83	FY-84	FY-85	FY-86	FY-87	Total
7.6 STRUCTURAL TEST	$50K	$50K				
7.7 STRESS AND DYN	2MM	2MM				
TOTAL	$56K	$56K				$112K

- o OVERALL ASSESSMENT OF MISSION IMPACT:

  ACCEPTABLE

Responsible Manager _____ Date _____

Responsible "Level 2" Manager _____ Date _____

Figure 4-C.1

PROJECT QRS

COST OFFSET PROGRAM - STATUS REPORT

STATUS - NOVEMBER 15, 1973

ITEMS RECEIVED BY PROJECT QRS OFFICE SINCE AUGUST 28

REF. NO.	TITLE	SUBMITTAL DATE	PROJ. QRS ACTION	$K AMOUNT OF APPROVED OFFSET
1	Transfer of Integration/Test	9/28	Approved	73
2	Subcontractor A Schedule Compression	9/28	Approved	133
3	Contractor A Manpower Dropoff	9/28	Approved	170
4	Transfer Column Life Testing	9/28	Approved	15
5	Delete Last Flight Unit	9/28	Approved	
6	Transfer Subcontractor B Contract	9/28	Disapproved*	
7	Use of Contractor A In-House Equipment Rather than "605" Vibration Fixture	9/28	Disapproved	
8	Subcontractor A Configuration Control Mode	10/19	Approved	180
9	Eliminate NASA Test Site H_2 Tank Cleaning	9/28	Approved	8

* Contractor A Recommended Item Not Be Implemented

Figure 4-C.2

from these and other cost offsets contributed to the ultimate success of this particular project.

Figure 4-C.3 contains a typical format for a Cost Concern on a major contractual effort. Notice that the CC also identifies an estimate(s) of cost impact by fiscal year(s). This document can be used in regular review meetings and also in the preparation of financial status reports. For example, Figure 4-C.4 identifies potential additional costs of $1021K due to eight cost concerns. This amount is also shown in Figure 4-C.5 which shows the status of CC's/CO's vis-a-vis the amount of contingency (or management reserve). Both of these reports are used for regular management reviews.

D. Management Reserve

In recent years NASA has placed much emphasis on the importance of management reserve on R&D projects. As a standard procedure, projects should include a reasonable amount of management reserve in their cost estimates. As a general rule on major R&D programs, NASA Headquarters will also establish a reserve fund to provide flexibility in dealing with unforeseen events or conditions impacting program execution. This reserve is identified as Allowance for Project Adjustment (APA). Detailed financial plans supporting POP's should contain a separate line item for management reserve.

Changes to management reserve should be documented and retained as part of the project resources history file.

The status of management reserve (or contingency) is an excellent subject for management reviews. The LaRC Director requires a graphic report on this subject as part of the material he reviews on selected R&D projects. Figure 4-C.5 contains an example of a report used for this purpose.

E. Special Analyses and Reviews

From time to time the Analyst performs special analyses and participates in special reviews related to resources status, outlook, and plans. Many of these efforts relate to major contracts, including activities during the proposal/selection/ negotiation phase, periodic reviews of the estimated cost to complete contractual efforts, and major replans of remaining efforts. These subjects are discussed in Section IV-F. It should be noted that analyses and reviews addressing contractual efforts frequently have significant implications with respect to the overall project resources plan.

Regardless of the specific type of project level analysis or review, there are several principles or guidelines

PROJECT X COST CONCERN

DESCRIPTION: _____

_____

_____

No. _____

Date: _____

WBS(s): _____

ESTIMATED COST IMPACT: _____

PRIMARY RESPONSIBILITY _____

FUNCTIONAL RESPONSIBILITY _____

FY 84 [ ] FY 85 [ ]

ACTION ASSIGNMENT	ACTION PLAN	SCHEDULE S	SCHEDULE P	SCHEDULE A	REMARKS

_____
CONTRACTOR

_____
NASA PROJECT OFFICE

Figure 4-C.3

LANGLEY RESEARCH CENTER

RESPONSIBILITY

APPROVAL _____

ACCOMPLISHMENT _____

COST CONCERNS / OFFSETS

PROJECT XYZ

Ref. POP 83-1

STATUS AS OF 4/28/83

DOLLARS IN THOUSANDS

REFERENCE NUMBER		ESTIMATED COST IMPACT	ACTUAL IMPACT
1-	COMPRESSOR (REWORK, UNKNOWNS - ADDITIONAL CONTRACTOR A AND B COSTS NOT INCLUDED IN BUDGET)	+ 50	
2-	NEITHER GROUND TEST NOR FLIGHT TEST ARTICLES ARE FLIGHT WORTHY (CONTRACTOR A TO FAB THIRD TEST ARTICLE)	+100	
3-	ARTICLES FAIL GROUND ACCEPTANCE TESTS (REWORK TEST ARTICLES - PROGRAM SLIP)	+650	
4-	CONTRACTOR A LEADING EDGE TEST ARTICLE REWORK	+ 52 ~~+ 62~~	
5-	CONTRACTOR C PANELS OVERRUN	+ 70	
6-	SYSTEMS EVALUATION CONTRACT OVERRUN	+ 23	
7-	NASA FAB COST GROWTH FOR AIRCRAFT MODIFICATIONS	+ 66	
8-	ADDITIONAL COST FOR SUCTION DUCTING	+ 10	
	TOTAL	$1021	

Figure 4-C.4

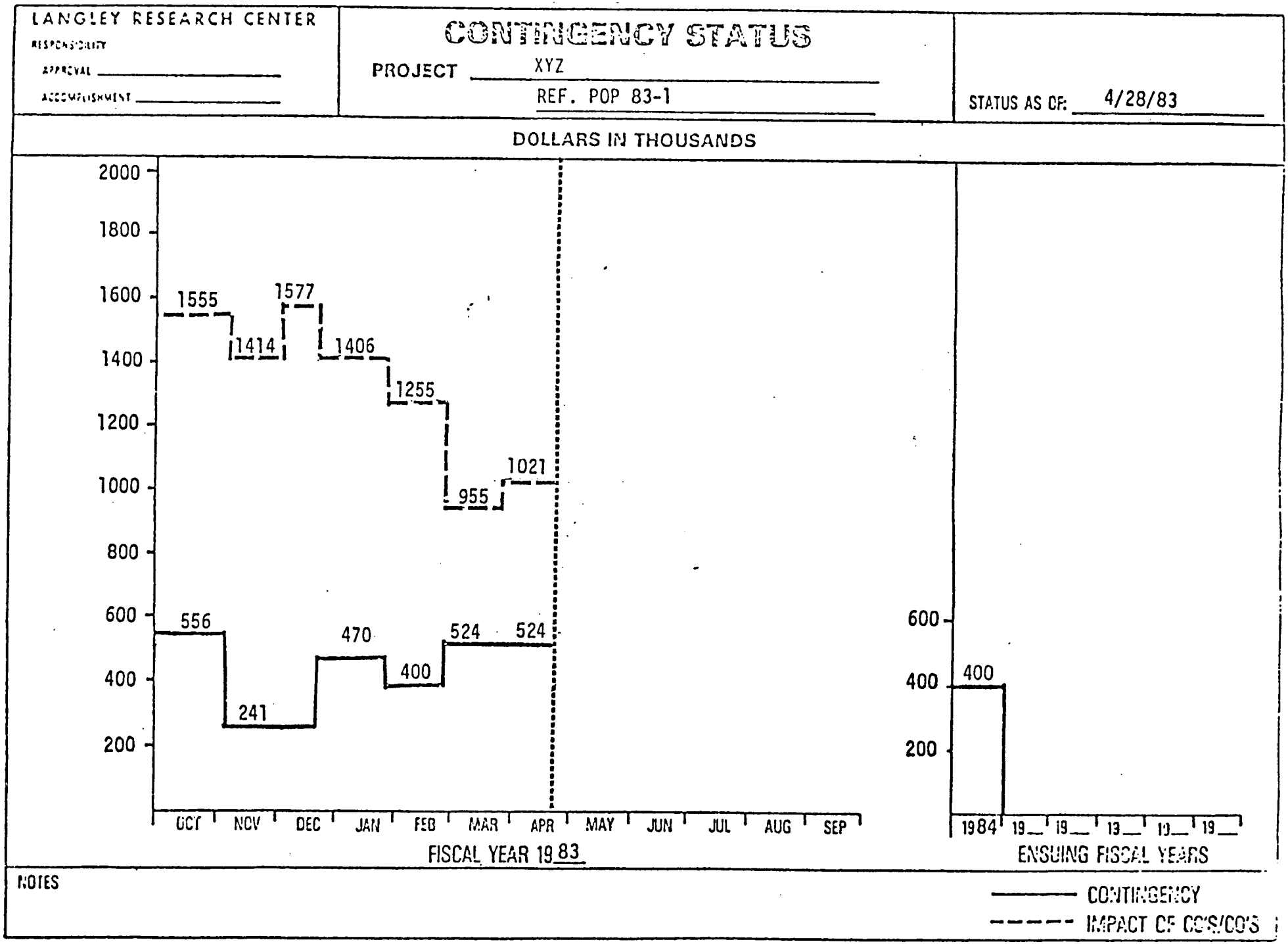
LANGLEY RESEARCH CENTER
RESPONSIBILITY
APPROVAL
ACCOMPLISHMENT
CONTINGENCY STATUS
PROJECT XYZ
REF. POP 83-1
STATUS AS OF: 4/28/83
DOLLARS IN THOUSANDS
2000
1800
1600
1400
1200
1000
800
600
400
200
1555
1414
1577
1406
1255
955
1021
556
241
470
400
524
524
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
FISCAL YEAR 1983
600
400
200
400
1984
19__
19__
19__
19__
19__
ENSUING FISCAL YEARS
NOTES
CONTINGENCY
IMPACT OF CO'S/CO'S

Figure 4-C.5

which should be observed. First, the Project Manager must be a strong supporter of the activity. Second, the individuals responsible for the various subareas of the project should be active participants. The Project Manager should be apprised of planned activities so that he or she may participate, as deemed appropriate. Third, there should be a clear understanding as to the rates and factors used to determine cost estimates; e.g., whether constant dollars or "real-year" dollars are used for estimating future costs. ("Real-year" dollars result from the use of anticipated rates in estimating costs for future years.) Further, the analysis or review should address the differences between current cost estimates and the current Baseline Plan even if the basic purpose of the activity is to determine the estimated costs of the remaining project tasks since the Project Manager must know how much the estimate for each subarea has changed and the reasons for the changes. This is important for management to maintain control of the subareas of the project and also to be able to communicate effectively with higher management and supporting organizations. The results of analyses and reviews should be documented, and should be presented to the Project Manager either orally or in written form in a timely manner, prior to the distribution of any report(s) containing the results of the analysis or review.

One special type of analysis is often performed on major in-house R&D projects-- a civil service manpower analysis. This activity is described in the following subsection.

E-1 In-House Manpower Planning and Control

Introduction

Manpower is a critical resource. It is therefore important that realistic manpower estimates be developed for any project under consideration. These estimates should identify the phasing and skill/organizational distribution of labor during the entire life of the project. The existence of such a plan helps in the advocacy and early planning of the project as well as providing the basic structure or baseline for maintaining manpower control during the implementation phase.

All levels of project management share the responsibility for ensuring effective utilization of manpower when implementing the project plan. However, the Project Manager is solely responsible for the development of a realistic manpower plan which is compatible with the Project Plan and for the control of manpower during the implementation phase of the project. On large R&D projects the Project Manager often receives support in this area from an Analyst. In this event it

is important that the Analyst be involved in the development of the manpower plan so that he or she has the necessary understanding of the plan to be able to analyze the actual versus plan data during the implementation phase. In addition, the Analyst can assist the Project Manager by explaining how manpower data are accumulated at LaRC and the reports which are available for monitoring manpower.

An example of how a LaRC project planned and controlled in-house manpower follows. This project, which will be called Project HIJ, is an atypical in-house project in that it encompassed a major contractual effort during its initial phase which was brought in-house for completion. However, it provides a real life example of an effective approach to manpower planning and control of an in-house project. A similar approach could be used effectively on most in-house R&D projects.

Project HIJ Manpower Planning and Control

In the case of Project HIJ, a Statement of Work (SOW) was developed for the major contract effort. When the work was brought in-house this document was modified but retained. Under typical conditions an in-house project does not have a SOW, as such, and the PWBS stands on its own as the official outline of the entire project effort. As shown in Figure 3-B.1, the Project HIJ PWBS identified the work to be performed down to or below the lowest level at which project management intended to control its resources. This was at the system or subsystem level. Lower level detail was included in the PWBS to ensure that task scopes were clear and responsibilities were not ambiguous. It also facilitated the identification of subareas which had significant variances from plan; i.e., subareas on which manpower charges were much higher or lower than were anticipated when the plan was developed. The PWBS identified the individuals responsible for all work elements, as well as a further breakout by organization and function; e.g., fab, integration, test. The Project HIJ PWBS also identified each work element by a unique RTR or Job Order Number. This was important to facilitate the segregation of actual data in the LaRC manpower reports in accordance with the PWBS.

The individuals responsible for each work element were actively involved in the development of the Project HIJ manpower plans. Estimates developed in this manner; i.e., from the bottom-up, are also referred to as engineering "grass roots" estimates, in contrast to estimates developed at a higher level by the use of parametric modeling techniques or management generated estimates.

The project's parent division compiled a "bottoms-up" estimate based on the PWBS, including manpower support requirements from the Flight Electronics Division (FED),

Instrument Research Division (IRD), Fabrication Division (FD), Atmospheric Sciences Division (ASD), Reliability and Quality Assurance (R&QA), schedule and resources support organizations, and project management. Manpower requirements were submitted by working level personnel knowledgeable in each functional area and compiled into time phased estimates identifiable to the PWBS. Additionally, the estimates were structured so as to identify the division(s) to provide support in each area. The names of individuals were included in the plan wherever possible to ensure that appropriate skills were included and to avoid redundancy. These preliminary estimates were reviewed and reiterated as discussions provided a clearer picture of the project tasks. The final plan was discussed with the management of all major supporting ogranizations and their concurrence of the plan was requested and received. The final plan was then presented to Directorate and Center Management for approval. Subsequent manpower reviews and updates were made in conjunction with the preparation of the major project planning documents; i.e., RTOP's and POP's.

The Project Manager and each individual responsible for one or more RTR's were provided with valid, timely manpower data biweekly on a regular basis. These reports, which are available from BDSD, showed manpower utilization by organization, JO, RTR, and RTOP. In addition, a special monthly report, BDSD Report AB052-05, was distributed which shows details regarding fabrication labor, including out-of-house contract labor. This report can be obtained by contacting RCO, Fabrication Division. The Project Support Branch, PRD, can provide assistance in the selection of reports to be used to monitor manpower.

Manpower Measurement

One major problem frequently encountered in manpower planning, control, and reporting is the selection and consistent usage of a particular unit of measurement. The Project Manager is normally required to develop an overall manpower plan which shows the amount of support required to perform the work elements comprising the project effort. This plan should be expressed in terms of the basic manpower unit in the LaRC RMS system, viz, Equivalent People, as this is the unit of manpower used at the Center level for planning and control purposes. The Equivalent People data pertains to any specified period of time. A related unit of manpower contained in the LaRC manpower reports is entitled, "Cum(ulative) Manpower, Annual Rate." It indicates the average "Equivalent People" for that portion of the current fiscal year which has occurred. It should be noted that these data reflect the following: (1) individual leave, (2) holidays, and (3) certain organizational overhead charges.

Figure 4-E.1 shows a manpower report format used by one LaRC project which highlights the manpower support by specific

PROJECT BCD

SWEPT AIRFOIL WIND TUNNEL TEST
ACTUAL EQUIVALENT MANPOWER

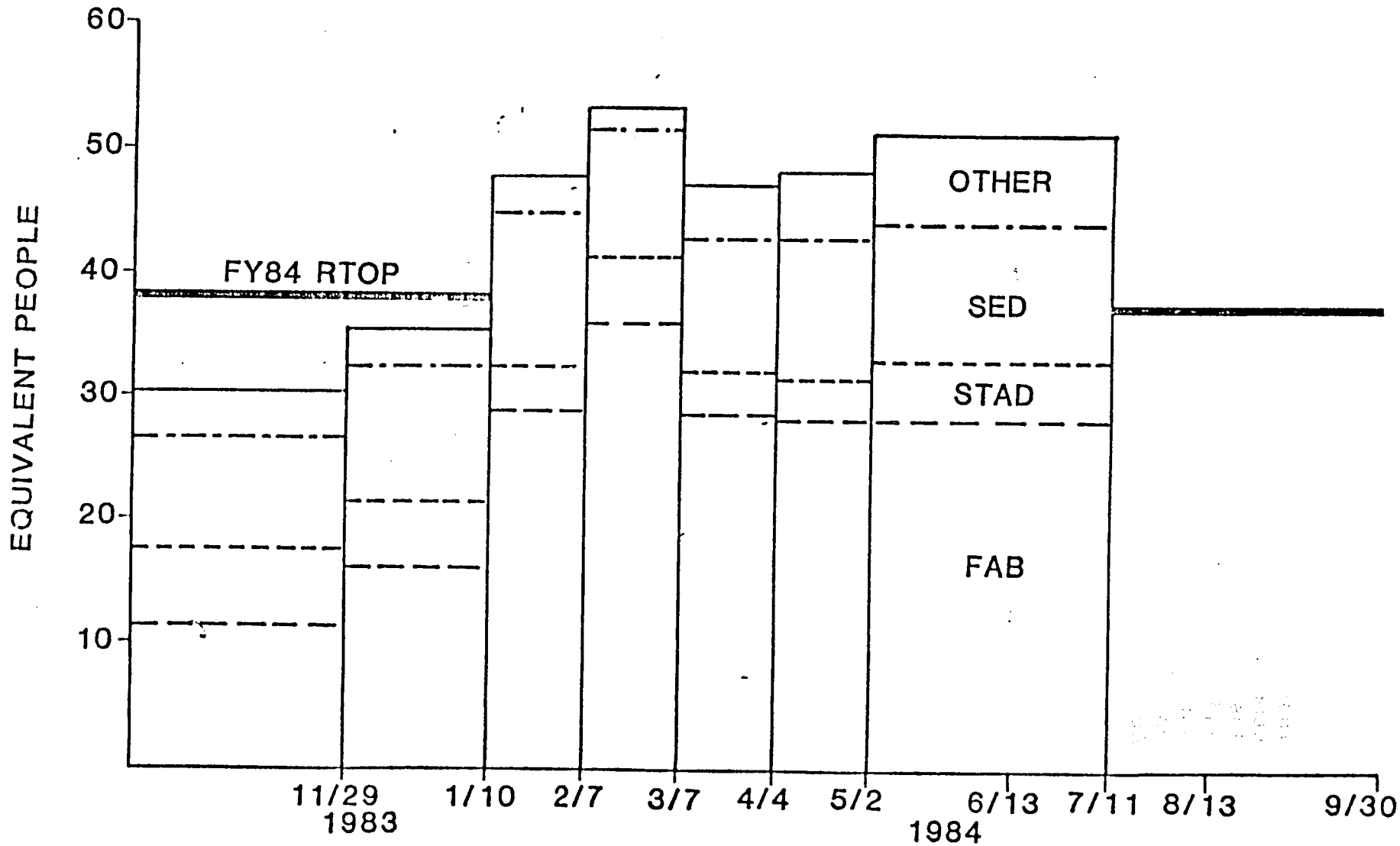

Figure 4-E.1

organizations. The information shown reflects the "Equivalent People" data in RMS Report 7.

The Project Support Branch, PRD, can provide assistance to the Project Manager in the development of manpower plans which are compatible with the manpower data in the RMS reports as well as explaining how the data in those reports are derived.

F. Contract Cost Management

A considerable amount of material on this subject is contained in NASA TM 83108, "Guideline for Cost Control and Analysis of Cost-Type Research and Development Contrcts." It is recommended that the reader use that TM as a supplement to the material contained in this section.

F-1 Contractor Work Breakdown Structure (CWBS)

Much of the material in Section III-B regarding the PWBS is generally relevant to the subject of the CWBS and it would be beneficial for the reader to refer back to that section before reading further.

It is important for the CWBS to be developed during the early phase of pre-contract planning. This facilitates the development of the Statement of Work which contains the requirements of the contract; i.e., what the contractor is to perform. The CWBS also provides a common reference point for the evaluation and comparison of contractor proposals on competitive, negotiated procurements. It is quite common for LaRC to specify the CWBS to be used for the purpose of proposal submittals, at least down to a certain level, and then require the contractor(s) to provide further detail at a lower level(s) of the CWBS. The contractor should be required to submit a "dictionary" for the CWBS in his proposal as well as for the CWBS that made a part of the contract upon completion of negotiations. Changes to the CWBS should be kept to a minimum so as to facilitate the understanding of, and use of the resources data submitted to NASA in this format; i.e., by the CWBS. The Government should approve any change to the CWBS prior to the contractor making the change.

F-2 Contract Cost Baselines

An understanding of cost baselines is essential for an individual to effectively deal with the subject of contract cost management. As discussed in Section 6.6 of TM 83108, there are sometimes more than one type of cost baseline on

a given contractual effort. Figure 4-F.1 illustrates the relationship between a Contract Budget Base(line) and a Performance Measurement Baseline as well as showing the elements which comprise the latter baseline. The Contract Budget Base(line) equals the negotiated contract cost plus the estimated cost for Government-authorized changes. It consists of the Performance Measurement Baseline (PMB) plus any management reserve. The PMB is a time-phased plan against which contract performance is measured, consisting of budgets assigned to planned work efforts plus any budgets which are held in reserve for work efforts which have not yet been planned. Figure 4-F.2 illustrates how the budgets for elements of the CWBS and different functional organizations relate to the Performance Measurement Baseline.

Contract modifications which have cost impact require that a change be made in the Performance Measurement Baseline. In addition, internal replanning can require changes to the PMB. Figure 4-F.3 shows the relationship between these types of changes. Figure 4-F.4 contains an example of a format used by GSFC to document contractor changes to a Performance Measurement Baseline. Notice that this form contains columns to reconcile changes with the Contract Target Cost as well as the Contract Budget Base. The CBB equals the Contract Target Cost plus the estimated cost of authorized but unpriced work. The Contract Target Cost includes only the original negotiated contract costs plus the negotiated costs of any contract changes. Figure 4-F.5 contains a good summary of guidelines for maintenance of a Performance Measurement Baseline.

F-3 Resources Reporting Requirements

At the conculsion of contract negotiations there should be a clear understanding as to the contractual resources reporting requirements. These requirements are normally delineated in a section of the contract containing Data Requirement Descriptions (DRD's). Reporting requirements vary somewhat depending on the duration, type, and size of the contract. Three examples of DRD's used on contracts can be found in Figures 4-F.6, 4-F.7, and 4-F.8. The first example specifies the most stringent requirement normally invoked by LaRC. It calls for the submittal of a Monthly Performance Report using NASA Form 533P or an equivalent Contractor report in addition to use of both the NASA 533M and 533Q reports. It also requires the use of a formal system for identifying and tracking cost concerns and cost offsets (actions which have the potential of reducing costs that otherwise would be incurred), monthly reporting of the status of these items and any changes in the Contractor's

CONTRACT BUDGET BASE vs. PERFORMANCE MEASUREMENT BASELINE

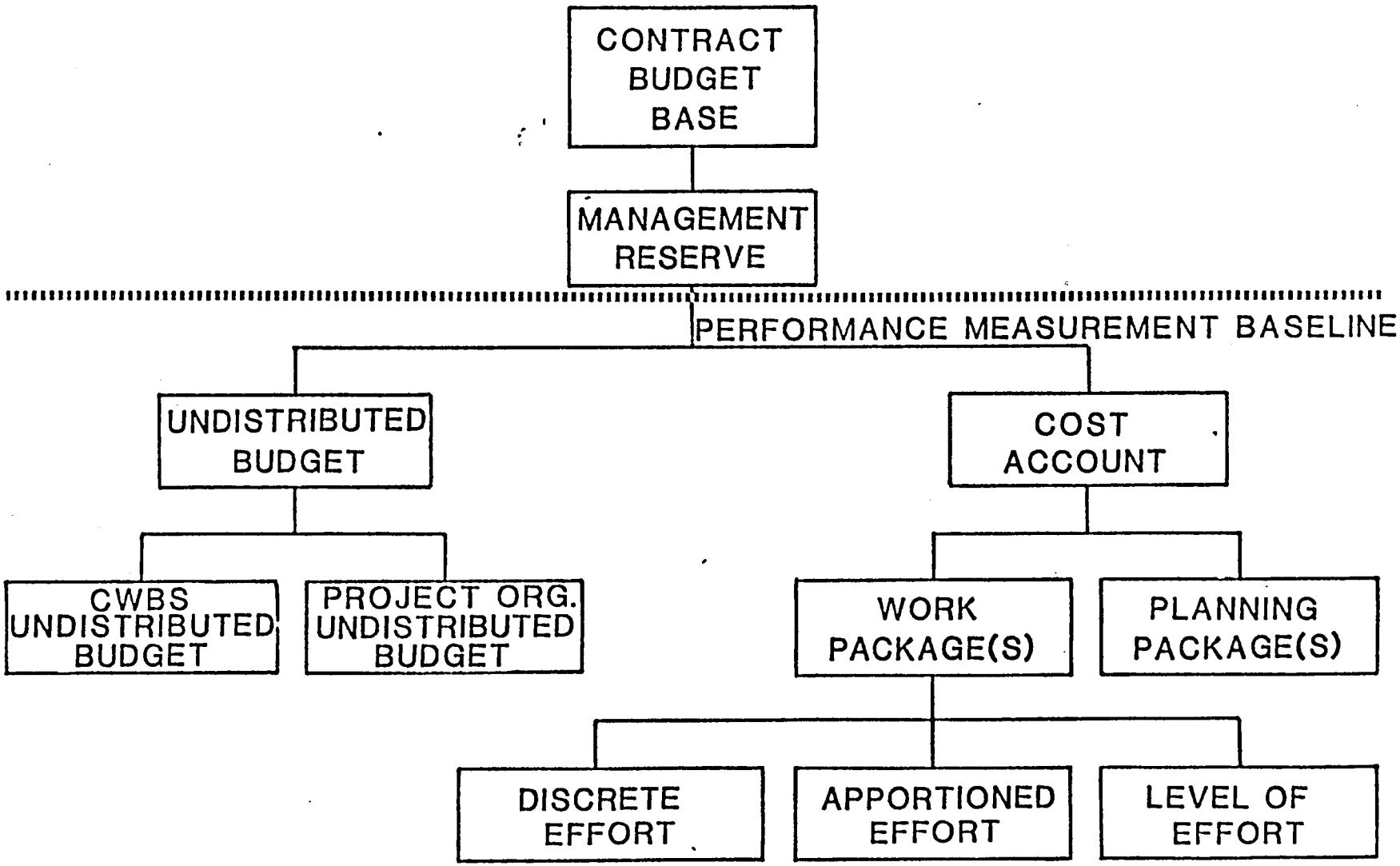

Figure 4-F.1

CWBS – ELEMENTS vs. ORGANIZATIONS

CWBS / Functional Organizations			SUBELEMENTS								BUDGETS ORGANIZATION	UB ORGANIZATION
			A			B			C			
			A1	A2	A3	B1	B2	B3	C1	C2		
	ENG'G	E1	$			$			$		20	
		E2			$			$		$	33	
		E3		$							4	
	MFG	M1				$	$				15	
		M2	$		$			$			9	2
	TEST	T1	$							$	4	
CWBS Element Budgets			8	4	14	8	12	10	14	15	85	2
CWBS Undistributed Budget (UB)							2		1		3	5

Performance Measurement Baseline (PMB)	90
Management Reserve (MR)	10
Contract Budget Base (CBB)	100

Figure 4-F.2

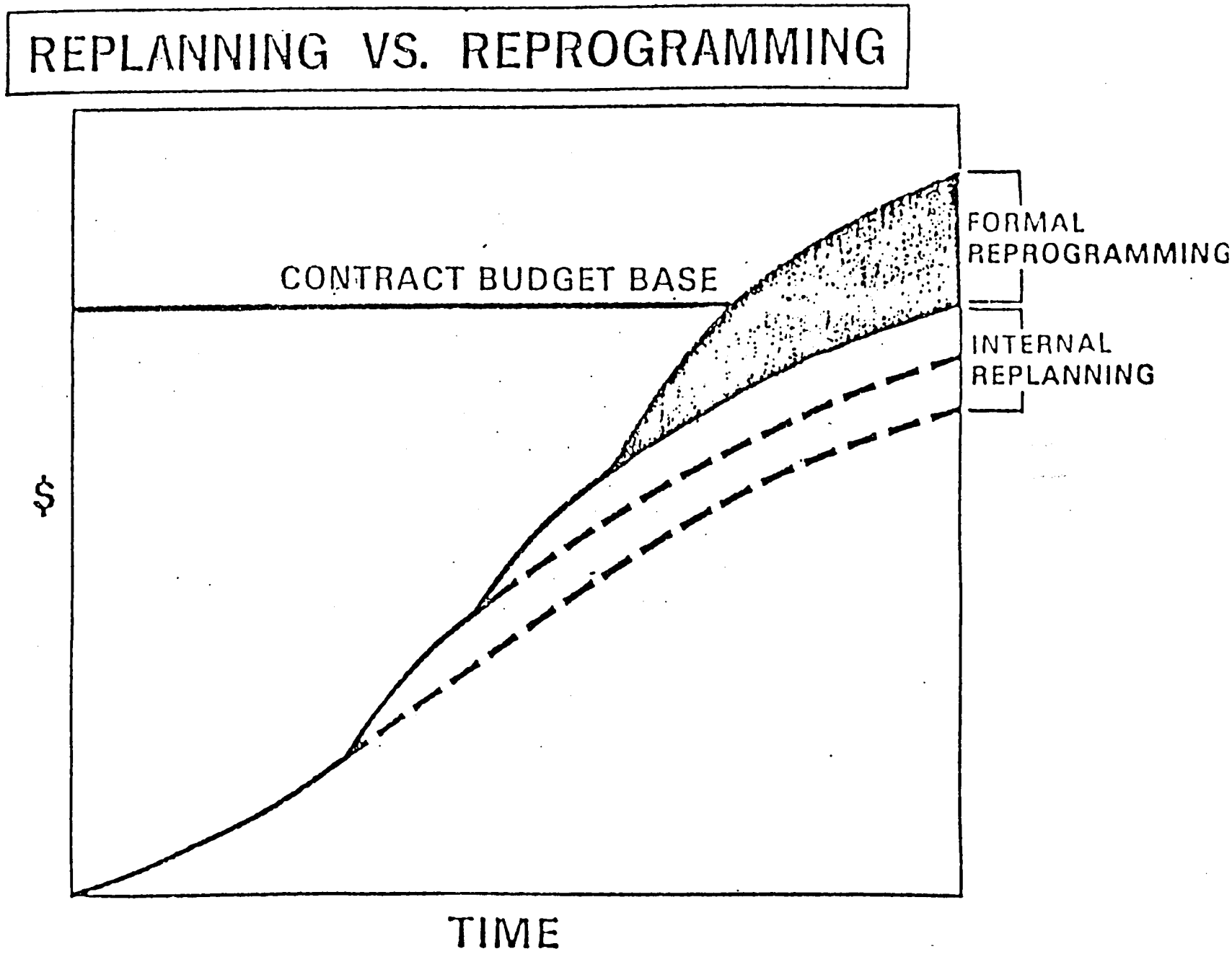
REPLANNING VS. REPROGRAMMING
CONTRACT BUDGET BASE
FORMAL REPROGRAMMING
INTERNAL REPLANNING
$
TIME

Figure 4-F.3

CHANGES TO PERFORMANCE MEASUREMENT BASELINE

DATE	CCST ACCOUNT	TOTAL BUDGETED	G&A	UNDISTRIBUTED BUDGET	PMB (BAC)	MANAGEMENT RESERVE	CONTRACT BUDGET BASE (CBB)	CONTRACT TARGET COST (CTC)	DIFFERENCE	JUSTIFICATION FOR CHANGE

Figure 4-F.4

GUIDELINES FOR MAINTENANCE OF PERFORMANCE MEASUREMENT BASELINE

- MUST INCORPORATE CHANGES IN A TIMELY MANNER
- MUST RECORD/LOG ALL MANAGEMENT RESERVE TRANSACTIONS
- MUST TRANSFER SOW WITH BUDGET TRANSACTIONS
- MUST HAVE PROCEDURES FULLY DOCUMENTING RESTRICTIONS
  - CANNOT MAKE RETROACTIVE CHANGES
  - CANNOT CHANGE BUDGETS TO OPEN WORK
  - MUST CONTROL REPLANNING OF UNOPENED WORK
- MUST FULLY DOCUMENT ALL CHANGES TO PMB
- MUST PREVENT CHANGES TO THE CBB EXCEPT THOSE AUTHORIZED

Figure 4-F.5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DATA REQUIREMENT DESCRIPTION

1. TITLE	2. NUMBER
Financial Management Reports	MF-014 (DRL EM 001)
3. USE Provides the NASA with the financial management and performance status of the contract.	4. DATE February 2, 1984
	5. ORGANIZATION PSB/PRD APPROVED BY:
7. INTERRELATIONSHIP	6. REFERENCES

8. PREPARATION INFORMATION

The Contractor's financial management reporting shall be in accordance with NHB 9501.2A and the paragraphs herein.

1. The Contractor shall establish and maintain a time-phased baseline budget for each reporting level WBS subdivision of work. These WBS subdivisions of work must be consistent with those established for the schedule control and analysis system. The sum of these baseline budgets and the Contractor's management reserve shall equal the negotiated contract value. Changes to baseline budgets and management reserve shall be fully explained in the Contractor Narrative Remarks accompanying the first report depicting the changes. Changes to baseline budgets should be held to a minimum and should not be made more frequently than twice during any twelve month period unless extra-ordinary conditions necessitate such action. The Contractor shall coordinate his plans regarding revisions to his baseline budget with the NASA TRCO prior to effecting such revisions.

The Contractor's Remarks section of the Contractor's reports shall include the status of the cost concern/cost offset, and management reserve disciplines outlined in paragraph 2 below, including the outlook for resolution of any cost concerns or cost offsets. This section of the Contractor's report shall also identify the pricing bases for direct and indirect costs in the first report submitted and any changes thereto in the first report reflecting the change, as well as the impact of such change.

2. In accordance with standard, good cost management techniques, it is assumed that the Contractor will establish a management reserve within the negotiated contract value as operating budgets are agreed to among his performing organizations/WBS managers.

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Figure 4-F.6

A cost control discipline shall be established. The cost control processes and terms applied should be those normally applied by the Contractor in his management of projects provided they embody actions equivalent to the following example:

> "As problems with potential impact on cost surface, they shall be quantified, assigned a "cost concern" control number, and carried as liens against management reserve until resolution is reached and the concerns are: (a) solved without cost impact, (b) funded from reserve and incorporated into the baseline budget, or (c) funded by an increase in the contract value as a result of an applicable contract modification and incorporated into the baseline budget. In addition, potential reductions in cost (within or out of contractual scope), when identified, shall be quantified, assigned a "cost offset" control number, and carried as potential additions to management reserve until resolution is reached and the offsets are: (a) dropped as infeasible, or (b) removed from the baseline budget and added to management reserve."

Any increase or decrease to the baseline budget of a WBS subdivision of work, or transfer of funds between subdivisions of work, except those resulting from contract modifications, shall be processed in accordance with the cost control discipline required above. Budget respreads, including those incorporating changes to management reserve, shall be reported to NASA and shall be accompanied by narrative remarks pertaining to any significant changes in the baseline plan including the estimated resources by subdivisions of work/elements of cost, the phasing of these estimated resources, and the direct/indirect rates reflected in the revised plan.

3. The Contractor shall submit the following reports using the elements of cost listed in paragraph 4 herein for all levels 1, 2, and 3 WBS subdivisions of work and those level 4 WBS subdivisions of work selected by NASA (reference Exhibit 12).

(a) Initial Report (reflecting the Contractor's baseline budget time-phased by accounting month).

(b) Monthly Report (NASA Form 533M)

(c) Quarterly Report (NASA Form 533Q)

(d) Baseline Budget Revisions (reflecting Contractor's revised budget, time-phased by accounting month).

(e) Monthly Performance Report (NASA Form 533P or Contractor report which is an equivalent of NASA 533P).

(f) Contractor narrative remarks shall be submitted with Forms 533M and 533P (as a single report), 533Q and Contractor baseline budget revisions.

4. Elements of Cost

(a) Direct Labor Hours (by discipline/function, e.g.: engineering, manufacturing, etc.)

(b) Direct Labor Dollars (by discipline/function, e.g.: engineering, manufacturing, etc.)

(c) Overhead or Burden (by discipline/function, e.g.: engineering, manufacturing, etc.)

(d) Material

(e) Subcontracts (over $100K; list each separately)

(f) Scientific Computer

(g) Other Direct Costs

(h) Subtotal

(i) General and Administrative (G&A)

(j) Subtotal (Total Cost Excluding Reserve)

(k) Management Reserve*

(l) Cost of Facilities Capital*

(m) Total Contract Cost*

* To be reported at WBS level 1 only.

5. For the submittal of the monthly report specified in paragraph 3(b) herein, the Contractor shall include the following in the preparation of Form 533M:

(a) Columns 7b. and 7d. should present the planned (budgeted) cost for the month being reported and cumulative to date respectively, consistent with the baseline budget as defined in paragraph 1.

(b) Unfilled Orders Outstanding should be shown at level 1 as a separate reporting category, i.e., line item, in addition to column 10.

6. For the submittal of the quarterly report specified in paragraph 3(c) herein, the Contractor shall include the following in the preparation of Form 533Q:

(a) Unfilled Orders Outstanding should be shown at level 1 as a separate reporting category, i.e., line item in addition to column 11.

7. The Contractor shall submit a WBS dictionary for NASA approval with Initial Report (paragraph 3.a above) and shall submit all recommended revisions to the dictionary for NASA approval. The WBS dictionary shall describe each WBS subdivision of work in terms of:

(a) Work to be performed

(b) Quantity of hardware to be developed and delivered

(c) Software or services to be furnished

(d) Other significant data which describe the nonrecurring "end products" of each WBS element.

In cases where there exists a one-to-one correlation between WBS subdivision of work and individual paragraphs of the Statement of Work, and the Statement of Work paragraph is sufficiently explicit, the dictionary need only reference the Statement of Work paragraph.

8. For subcontracts (or interdivisional transfers) over $500K, the Contractor shall submit the same reports listed in paragraph 3 utilizing the elements of cost listed in paragraph 4.

9. Generally, the reports specified in paragraph 1 and 3 will be the maximum required; however, supplementary information shall be provided on an exception basis. For example, for reporting level WBS subdivisions of work determined by NASA to be critical from the standpoint of schedule or level of effort, the Contractor may be required to provide weekly quick-look status reports showing actual manhours versus budget and the status of major/critical material procurements. These quick-look reports need not agree precisely with the formal monthly financial reports. Likewise, under certain conditions the Contractor may be required to provide cost and manpower data for WBS subdivisions of work which are not normally reported on.

w/o CC-CO

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DATA REQUIREMENT DESCRIPTION

1. TITLE	2. NUMBER
Financial Management Reports	(DRL-004)
3. USE	4. DATE
Provides the NASA with the financial management and performance status of the contract.	November 8, 1982
	5. ORGANIZATION APPROVED BY: RJM 11/5/82 CWC 11/10/82
7. INTERRELATIONSHIP	6. REFERENCES

8. PREPARATION INFORMATION

The Contractor's financial management reporting shall be in accordance with NHB 9501.2A and the paragraphs herein.

1. The Contractor shall establish and maintain a time-phased baseline budget for each reporting level WBS subdivision of work. These WBS subdivisions of work must be consistent with those established for the schedule control and analysis system. The sum of these baseline budgets and the Contractor's management reserve shall equal the negotiated contract value. Changes to baseline budgets and management reserve shall be fully explained in the Contractor Narrative Remarks accompanying the first report depicting the changes. Changes to baseline budgets should be held to a minimum and should not be made more frequently than twice during any twelve month period unless extra-ordinary conditions necessitate such action. The Contractor shall coordinate his plans regarding revisions to his baseline budget with the NASA TRCO prior to effecting such revisions.

In addition, the Contractor shall report monthly actual expenditures against budget for each WBS subdivision of work. These data, generated under the Contractor's internal management and control system, shall form the basis for the Contractor Narrative Remarks. This narrative shall address monthly and cumulative variances from the budget plan by WBS subdivision of work. Incurred or potential cost variances shall be explained in terms of the elements of cost contributing to the variances, e.g., labor hours, materials, or overhead. This report shall include the plans and outlook for resolution of any cost concerns.

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Figure 4-F.7

1 of 3

Narrative Remarks will include the pricing bases for direct and indirect cost in the first report submitted and any changes thereto in the first report reflecting the change, as well as the impact of such change.

2. The Contractor shall submit the following reports, in accordance with the NASA NHB 9501.2A (Chapter 3) and paragraphs 1 and 2 herein, using the elements of cost listed in paragraph 4 herein for all levels 1, 2, and 3 WBS subdivisions of work and those level 4 WBS subdivisions of work selected by NASA.

(a) Initial Report (per paragraph 300 of NHB 9501.2A, reflecting the Contractor's baseline budget time-phased by accounting month).

(b) Monthly Report (NASA Form 533M per paragraph 300 and 301 of NHB 9501.2A and paragraph 5 herein) (12 per year).

(c) Quarterly Report (NASA Form 533Q per paragraphs 300 and 302 of NHB 9501.2A and paragraph 6 herein) (4 per year).

(d) Baseline Budget Revisions (reflecting Contractor's revised budget, time-phased by accounting month).

(e) Contractor Narrative Remarks (per paragraph 304 of NHB 9501.2A and paragraphs 1 and 2 herein) submitted with Forms 533M, 533Q, and Contractor baseline budget revisions.

3. Elements of Cost

(a) Direct Labor Hours (by discipline/function, e.g.: engineering, manufacturing, etc.)

(b) Direct Labor Dollars (by discipline/function, e.g.: engineering, manufacturing, etc.)

(c) Overhead or Burden (by discipline/function, e.g.: engineering, manufacturing, etc.)

(d) Material

(e) Other Direct Costs

(f) Subtotal

(g) General and Administrative (G&A)

(h) Subtotal (Total Cost Excluding Reserve)

(i) Management Reserve* (if any)

(j) Cost of Facilities Capital*

(k) Total Contract Cost*

*To be reported at WBS Level 1 only.

4. For the submittal of the monthly report specified in paragraph 3(b) herein, the Contractor shall include the following in the preparation of Form 533M:

(a) Columns 7b. and 7d. should present the planned (budgeted) cost for the month being reported and cumulative to date, respectively, consistent with the baseline budget as defined in paragraph 1.

(b) Unfilled Orders Outstanding, if any, should be shown at Level 1 as a separate reporting category, i.e., line item, in addition to column 10.

5. For the submittal of the quarterly report specified in paragraph 3(c) herein, the Contractor shall include the following in the preparation of Form 533Q.

(a) Unfilled Orders Outstanding, if any, should be shown at Level 1 as a separate reporting category, i.e., line item in addition to column 11.

6. The Contractor shall submit a WBS dictionary for NASA approval with Initial Report (paragraph 3.a above) and shall submit all recommended revisions to the dictionary for NASA approval. In cases where there exists a one-to-one correlation between WBS subdivision of work and individual paragraphs of the Statement of Work, and the Statement of Work paragraph is sufficiently explicit, the dictionary need only reference the Statement of Work paragraph.

7. Generally, the reports specified in paragraph 1 and 3 will be the maximum required; however, supplementary information shall be provided upon request on an exception basis. For example, for reporting level WBS subdivisions of work determined by NASA to be critical from the standpoint of schedule or level of effort, the Contractor may be required to provide weekly quick-look status reports showing actual manhours versus budget and the status of major/critical material procurements. These quick-look reports need not agree precisely with the formal monthly financial reports. Likewise, under certain conditions the Contractor may be required to provide cost and manpower data for WBS subdivisions of work which are not normally reported on.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DATA REQUIREMENT DESCRIPTION

1. TITLE	2. NUMBER
Financial Management Reports	
3. USE	4. DATE
Provides the NASA with the financial management and performance status of the contract.	April 7, 1983
	5. ORGANIZATION APPROVED BY:
7. INTERRELATIONSHIP	6. REFERENCES

8. PREPARATION INFORMATION

The Contractor's financial management reporting shall be in accordance with NHB 9501.2A and the paragraphs herein.

1. Initial Report

An Initial Report, showing detail for Levels 1, 2, and 3, time-phased for the expected life of the contract, will be submitted by the Contractor within ten (10) days after authorization to proceed has been granted by the Contracting Officer. This Initial Report will reflect the original contract value and shall be the original contract baseline plan. In the event that contractual or programmatic changes are made affecting this plan a revised contract baseline plan will be submitted. The preparation and submittal of any such revisions shall be coordinated with the Contracting Officer. The following categories (if applicable) shall be included in the Initial Report and any subsequent revisions thereof:

1. Direct Labor Hours
2. Direct Labor Dollars
3. Overhead(s)
4. Subcontract
5. Material
6. Other Direct Cost
7. General and Administrative (G&A)
8. Management Reserve (Level 1 only)
9. Cost of Facilities Capital (Level 1 only)
10. Total Contract Cost

NASA FORM 9 NASA Langley Overprint (June 1979)

Figure 4-F.8

The Contractor shall submit definitions of the content of each reporting category at the same time that the Initial Report is submitted.

2. Monthly Financial Management Reports

Monthly reports shall be submitted utilizing NASA Form 533M, Monthly Contractor Financial Management Report, in accordance with submission instructions on the reverse side of this form. The planned data shown in Columns 7b and 7d of the 533M should agree with the corresponding data in either the Initial Report or current revised contract baseline plan. Columns 8a and 8b of the 533M shall contain estimates for the following two successive months for the reporting categories set forth in Column 6. The following categories (if applicable) shall be included in this report at Levels 1 and 2:

1. Direct Labor Hours
2. Direct Labor Dollars
3. Overhead(s)
4. Subcontract
5. Material
6. Other Direct Cost
7. General and Administrative (G&A)
8. Management Reserve (Level 1 only)
9. Cost of Facilities Capital (Level 1 only)
10. Total Contract Cost

The Contractor's remarks accompanying each monthly report shall include a subdivision of changes authorized but not finalized, as specified on the reverse side of the 533M form.

The Contractor shall also provide a monthly report reflecting cumulative actual hours and dollars charged against each Level 3 subdivision of work. This report may be prepared in any appropriate format. It shall be submitted as an addendum to the 533M report.

Upon completion, and acceptance by NASA, of all contract schedule line items, the Contractor, unless otherwise directed in writing by NASA, shall discontinue submitting the detailed NASA Form 533 report, and shall limit subsequent reporting to specific line items reflecting cost increases or decreases on a quarterly basis.

During the performance of this contract, if NASA requires a change, either an increase or decrease in the information or reporting requirements specified in this data requirement description, such change shall be effected by the Contracting Officer in accordance with the procedures of the "Changes" clause of this contract.

management reserve, with narrative comments. This DRD is used only on large R&D contracts where there is a potential for major resources problems. The amount and type of reporting specified in this DRD is expensive, and this factor should be considered. It is difficult to generalize as to the cost of such financial reporting since there is no standard method for segregating these costs from the costs which would have been incurred for resources planning, control, and reporting if the Government had not invoked these reporting requirements. NASA and DOD experience indicates a cost range between 2 or 4 percent of total contract costs for resources planning, control, and reporting on major R&D efforts. However, there are many companies using an earned value system at their own initiative because they believe cost savings resulting from this type of system more than offset any additional costs required to implement it.

It should be noted that the DRD in Figure 4-F.6 gives the contractor an option of providing a performance report of his choice if it is an equivalent of the NASA Form 533P report. Since many of the major contractors with whom NASA does business have performance measurement systems there is a good possibility that a contractor's report may be used in lieu of NASA Form 533P. In many cases contractors have comprehensive guidelines for the design and operation of such a system. By way of contrast, the total documentation of NASA's 533P "system" consists of the instructions for completing the form contained on the reverse side of the form and the commentary in Section 303 of NASA Handbook NHB 9501.2A. It is often possible to get a better performance report at a lower cost by utilizing an existing contractor report. Figures 4-F.9 and 4-F.10 contain examples of agreements between NASA and a contractor to obtain appropriate resources reporting in a cost effective manner; i.e., by using data generated by a contractor's internal system.

The sample DRD in Figure 4-F.7 is similar to the one in Figure 4-F.6 except for the following: (1) no Performance Report (NASA Form 533P) is required, (2) no Cost Concern/Cost Offset System and report are required, and (3) changes in budgets need not be reported. The sample DRD in Figure 4-F.8 is applicable to a study contract of less than 1-year duration. It calls for an Initial Report at Level 3, then monthly report at Level 2 with a contractor report showing only cumulative actual hours and dollars at Level 3 as an addendum to the 533M report.

It is recommended that the DRD for contractor financial reporting include a statement providing for special reports on an exception basis similar to the one in the last paragraph of Figures 4-F.6 and 4-F.7.

NASA/CONTRACTOR X AGREEMENT REGARDING

THE CONTRACTOR X ALTERNATE REPORT IN LIEU OF THE 533P

On April 8, 1976, NASA Project ZX personnel were provided a comprehensive review of the details of the control systems Contractor X is using to manage the ZX program. At the completion of this review, Contractor X proposed an alternate report, in liew of the 533P at each Work Breakdown Structure Element (WBSE).

The NASA evaluation concluded that the Contractor X internal control system will provide effective cost and schedule control but does not lend itself to low level application of the 533P; therefore, NASA will accept Level 2 only of the work breakdown structure, a monthly evaluation of its cost/schedule progress, using the 533P form, plus an alternate report for lower level WBS elements.

The makeup of the alternate report will be as follows:

1. Milestone schedules at each work breakdown structure Level 3 element and each Level 4 element, which is a design-to-cost hardware work package, will be provided monthly along with the 533M or 533Q. Exhibit A lists the WBSE's and work packages for which these schedules will be provided. It should be noted that certain Level 3 WBSE's have been omitted as mutually agreed between NASA and Contractor X; for example, spares, engine contractor support, contractor management.

   These schedules will be provided progressively starting in May of 1976. Schedules will be developed on the basis of dollar value and the point when spending will start to occur, that is to say, schedules for tests starting late in the program will not be provided immediately. However, schedules for areas where dollars are being spent will be provided as soon as definitive planning has been completed.

2. Manufacturing earned value charts for those WBSE/work packages involving Manufacturing activity.

3. An updated budget visibility report, submitted as often as significant changes occur, but not more frequently than monthly.

Concurrence:

NASA _____ CONTRACTOR X _____

Figure 4-F.9

NASA/CONTRACTOR X AGREEMENT REGARDING ADDITIONAL CONTROL DATA

FOR NASA PROJECT OFFICE PROGRAM VISIBILITY

In order to provide NASA additional program control visibility at the NASA Center A, it was agreed during the meeting of April 8-9, 1976, that Contractor X would provide one copy each of the following information:

1. For WBSE Level 3/work packages (Level 4):
   A. Dollar Curves
   B. Manpower Charts
   C. Engineering Releases, where applicable
   D. Variance Analysis Reports, when applicable.

2. Labor rate summary charges.

3. Manufacturing earned value charts at the functional organization summary level.

4. Calculations of labor and overhead rates at the total program level, in conjunction with the 533 reports.

Concurrence: _____ _____

NASA CONTRACTOR X

Figure 4-F.10

F-4 Contractor's Cost Management System

It is standard practice on major cost-type procurements for NASA/LaRC to require in the Request for Proposal (RFP) that the proposers identify and describe the management systems they plan to use to plan and control costs. This is an important aspect of contract performance since on this type of contract there is little if any financial incentive for contractors to rigorously control costs. The proposer selected for contract negotiations should be asked to clarify or elaborate on any aspects of the material in his proposal pertaining to his methods/procedures for controlling costs which NASA personnel do not understand or about which they have reservations. During the period of contract performance the Analyst should verify that the Contractor is in fact using the methods contained in his proposal, as amended as a result of pre-award communications with NASA, as well as meeting all of the reporting requirements specified in the contract.

The cost account is a crucial element of a contractor's cost management system. As stated in the DOE summary level document on Contract Performance Measurement (DOE/MA-0086), "At this (the cost account) level, budgets, estimates, schedules, work assignments, costs, progress assessment (i.e., earned value), and problem identification initially come together and corrective actions are initiated..... Most management actions taken at higher levels to solve significant problems are on an exception basis, based on problems identified at the cost account level. For these reasons the CWBS and functional levels selected for establishment of cost accounts should be carefully considered at the outset..... to ensure that the work will be defined properly into manageable units and that the functional responsibilities are clearly and reasonably established. The quality and amount of visibility available on contract performance relate directly to the level and makeup of the cost accounts." Figures 4-F.11 and 4-F.12 contain good summary level descriptions of cost accounts and work packages which are the basic building blocks of the cost accounts. Because of the importance of cost accounts, the Analyst should understand how they "fit" in the Contractor's system for cost planning, controlling, and reporting.

It is possible that the Contractor is doing what he had planned to do and is complying with the contractual provisions for financial reporting but that his cost control methods or his reports to NASA are not adequate. This is a sensitive problem as it raises a question as to out-of-scope effort; i.e., work not envisioned in the original contract which, if made a requirement, could necessitate a change to the contract, and an increase in the Contract Value. Under these circumstances, the Analyst should coordinate very closely with the TRCO and also with the cognizant Contract Specialist as to

THE COST ACCOUNT

WHAT IS IT?

A MEANINGFUL MANAGEMENT CONTROL POINT FOR COST, SCHEDULE, AND TECHNICAL PROGRAM PARAMETERS

A UNIT OF:

THE WBS	RESPONSIBILITY
PLANNING	PERFORMANCE MEASUREMENT
BUDGETING	COST ACCUMULATION
SCHEDULING	

CONTAINS:

A WORK SCOPE DEFINITION

A DEFINITE SCHEDULE

A BUDGET

COST ELEMENT IDENTITY

WORK PACKAGES, APPORTIONED EFFORT, LEVEL OF EFFORT

SINGLE ORGANIZATION RESPONSIBILITY

MONTHLY PERFORMANCE MEASUREMENT DATA

VARIANCE ANALYSIS (AS NECESSARY)

CORRECTIVE ACTION PLANNING (AS NECESSARY)

Figure 4-F.11

THE WORK PACKAGE

CONTAINS:

- A WORK SCOPE DEFINITION
- A DEFINITE SCHEDULE (SHORT IN DURATION)
- A PLANNED VALUE (BUDGET)
- COST ELEMENT IDENTITY
- SINGLE PERFORMING ORGANIZATION IDENTITY
- A MEANS OF DETERMINING THE VALUE OF WIP
- COST ACCOUNT TRACEABILITY

Figure 4-F.12

his or her communications with any Contractor personnel on this subject.

Examples of items which typically warrant monitoring by the Analyst are as follows: (1) consistent use of a Budget Change System, including management reserve, with appropriate documentation; (2) determination of performance (earned value) measurements in accordance with an appropriate standard technique(s); (3) participation of appropriate managers in the process of resources planning, reviews, and report preparation; and (4) timeliness, accuracy, completeness, and consistency of contractor's reports. If the Analyst finds a significant deficiency in any of these areas, he or she should discuss the matter with the TRCO for determination as to what actions to take with the Contractor.

F-5 Proposal Evaluation

On major competitive procurements, a Source Evaluation Board (SEB) will normally be established to administer the process of proposal evaluation and make a report of its findings to the Selection Official. The process and organization employed is described in LHB 5103.6A. An Analyst may be asked to participate in the evaluation process, typically as a member of the committee which is responsible for reviewing the cost proposals and/or the management systems of the proposers. In either case the work assigned the Analyst is his or her prime priority, taking precedence over all other work. He or she works under the direction of the committee chairperson. Because of the confidentiality of the subject matter, the Analyst is prohibited from discussing anything related to his or her activity with others not selected to support the SEB, including the Analyst's supervisor.

F-6 Funding Requirements

The Analyst is responsible for the development and execution of a reasonable funding plan for all contractual efforts on the project. In the case of major cost-type R&D contracts, this is often an extremely difficult task because of the inherent uncertainties of the work typically performed under such contracts. Changes in the project's total funding authorization can also have a serious effect on the funding plan(s) for a major contract(s).

As a general rule, the Analyst's funding (obligation) plan for a project should reflect at least 2 months of forward funding for major cost-type R&D contracts; i.e., the project should plan to obligate dollars on contracts such that at all times the Contractor(s) will have Government assurance of reimbursement for the costs anticipated during the ensuing 2-month period. This minimum amount of forward funding is

appropriate to provide continuity of the Contractor's effort and to avoid spending an inordinate amount of time on the subject of funding. It also tends to engender an effective working relationship between the NASA and Contractor personnel involved in cost management whereas a lesser amount of forward funding sometimes taxes the existing working relationship between these personnel.

Clearly, there are exceptions to the above guideline. The most notable exception is the unfortunate situation in which there just is not enough funding authority to forward fund a contract(s) for a 2-month period. At this point it is necessary for NASA to know how much it can obligate against the contract(s) in question in the near future. This usually requires a review of the project's entire obligation plan to determine if any planned obligations could be eliminated or, more likely, deferred. In rare cases it may also be possible to deobligate dollars which have already been obligated. If this type of review does not produce the needed amount of funding authority, other steps must be taken which involve the Contractor. Because of the sensitivity of this subject, it is important that the NASA Contract Administrator and TRCO maintain timely, thorough communications with their Contractor counterparts. One possible source of relief for NASA is to forward fund the contract for less than a 2-month period. When faced with the alternatives, Contractors will usually accede to forward funding of a period less than 2 months on a temporary basis. One remaining course of action open to NASA (other than descoping or terminating the contract) is to reach an agreement with the Contractor as to the (limited) amount of effort to be performed for the period in question. Assuming that the scope of the contract is not decreased, this approach will almost always result in additional all-years costs because of the deferral of effort. The Analyst is usually involved in the above types of reviews to estimate the costs which would be incurred, as well as the timing of these costs, under each option which NASA wishes to consider.

There are circumstances under which the Analyst should consider forward funding a contract(s) by more than 2 months; e.g., when a contract will have a low level of costs for an extended period of time. Under this circumstance, limiting forward funding to a 2-month period would not be cost effective.

F-7 Cost Accrual Assessment

By statue, NASA is required to use an accrued revenue and expenditure accounting system. Under this system, costs are considered to have been accrued (or incurred) at the time that material is used or provided, or a service is rendered, regardless of whether payment is made before the event,

concurrently with the event, or at a later time. This of course includes the costs under major cost-type contracts, which are a significant portion of NASA's total costs. The Analyst has responsibility for providing the best estimate(s) of accrued costs on any contract(s) selected by FMD for such individual attention. These data are updated monthly in accordance with a schedule set by FMD in order to meet NASA Headquarters' reporting deadline. On most contracts actual cost data for the current month are not available by the date established for inputting accrued cost data to FMD. In such cases the Analyst should make the best estimate as to what the accrued costs will be at the end of the month and provide this information to FMD. This usually requires making a phone call to the Contractor's Financial Manager. The Analyst should check the amount of (cumulative) accrued cost last shown in the RMS and provide FMD an incremental amount for the current month which will result in the best estimate of cumulative accrued costs through the end of the current period. In this way any necessary adjustments to the previous input can be made.

The Analyst should maintain a record of his inputs to FMD, and the rationale for his inputs.

F-8 Cost Analysis

The reader should consult Chapter 7 of TM 83108 for information on this subject. The following narrative material for the most part summarizes that information; however, some additional commentary and a large number of examples have been added. In particular, the following subsection entitled, "Earned Value Analysis" contains a considerable amount of information which is not in the TM.

The Analyst should maintain an understanding of the financial status and outlook of a major contractual effort. This is accomplished primarily by obtaining timely, relevant information and reviewing/analyzing that information with respect to the current baseline plan. Information is obtained from various sources including the NASA TRCO and project technical leads, meetings or teleconferences between NASA and Contractor personnel, the Analyst's Contractor counterpart, and Contractor reports. The Analyst reviews/analyzes the Contractor's Financial Management Reports submitted in response to contractual requirements as well as any other relevant reports submitted by the Contractor per informal agreements or requests. In many cases, meaningful resources reports are obtained verbally.

The Analyst should make sure that he/she understands what is in the Contractor's report; e.g., whether the costs for recently identified additional planned testing or a new labor rate file have been incorporated into the ETC. The Analyst should also determine whether the report reflects any significant changes in the Contractor's plan vis-a-vis his previous report.

The Analyst should identify any significant variances, either actual vs. planned costs or actual costs vs. earned value (Budgeted Cost of Work Performed (BCWP)). The latter type of variance is discussed in detail in the following subsection. Variances for both the current period and cumulative-to-date should be considered. Variances in actual vs. planned rates (direct and indirect) should also be addressed, and the possibility of showing significant rate variances graphically should be considered; e.g., a comparison of the NASA vs. the Contractor's cost estimate for a fully loaded man-hour of engineering and manufacturing labor. If the pricing factors used by the Contractor do not produce valid cost estimates, the Analyst should recalculate the estimated costs using more realistic rates and document the rationale. Variances should be identified by element of cost; e.g., material or direct labor, as well as by CWBS subdivision of work.

The Analyst should give special attention to the sections of the Contractor's report addressing Management Reserve and Cost Concerns/Cost Offsets as these are especially good indicators of the cost outlook.

The Analyst should determine whether the Contractor has a valid plan, based on his cost performance, and also whether the Contractor is providing appropriate data and assessment information to NASA/LaRC.

Earned Value Analysis

In recent years considerable attention has been given to a type of contract cost analysis known as Earned Value. The essential element of this type of analysis is the measurement of work performed in terms of the budget planned for that work; i.e., the evaluation of the work that was accomplished. This data element is most often referred to as the "Budgeted Cost of Work Performed (BCWP);" however, it is sometimes referred to as "Planned Value of Work Accomplished (PVWA)" or simply "Earned Value (EV)." It should be noted that an Earned Value Analysis can also provide insight into the contractor's schedule performance.

Before getting into a discussion of the mechanics of Earned Value Analysis, it might be appropriate to discuss briefly how such an analysis is obtained; i.e., where the data comes from and who performs the analysis. The vast majority of the Earned Value Analyses of contract efforts performed to date have been made by contractors in compliance with contract requirements. On large R&D contracts the DOD and DOE receive standard reports from contractors reflecting the results of such analyses. The submittal of these reports is only part of the effort required of DOD and DOE major R&D contractors to meet the requirements of a comprehensive specification of criteria for a cost/schedule

control system to be used by the contractor during the period of contract performance. These criteria require a contractor to use a comprehensive Performance Measurement System (PMS) including Earned Value Analyses at a very low level, viz, for each cost account.

NASA does not have a requirement pertaining to Earned Value Analysis comparable to the DOD and DOE requirements. However, NASA does have a monthly Contractor Financial Management Performance Analysis Report, Form 533P, which reflects certain earned value type data. In accordance with NMI 9501.1D, dated November 9, 1983, this report is required on all NASA cost-type (as well as price-redetermination and fixed-price incentive) R&D flight hardware contracts with a value of at least $25 million and a period of performance of at least 1 year. Its use on other contracts is strictly optional. In recent years, LaRC has required many major R&D contractors to submit this report or an equivalent report on a regular basis. In addition, in a limited number of cases LaRC projects have either required contractors to provide an earned value type report for a selected area(s) of their contract effort or performed independent earned value analyses. Some of the techniques which have been or can be employed, and the resultant reports, are discussed in the remainder of this section.

The term BCWP has been defined above. The difference between BCWP and the Actual Cost of Work Performed (ACWP) represents the Cost Variance (CV), which indicates whether the work that was actually performed cost more or less than it was planned to cost.

As mentioned above, an Earned Value Analysis also produces a measurement of schedule performance, Schedule Variance (SV), which is expressed in terms of dollars. The SV is the difference between the BCWP and the Budgeted Cost for Work Scheduled (BCWS); the latter equals the dollar amount in the time-phased performance measurement baseline plan from the start of the work effort to the date when the measurement is made. SV indicates whether more or less work was done than was scheduled to be done. Figure 4-F.13 contains a concise summary of earned value terminology. An example of the possible interpretations of the above two types of variances, viz, CV and SV, is shown in Figure 4-F.14. Using the above identified data elements, it is possible to quantify a number of different relationships which can be useful in analyzing contractor performance and forecasting future performance. First, the percentage relationships of the variances can be determined. Cost and schedule performance can also be expressed by an index or performance factor, usually referred to as a CPI and SPI. It is usually appropriate to show cumulative as well as "by period" data on a graph of CPI or SPI data. Figure 4-F.15 illustrates the relationship of the cumulative and "by period" CPI for the same set of data. It is

EARNED VALUE LANGUAGE

ELEMENT	TERM	ACRONYM
WORK PLANNED	BUDGETED COST FOR WORK SCHEDULED	BCWS
WORK ACCOMPLISHED/EARNED VALUE	BUDGETED COST FOR WORK PERFORMED	BCWP
COST OF WORK ACCOMPLISHED	ACTUAL COST OF WORK PERFORMED	ACWP
WORK AUTHORIZED	BUDGETED COST AT COMPLETION	BAC
ESTIMATE OF FINAL COST	ESTIMATED COST AT COMPLETION	EAC
COST VARIANCE	COST VARIANCE (BCWP MINUS ACWP)	CV
SCHEDULE VARIANCE	SCHEDULE VARIANCE (BCWP MINUS BCWS)	SV
AT COMPLETION VARIANCE	AT COMPLETION VARIANCE (BAC MINUS EAC)	ACV

Figure 4-F.13

A. INTERPRETATION OF COST AND SCHEDULE VARIANCES						
BCWS	BCWP	ACWP	COST VARIANCE	SCHEDULE VARIANCE	DESCRIPTION	
$1	$1	$1	$0	$0	On Schedule	On Cost
$2	$2	$1	$1	$0	On Schedule	Under Cost
$1	$1	$2	($1)	$0	On Schedule	Over Cost
$1	$2	$2	$0	$1	Ahead of Schedule	On Cost
$1	$2	$3	($1)	$1	Ahead of Schedule	Over Cost
$1	$2	$1	$1	$1	Ahead of Schedule	Under Cost
$3	$2	$1	$1	($1)	Behind Schedule	Under Cost
$2	$1	$3	($2)	($1)	Behind Schedule	Over Cost
$2	$1	$1	$0	($1)	Behind Schedule	On Cost

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

EARNED VALUE DATA ELEMENTS INTERPRETATION

Figure 4-F.14

CUMULATIVE AND MONTHLY CPI

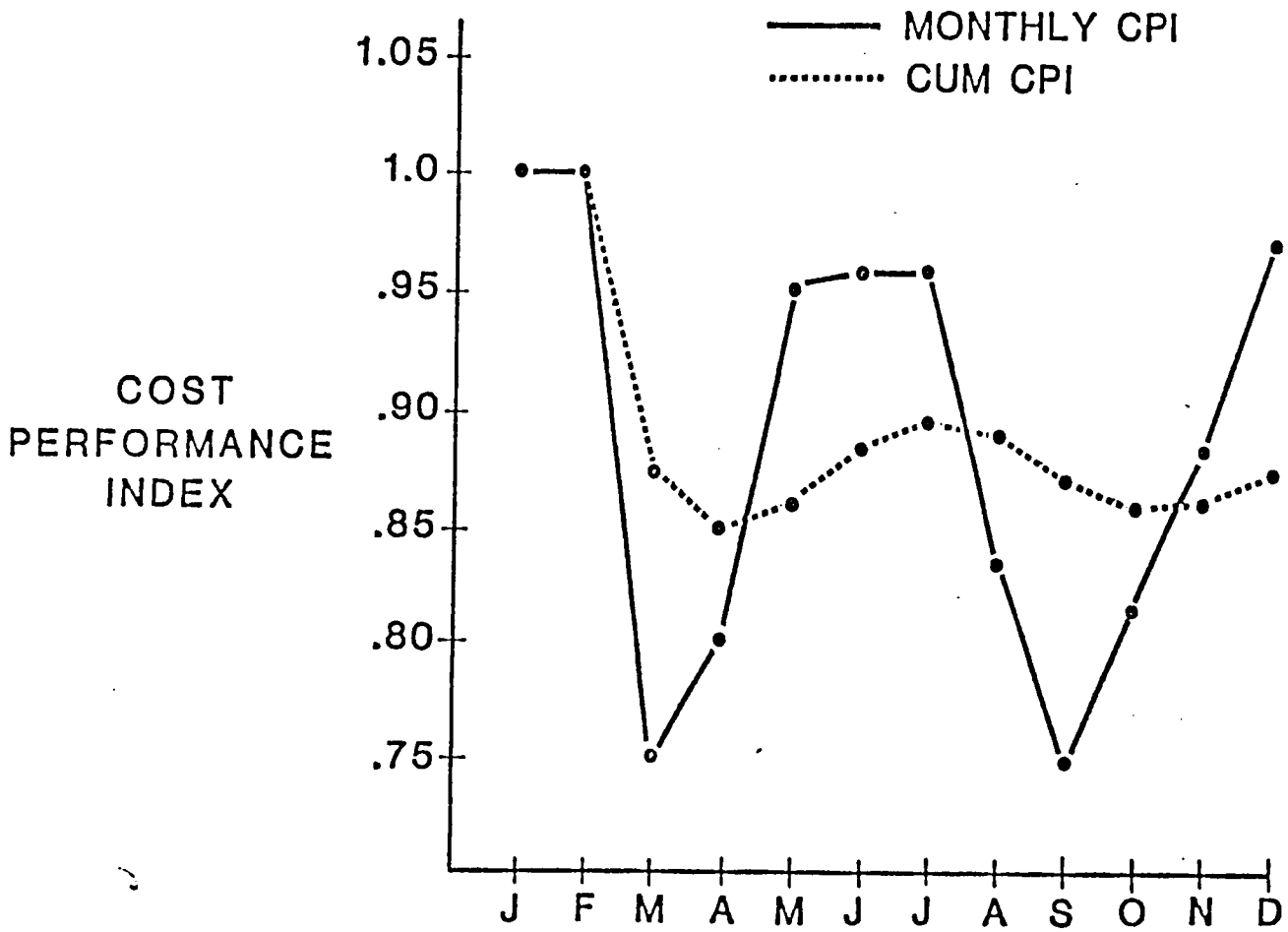


Figure 4-F.15

also possible to identify relationships which relate to the best estimate which can currently be made as to the total costs at completion. Figure 4-F.16 contains a summary of these relational data elements. Figure 4-F.17 contains a graphic presentation of the basic earned value variances.

Figures 4-F.18a and 4-F.18b contain examples of several different types of earned value calculations over a period of time. Figures 4-F.19a and 4-F.19b show some of the relationships of these data in graphic form. With reference to Figure 4-F.19a, the TCPI, which is the rate of efficiency necessary on the work remaining in order to meet the Estimate at Completion, is of course directly affected by that data element. In this case it is assumed that the Contractor has held to an EAC of 800 in spite of his performance during the six periods. The upward slope of the TCPI curve is due to the continued low rate of cost performance and the decreased opportunity recover from the negative cost experience. The data in Figure 4-F.18a provides strong prima facie evidence that the Contractor's is not realistic. It should be noted that all of the above calculations can be made by the Contractor; it is recommended that strong consideration be given to this option.

The IEAC in Figure 4-18a reflects the most elementary version of the EAC projection using the premise that all remaining work will be performed at the same rate of efficiency as has been experienced to date. It should be noted that this calculation can be modified to permit the use of a different rate of efficiency for the remaining work. One modification which is frequently used substitutes the Cost Performance Index (CPI) for the last 5 months for the CPI for the entire period to date, thus eliminating earlier performance as a factor in estimating future costs while emphasizing recent experience as a prognostic factor. The formula for this method of calculating an IEAC is shown below. An example of this calculation is shown in Figure 4-F.18b.

$$IEAC_r = A + \frac{1}{\text{AVERAGE CPI FOR LAST 5 MONTHS}} \times (BAC - EV)$$

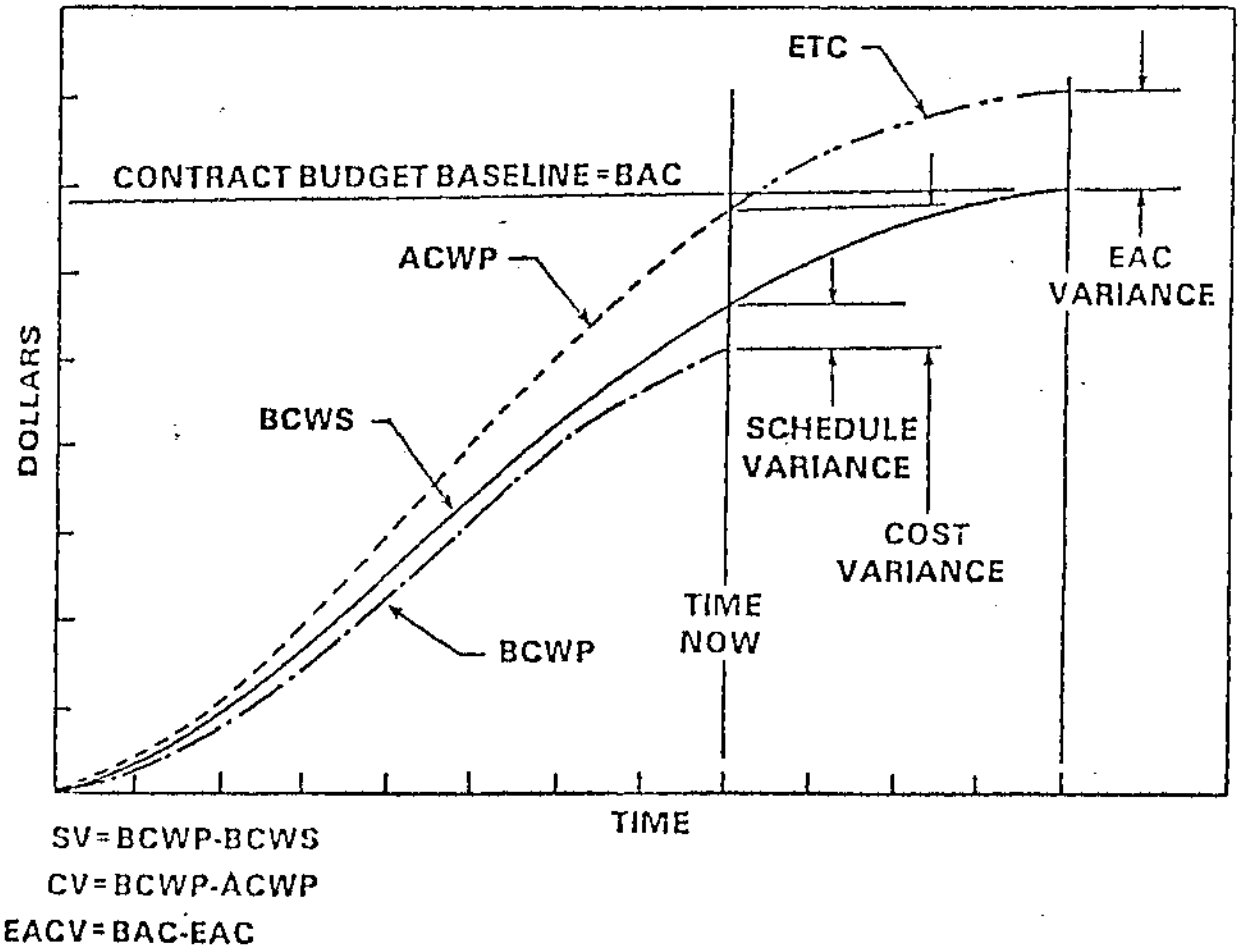
More sophisticated formulae for determining an IEAC have been developed in recent years including some which reflect schedule performance as well as cost performance. Information on additional techniques can be obtained from either the Defense Systems Management College, Ft. Belvoir, Virginia, or the Air Force Institute of Technology, WPAFB, Dayton, Ohio. Both of these organizations offer courses on C/SCSC which go into considerable detail regarding techniques for analyzing contractor performance measurement system data.

DATA ANALYSIS RELATIONSHIPS

TERM	SYMBOL	FORMULA	CONCEPT/RELATIONSHIP
PERCENT COMPLETE	% DONE	$\frac{BCWP}{BAC}$	RATIO OF WORK ACCOMPLISHED IN TERMS OF THE TOTAL AMOUNT OF WORK TO DO
COST PERFORMANCE INDEX	CPI OR P_F	$\frac{BCWP}{ACWP}$	RATIO OF WORK ACCOMPLISHED AGAINST MONEY SPENT (AN EFFICIENCY RATING: WORK DONE FOR RESOURCES EXPENDED)
TO COMPLETE PERFORMANCE INDEX OR VERIFICATION FACTOR	TCPI OR V_F	$\frac{(BAC - BCWP)}{(EAC - ACWP)}$	RATIO OF WORK REMAINING AGAINST MONEY REMAINING (EFFICIENCY WHICH MUST BE ACHIEVED TO COMPLETE THE REMAINING WORK WITH EXPECTED REMAINING MONEY)
SCHEDULE PERFORMANCE INDEX	SPI	$\frac{BCWP}{BCWS}$	RATIO OF WORK ACCOMPLISHED AGAINST WHAT SHOULD HAVE BEEN DONE (EFFICIENCY RATING: WORK DONE AS COMPARED TO WHAT SHOULD HAVE BEEN DONE)
SCHEDULE CORRELATION	SCHED. CORR.	$\frac{SV}{\text{AVERAGE BCWP}}$	RATIO OF SCHEDULE VARIANCE (SV) IN TERMS OF AVERAGE AMOUNT OF WORK ACCOMPLISHED (IN WEEKS OR MONTHS) INDICATES A CORRELATION TO PROGRAM TRUE SCHEDULE POSITION
ESTIMATE AT COMPLETION	EAC	1) $\frac{BAC}{CPI}$ 2) BAC/SPI 3) $ACWP + \frac{1}{CPI}(BAC - BCWP)$	CALCULATION OF THE COST AT COMPLETION TO COMPARE WITH OTHER RATIONALESOF COST AT COMPLETION 1) RATIO OF TOTAL WORK TO BE DONE AGAINST COST EFFICIENCY 2) RATIO OF TOTAL WORK TO BE DONE AGAINST SCHEDULE EFFICIENCY 3) COSTS ACCUMULATED TO DATE ADDED TO AN ESTIMATE OF REMAINING COSTS (OF WORK TO BE PERFORMED) USING COST EFFICIENCY TO DATE
VARIANCE AT COMPLETION	VAC	BAC - EAC	COMPARISON BETWEEN THE BUDGET TO COMPLETE A JOB (TASK, PROGRAM) AND THE ESTIMATE OF COSTS TO COMPLETE A JOB (TASK, PROGRAM). A NEGATIVE ANSWER MEANS AN ANTICIPATED OVERRUN

Figure 4-F.16

EARNED VALUE VARIANCES



SV = BCWP-BCWS

CV = BCWP-ACWP

EACV = BAC-EAC

Figure 4-F.17

BASIC EARNED VALUE CALCULATIONS

ASSUMPTION: Contractor's Budget at Completion (BAC) = 800 for Periods 1 Thru 6

TIME PERIOD	1	2	3	4	5	6
Actual Costs (ACWP) or (A)						
For Period	100	90	80	70	60	50
Cumulative	100	190	270	340	400	450
A/BAC	.125	.238	.338	.425	.500	.563
EV (BCWP)						
For Period	80	70	60	50	40	30
Cumulative	80	150	210	260	300	330
EV/BAC	.100	.188	.263	.325	.375	.413
CPI (EV ÷ Actual)						
For Period	.800	.778	.750	.714	.667	.600
Cumulative	.800	.790	.778	.765	.750	.733
TCPI	1.029	1.066	1.113	1.174	1.250	1.343
IEAC	1000	1013	1028	1046	1067	1091

1. EV = BCWP = EARNED VALUE = BUDGETED COST OF WORK PERFORMED
2. CPI = COST PERFORMANCE INDEX
3. TCPI = (BAC - EV) ÷ (EAC-A) = TO COMPLETE PERFORMANCE INDEX = VERIFICATION INDEX
4. IEAC = INDEPENDENT EAC = A + $(\frac{1}{CPI} \times BAC - EV)$

NOTE: ALL RATIOS SHOULD BE ROUNDED TO THE NEAREST THOUSANDTH.

Figure 4-F.18a

EAC CALCULATION EMPHASIZING RECENT COST PERFORMANCE

(ALL UNITS OTHER THAN CPI ARE X DOLLARS UNLESS OTHERWISE IDENTIFIED)

Assumptions with reference to Figure 6-F.18a

1. Present date is the end of Period 6
2. Each period is 5 months long
3. Applicable Period 6 data:

ACTUAL (cumulative)	450
AVER CPI (last 5 months)	.600
EV (cumulative)	330
BAC	800

CALCULATION:

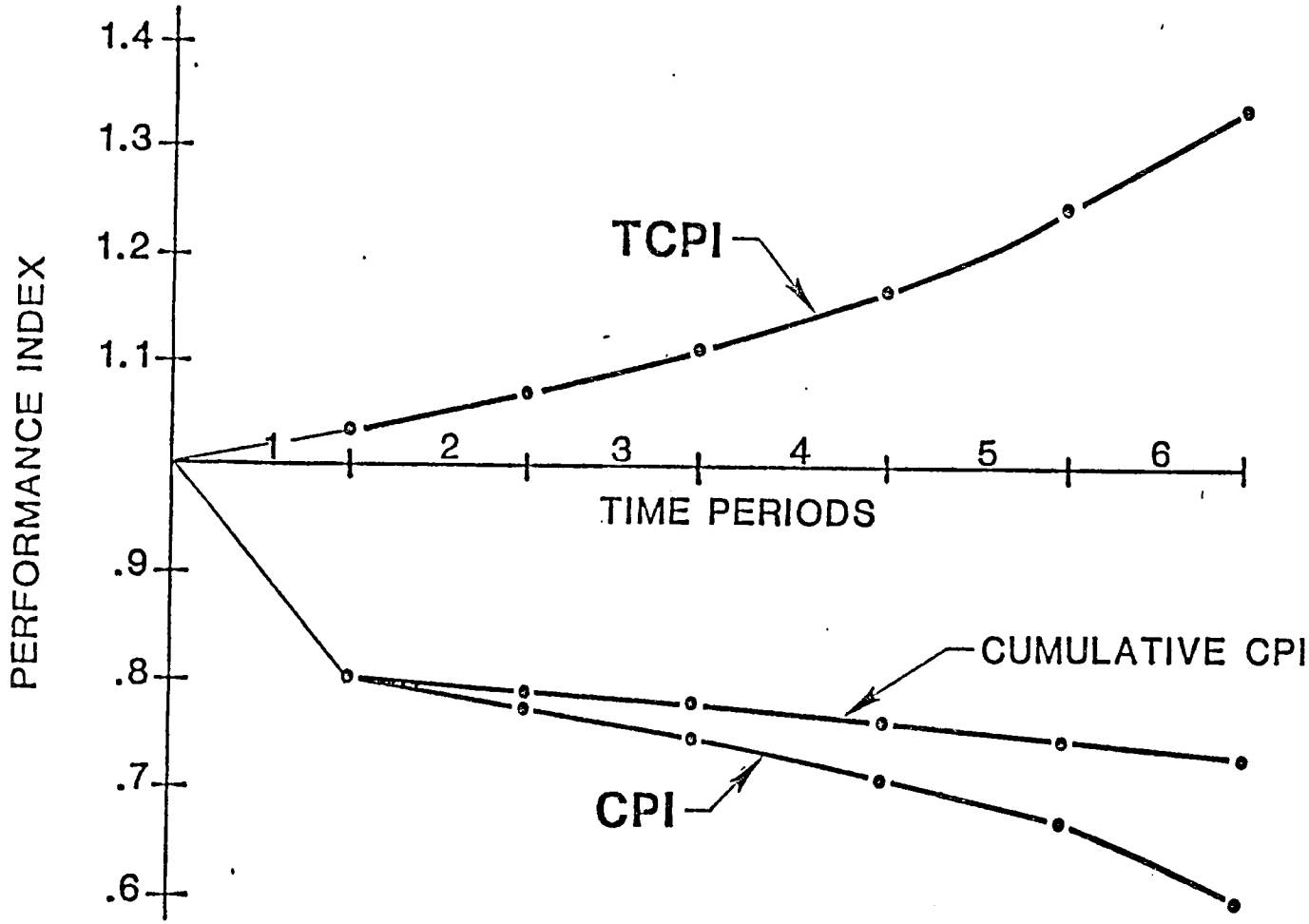
$$IEAC_r = A + \frac{1}{\text{AVER. CPI FOR LAST 5 MONTHS}} \times (BAC - EV)$$

$$IEAC_r = 450 + \frac{1}{.6} \times (800 - 330)$$

$$IEAC_r = 450 + 783 = 1233$$

Figure 4-F.18b

CPI vs TCPI



CPI = COST PERFORMANCE INDEX
TCPI = TO COMPLETE COST PERFORMANCE INDEX

Figure 4-F.19a

ESTIMATE AT COMPLETION AS A DIRECT FUNCTION OF EARNED VALUE

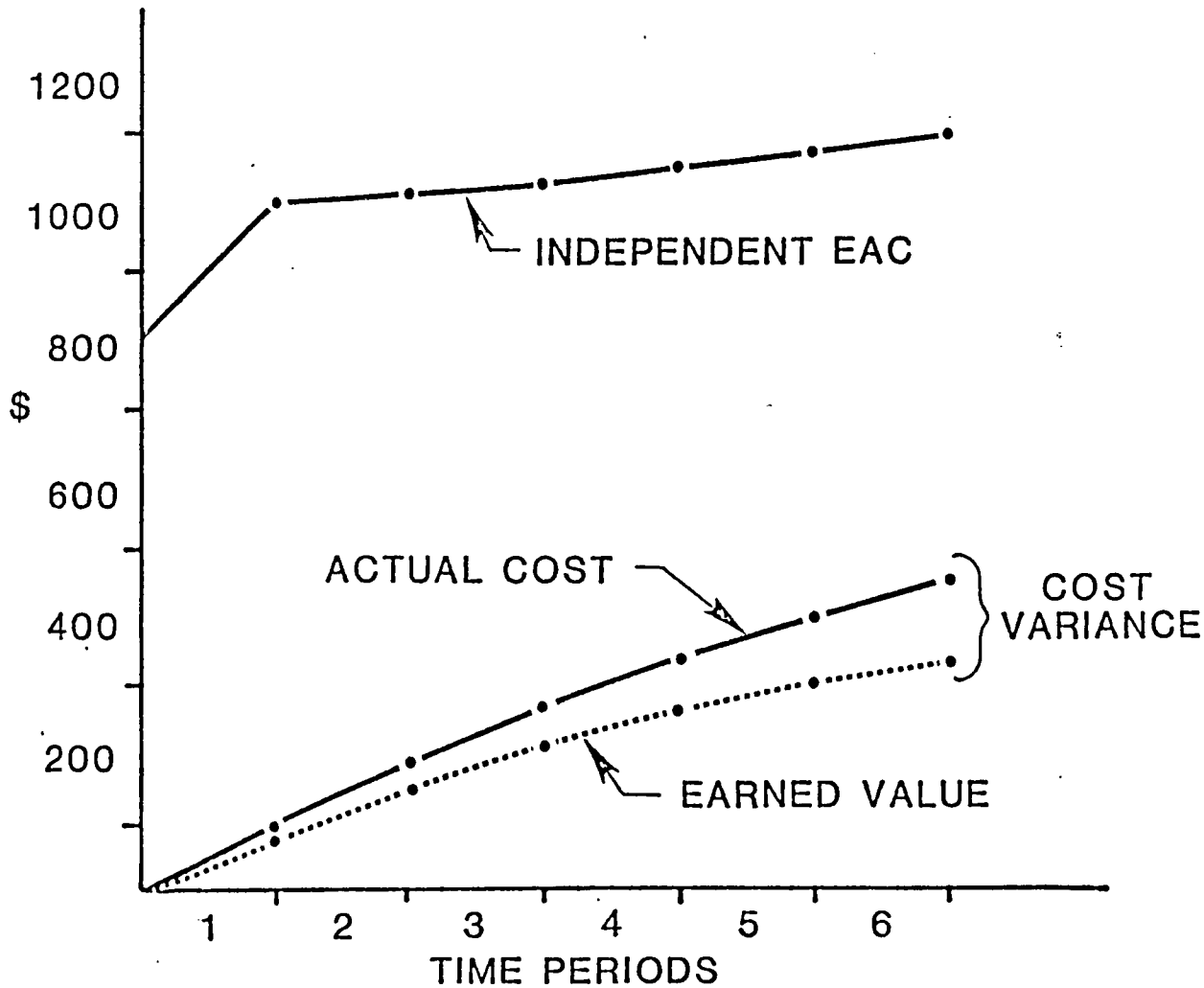


Figure 4-F.19b

The Analyst, in concert with the TRCO, should consider whether an Earned Value Analysis of contractor cost performance will be made by NASA personnel, either in lieu of, or in addition to, such an analysis by the Contractor. If the decision is made for NASA personnel to do an Earned Value Analysis a number of ancillary decisions must be made. Major factors to be considered include the quality and type of data which is available, the amount of dollars at risk, the level of confidence in the contractor's financial reports, and the amount and types of involvement which would be required on the part of the Analyst and other NASA personnel.

Several types of Earned Value Analyses have been used on LaRC projects. One method is based on the number of equivalent units which have been completed. By this method the earned value at any point in time is equal to the number of equivalent units completed multiplied by the dollar value of one equivalent unit (total cost divided by the total number of equivalent units). This method is inappropriate unless at least several units are involved and the design phase is completed. It is not a truly objective method, however, since the determination of equivalent units completed involves a subjective evaluation. A second method which has been used is based on the assignment of values to key milestones. By this method, the earned value at any point in time is equal to the sum of the assigned values for all of the key milestones which have been completed. The results obtained by this method improve significantly when a minimum of several key milestones are selected for each (usually monthly) period. A third method which has been used is based on a subjective evaluation of the percentage of work which has been accomplished in each subdivision of work in the WBS. The earned value is the product of this percentage and the Budget At Completion (BAC) for the particular subdivision(s) of work. GSFC has had good results using a relatively simple form of Earned Value Analysis that is based strictly on the number of activities in the baseline plan which have been completed compared to the number of activities in the baseline plan which were planned to be completed. According to this technique, at any point in time the earned value is equal to the product of (1) the number of completed activities divided by the number of planned activities, and (2) the dollar value in the baseline plan at that point in time. A very large number of activities must be used for each period to offset the potential distortion of this method of determining earned value due to the fact that the same credit is given for each activity that has been completed even though the true dollar value of activities varies considerably.

The above methods require a schedule baseline and corresponding cost baseline as well as valid status information. Both the schedule and cost baselines must be maintained in order to obtain valid results using these or any other earned value system. It should be noted that the above methods produce better

data on a cumulative basis as the effort progresses since there will be more data points in the calculation of earned value.

From a theoretical standpoint these methods of determining earned value cannot produce results as good as a contractor can provide regarding his own efforts, assuming he uses a system which meets the criteria of the DOD C/SCSC, as that specification calls for the contractor's use of the most appropriate of six methods for determining earned value for each cost account as well as many other requirements to ensure that the contractor's system is effective. However, each of the above methods is capable of providing a reasonably objective indicator of earned value. Even if the Contractor is providing earned value data it might be worthwhile to use such a technique as a form of check on the contractor's system.

Contract Analysis Reports

The Analyst, in concert with the TRCO, should determine the content and format of the reports which are to be prepared regularly to reflect the financial status and outlook of any major contracts. It is recommended that consideration be given to requiring the Contractor to prepare and submit as many of the financial management reports, including earned value reports, as possible, which the Project Manager feels the project should have as this is usually the most cost effective means of obtaining such data and fosters effective communications between LaRC and Contractor personnel. Of course it is unlikely that a Contractor will disclose everything he knows about his financial status and outlook on a particular contractual effort. His goals and interests are very different from those of NASA, and he will most likely from time to time prefer to keep certain information "under wraps." The Analyst should be aware of the types of manipulations which are sometimes made in this regard. Figure 4-F.20 contains a summary of the principal types of these "gaming techniques" and the effects of their use.

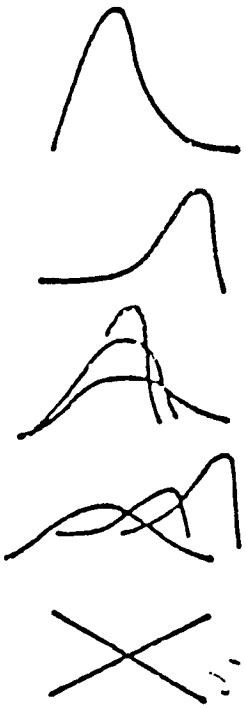
Figure 4-F.21 identifies the types of cost variances that are most often experienced and the most frequently encountered causes of variances. Figure 4-F.22 lists examples of comments sometimes used in reports which miss the mark as far as explaining what really caused a particular variance.

Figures 4-F.4, 4-F.19a, and 4-F.23 through 4-F.33 contain either examples of or guidelines for the preparation of earned value data analysis reports which are used by GSFC. Typically, GSFC requires major contractors to submit most of these reports in response to contractual reporting requirements.

Figure 4-F.29 contains the variance thresholds to be used by contractors in order to meet the requirements of GSFC's PMS. It should be noted that two sets of thresholds are

GAMING TECHNIQUES

COST ACCOUNT LEVEL PLANNING



	CHARACTERISTICS	IMPEDIMENTS
1. "FRONT LOADING"	EARLY FAVORABLE COST VARIANCE	VARIANCE REPORTING & TREND ANALYSIS
2. "END LOADING"	EARLY UNFAVORABLE COST VARIANCE	
3. "SURFING"	BUDGET ADVANCED FROM FORWARD TIME PERIODS BEHIND SCHED VAR TREND	FREEZE OF AMOUNTS BY ROLLING WAVE
4. "SNOW PLOWING"	SHIFTING BUDGET FROM NEAR- TO FAR-TIME PERIODS	REPHASING CONSTRAINTS PLUS POSSIBLE LOSS OF DOWNSTREAM BUDGET
5. "RATE MANIPULATION"	FREQUENT CHANGES TO DIRECT LABOR RATES	RATE VAR REPORTING DOLLAR BUDGETING

Figure 4-F.20

GAMING TECHNIQUES (CONT'D)

NAME	MASKING EFFECT/RESULT
1. LEVEL OF EFFORT FRONT END LOADED (TASK NOT WORKED)	RESULTS IN FAVORABLE COST VARIANCES WITH NO SCHEDULE VARIANCES. GIVES APPEARANCE OF PROGRAM PROGRESS
2. 50/50 TECHNIQUE. (NO CONTROL ON "ADVANCE CREDIT")	RESULTS IN EARNED VALUE (BCWP) FOR LITTLE OR NO EXPENDITURE OF RESOURCES (ACWP). DEVELOPS FAVORABLE COST AND SCHEDULE VARIANCES
3. BOOKING LAG (ACCRUE BCWP FOR MATERIAL WITHOUT REPORTING COSTS ((ACWP)) DURING SAME PERIOD)	GENERATES FAVORABLE COST VARIANCES DURING PERIOD OF "BOOKING-LAG"
4. OVERHEAD (INDIRECT COSTS) RATE MANIPULATION (USE OF DIFFERENT RATES FOR INDIRECT COSTS CONTAINED IN BCWS AND BCWP)	RESULTS IN EARNED VALUE (BCWP) AT HIGHER VALUE THAN REFLECTED IN BCWS. DEVELOPS FAVORABLE COST/SCHEDULE VARIANCES.
5. P = A SYNDROME FOR COST TYPE SUBCONTRACTORS (SETTING BCWP EQUAL TO INVOICE AMOUNT (ACWP)).	DEVELOPS FAVORABLE SCHEDULE VARIANCES AS SUBCONTRACTOR SPENDS. ACCRUES LOTS OF PERFORMANCE (BCWP) AS SUBCONTRACTOR SPENDS. DISTORTS PROGRAM PROGRESS UNTIL LEVELING OF BCWP (WHICH IS TOTAL WHEN SUBCONTRACTOR "SPENDS" ALL BUDGET).

ANALYSIS OF COST VARIANCES

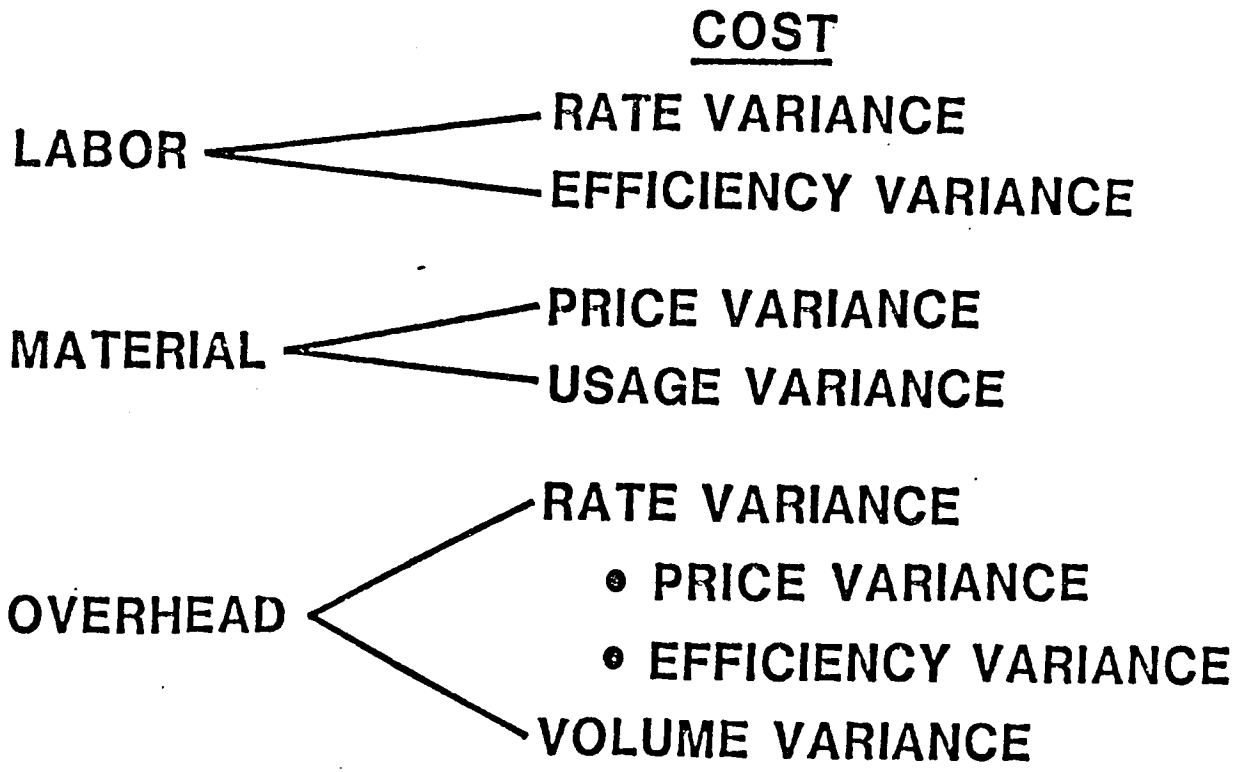


Figure 4-F.21

ANALYSIS OF COST VARIANCES (CONT'D)

IDENTIFY CAUSES

- ESTIMATING ERRORS
- TECHNICAL PROBLEMS
  - DESIGN
  - CONSTRUCTION
  - CHANGING CONDITIONS
- MANAGEMENT PROBLEMS
  - PERSONNEL
  - LABOR
  - ORGANIZATION
- ECONOMIC/INFLATION
- ACTS OF GOD
- CHANGING BUSINESS BASE
- VENDORS/ SUBCONTRACTORS

EXAMPLES OF POOR CAUSE OF VARIANCE CONDITION

- THIS COST ACCOUNT IS OVERRUN BECAUSE I SPENT MORE THAN I HAD PLANNED.
- I AM OVERRUN BECAUSE ENGINEERING CHARGED MORE HOURS THAN THEY HAD AGREED.
- I AM OVERRUN BECAUSE I WORKED LONGER THAN I PLANNED TO.
- I USED MORE COMPUTER TIME THAN I PLANNED.
- I AM BEHIND SCHEDULE BECAUSE IT TOOK LONGER THAN I THOUGHT.

EXAMPLES OF POOR CORRECTIVE ACTION

- NONE REQUIRED.
- I PLAN TO WORK HARDER.
- I SHOULD BE ABLE TO MAKE UP THE OVERRUN DOWNSTREAM.

Figure 4-F.22

PERFORMANCE MEASUREMENT STATUS REPORT
PROBLEM ANALYSIS

CONTRACTOR LOCATION	CONTRACT TYPE/NO.:	PROGRAM NAME/NUMBER:	REPORT PERIOD:

EVALUATION

Part 1 - Total Contract: Provide a summary analysis identifying significant problems affecting performance. Indicate corrective actions required, including Government action were applicable.

Part 2 - Cost and Schedule Variances: Explain all variances which exceed specified variance thresholds. Explanations of variances must clearly identify the nature of the problem, the reasons for cost or schedule variance, impact on the immediate task, impact on the total program, and the corrective action taken. Explanations of cost variances should identify amounts attributable to rate changes separately from amounts applicable to manhours used; amounts attributable to material price changes separately from amounts applicable to material usage; and amounts attributable to overhead rate changes from amounts applicable to overhead base changes and amounts applicable to changes in the overhead allocation basis.

Within this action, the following specific variances must be explained:

a. Schedule variances (Budgeted Cost for Work Scheduled vs. Budgeted Cost for Work Performed)
b. Cost variances (Budgeted Cost for Work Performed vs. Actual Cost of Work Performed)
c. Cost variances at completion (Budgeted at Completion vs. Latest Revised Estimate at Complettion)

Part 3 - Other Analysis: In addition to the variance explanations above, the following analyses are mandatory:

a. Identify the effort to which the undistributed budget applies.
b. Identify the amount of management reserve applied during the reporting period, the WBS elements to which applied, and the reasons for application.
c. Explain reasons for significant shifts in time-phasing of the PM Baseline.
d. Explain significant changes in total man-months at completion.
e. Explain reasons for significant shifts in time-phasing of planned or actual manpower.

Figure 4-F.23

CONTRACTOR Houdini Space Company LOCATION Utopia, Calif.	PERFORMANCE MEASUREMENT STATUS REPORT WORK BREAKDOWN STRUCTURE			SIGNATURE, TITLE & DATE Avery T. Fine Program Manager
	CONTRACT TYPE/No. CPAF/22222	PROGRAM NAME/No. IMAFULU	REPORT PERIOD: 3/31/83	

CONTRACT DATA

ORIGINAL CONTRACT COST	NEGOTIATED CONTRACT CHANGES	CURRENT CONTRACT COST	ESTIMATED COST OF AUTHORIZED UNPRICED WORK	CONTRACT BUDGET BASE
26060	$2,000.	$28,060	$500	28,560

CURRENT MONTH PERFORMANCE DATA

WORK BREAKDOWN STRUCTURE 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)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.0 Project Mgmt	83.0	83.0	55.0	-0-	28	1500	1500	1000	-0-	500	3000	3000	-0-
2.0 Systems Eng.	-0-	-0-	-0-	-0-	-0-	2000	2000	2300	-0-	(300)	2000	2000	-0-
3.0 Spacecraft	1000	900	1000	(100)	(100)	6000	5500	5800	(500)	(300)	12000	12300	(300)
4.0 Quality Control	50	50	25	-0-	25	300	300	150	-0-	150	1200	1200	-0-
5.0 Flight Support Equip.	60.0	55.0	65.0	(5)	(10)	1200	1100	1300	(100)	(200)	2000	2000	-0-
6.0 Observatory I&T	12.5	12.5	12.5	-0-	-0-	225	225	225	-0-	-0-	2000	2000	-0-
7.0 Mission Ops	8.3	8.3	8.3	-0-	-0-	150	150	150	-0-	-0-	1000	1000	-0-
Total	1213.8	1108.8	1165.8	(105)	(57)	11375	10775	10925	(600)	(150)	23200	23500	(300)
COST OF MONEY	18.2	16.6	17.5	(1.6)	(.9)	170.6	161.6	163.9	(9)	(2.3)	348	352	(4)
GENERAL AND ADMIN	194.2	177.6	186.5	(16.8)	(9.1)	1820	1734	1748	(96)	(24)	3712	3760	(48)
UNDISTRIBUTED BUDGET											500	500	-0-
SUB TOTAL	1426.2	1303	1369.8	(123.4)	(67)	13366	12630	12837	(705)	(176.3	27760	28112	(352)
MANAGEMENT RESERVE											800	800	-0-
TOTAL	1426.2	1303	1369.8	(123.4)	(67)	13366	12630	12837	(705)	(176.3	28560	28912	(352)

Figure 4-F.24

CONTRACTOR Houdini Space Co.	PERFORMANCE MEASUREMENT STATUS REPORT BASELINE STATUS			SIGNATURE, TITLE & DATE
LOCATION Utopia, Calif.	CONTRACT TYPE/NO. CPAF/22222	PROGRAM NAME/NO. IMAFULU	REPORT PERIOD: 3/31/83	Avery T. Fine Program Manager

ITEM	BCWS CUM TO DATE	BCWS FOR REPORT PERIOD	BUDGETED COST FOR WORK SCHEDULED (NON-CUMULATIVE)										UNDIST BUDGET	TOTAL BUDGET
			SIX MONTH FORECAST						QTR	QTR	QTR	QTR		
			+1	+2	+3	+4	+5	+6						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
PM BASELINE (BEGINNING OF PERIOD)		11940	1426	1426	1400	1400	1350	1200	1000	1530	1530	1530	1528	500	27760
Mod 12					200										
Mod 13										(200)					
Replan FSE Procurement									300		(300)				
Definitized Mod 11										250	250				
PM BASELINE (END OF PERIOD)			1426	1600	1400	1350	1200	1300		1580	1480	1530	1528	-0-	27760
MANAGEMENT RESERVE															800
TOTAL															28560

Figure 4-F.25

DATA ANALYSIS – PROGRAM INDICIES

MONTH	% DONE	CPI (P_F)	TCPI (V_F)	SPI	SCHED. COMP.	EAC_{his}*	EAC_I*	BAC	VAC

* NOTE: EAC_{his} = CONTRACTOR PROJECT MGR'S ASSESSMENT
EAC_I = IEAC (See Figure 4-F.18)

Figure 4-F.26

TREND ANALYSIS

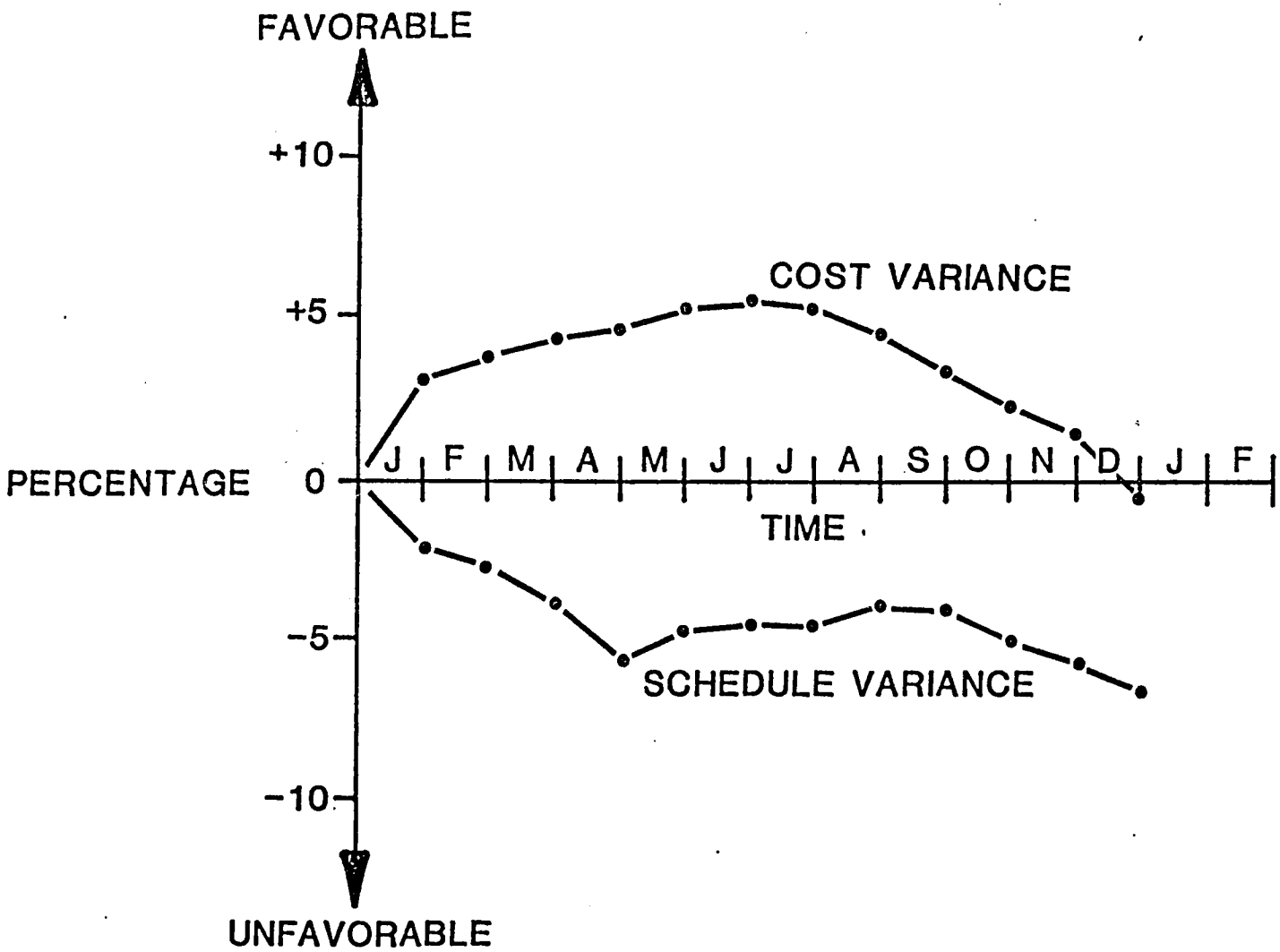
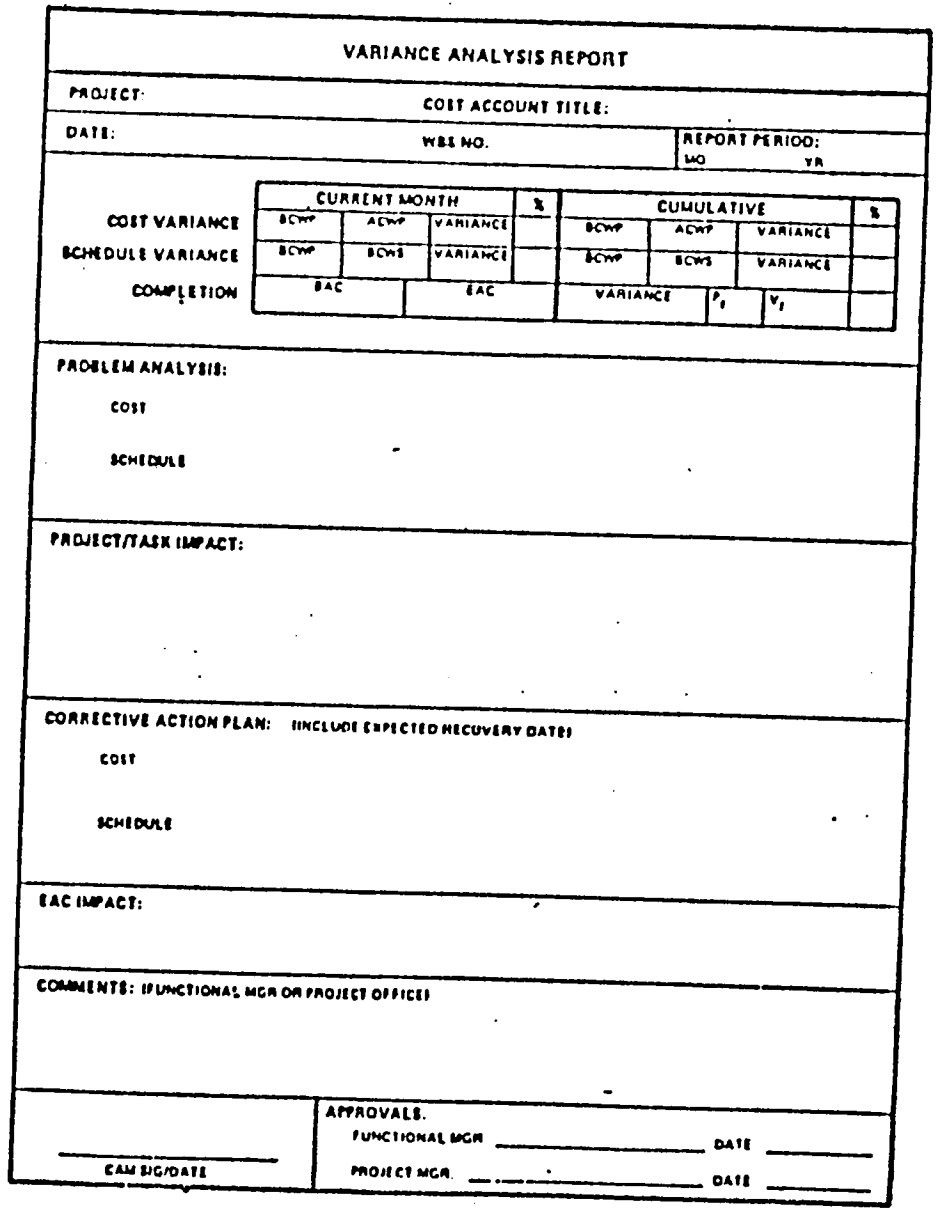


Figure 4-F.27

VARIANCE ANALYSIS REPORT



VARIANCE ANALYSIS REPORT

PROJECT: COST ACCOUNT TITLE:

DATE: WBS NO. REPORT PERIOD: MO YR

	CURRENT MONTH			%	CUMULATIVE			%
COST VARIANCE	BCWP	ACWP	VARIANCE		BCWP	ACWP	VARIANCE	
SCHEDULE VARIANCE	BCWP	BCWS	VARIANCE		BCWP	BCWS	VARIANCE	
COMPLETION	BAC		EAC		VARIANCE	P_f	V_f	

PROBLEM ANALYSIS:

COST

SCHEDULE

PROJECT/TASK IMPACT:

CORRECTIVE ACTION PLAN: (INCLUDE EXPECTED RECOVERY DATE)

COST

SCHEDULE

EAC IMPACT:

COMMENTS: (FUNCTIONAL MGR OR PROJECT OFFICE)

CAM SIG/DATE

APPROVALS.

FUNCTIONAL MGR _____ DATE _____

PROJECT MGR. _____ DATE _____

Figure 4-F.28

VARIANCE ANALYSIS THRESHOLDS

THRESHOLD VALUES AT THE COST ACCOUNT LEVEL:

	MINIMUM VALUE	COST* -%	COST* +%	SCHEDULE** -%	SCHEDULE** +%
CURRENT MONTH					
ENGINEERING LABOR	100 HRS	15	20	15	20
MANUFACTURING LABOR	250 HRS	15	20	15	20
PRODUCTION MATERIAL	$2,500	15	20	15	20
TOOLING MATERIAL	$1,200	15	20	15	20
SUBCONTRACTORS					
CUM TO DATE					
ENGINEERING LABOR	250 HRS	10	15	10	15
MANUFACTURING LABOR	500 HRS	10	15	10	15
PRODUCTION MATERIAL	$5,000	10	15	10	15
TOOLING MATERIAL	$2,500	10	15	10	15
SUBCONTRACTORS					
AT COMPLETION					
ENGINEERING LABOR	250 HRS	10	10		
MANUFACTURING LABOR	500 HRS	10	10		
PRODUCTION MATERIAL	$5,000	10	10		
TOOLING MATERIAL	$2,500	10	10		
SUBCONTRACTORS					

$$* \% = \frac{BCWP - ACWP}{BCWP} \qquad ** \% = \frac{BCWP - BCWS}{BCWS}$$

Figure 4-F.29

VARIANCE ANALYSIS THRESHOLDS CONT'D

THRESHOLD VALUES AT THE REPORTING LEVELS OF THE WBS:

	FAVORABLE	UNFAVORABLE	MINIMUM VALUES
CURRENT MONTH	$20,000 or 15% WHICHEVER IS GREATER	($10,000) or (15%) WHICHEVER IS GREATER	$ 5,000
CUM TO DATE	$100,000 or 10% WHICHEVER IS LESS	($50,000) or (10%) WHICHEVER IS LESS	$25,000
AT COMPLETION	$200,000	($100,000)	

VARIANCE ANALYSIS REPORT - GUIDELINES FOR NARRATIVE

CAUSE OF THE PROBLEM

- DISCUSS CV AND SV SEPARATELY
- CLEARLY IDENTIFY THE REASON FOR THE VARIANCE
- ISOLATE SIGNIFICANT LABOR RATE VARIANCES
- EMPHASIS ON THE QUANTITATIVE NOT QUALITATIVE
- EMPHASIS ON THE SPECIFIC NOT THE GENERAL
- EMPHASIS ON SIGNIFICANT PROBLEMS NOT ALL PROBLEMS

IMPACT ON PROJECT

- DESCRIBE SPECIFIC COST, SCHEDULE, AND TECHNICAL IMPACT ON THE PROJECT
- ADDRESS INTERMEDIATE SCHEDULES
- DESCRIBE IMPACT ON OTHER COST ACCOUNTS/WORK AGREEMENTS
- ASSESS THE NEED TO REVISE THE EAC

CORRECTIVE ACTION PLANNING

- DESCRIBE SPECIFIC ACTIONS BEING TAKEN OR TO BE TAKEN TO ALLEVIATE OR MINIMIZE THE IMPACT OF THE PROBLEM
- INCLUDE THE INDIVIDUAL OR ORGANIZATION RESPONSIBLE FOR THE REQUIRED ACTION
- INCLUDE SCHEDULES FOR THE ACTIONS AND GET WELL DATES
- IF NO CORRECTIVE ACTION IS POSSIBLE, EXPLAIN WHY
- INCLUDE RESULTS OF CORRECTIVE ACTION PLANS IN PREVIOUS VAR'S

Figure 4-F.30

MANAGEMENT RESERVE AND COST VARIANCE

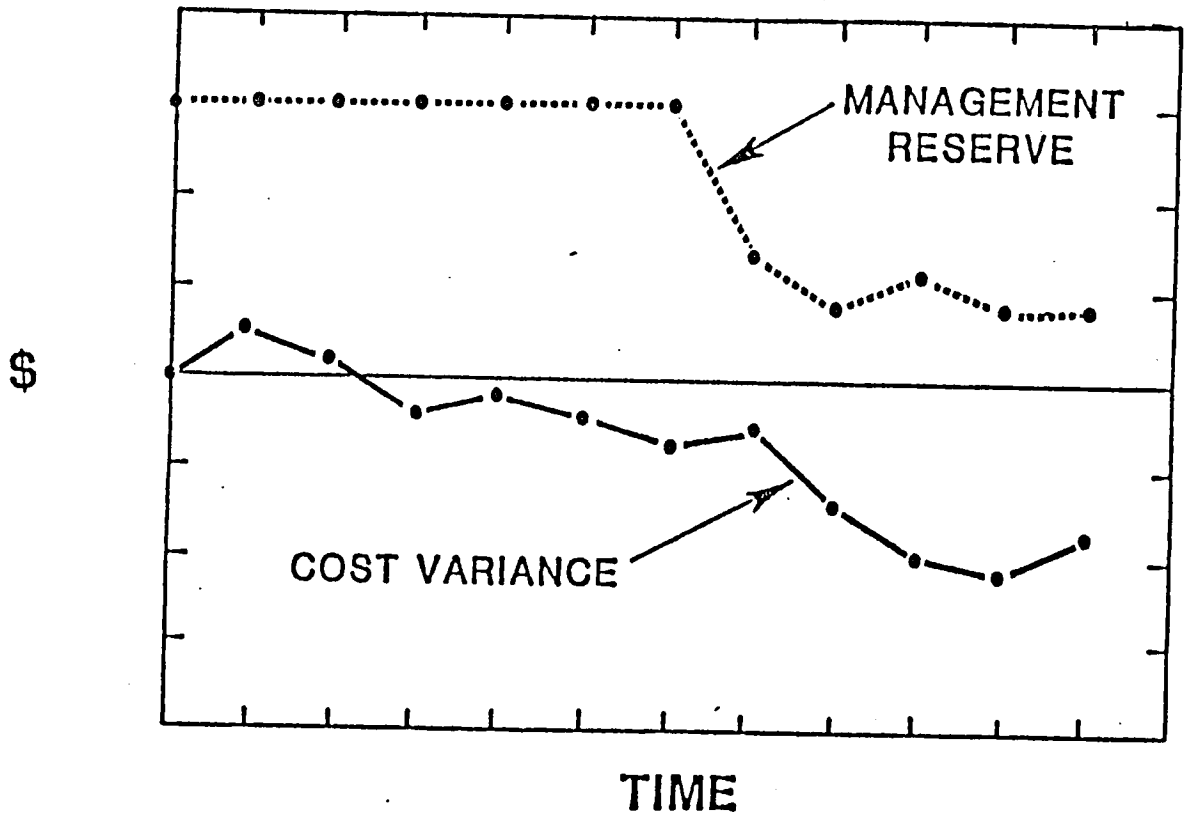


Figure 4-F.31

PROJECT T

CONTRACTOR U

CONTRACT 123

(EXCLUDING SUBCONTRACTS)

COST/SCHEDULE PERFORMANCE STATUS

Status As Of 3/14/83

Schedule Performance

- Schedule efficiency continues at a 77% rate.
- This is lower than the program average (84%) and will begin to impact estimates at completion if not improved.

Cost Performance

- While the plan vs. actual overrun through January is only 8%, the cost performance index remains at .71 due to late schedule accomplishment.
- Cost performance indicators will decline during February and March (Based on current schedule accomplishment).

Bottom Line

- Schedule performance will become a cost driver. Manpower levels will have to be held higher than the plan if schedule is to be maintained.

Figure 4-F.32

ESTIMATES OF COSTS AT COMPLETION

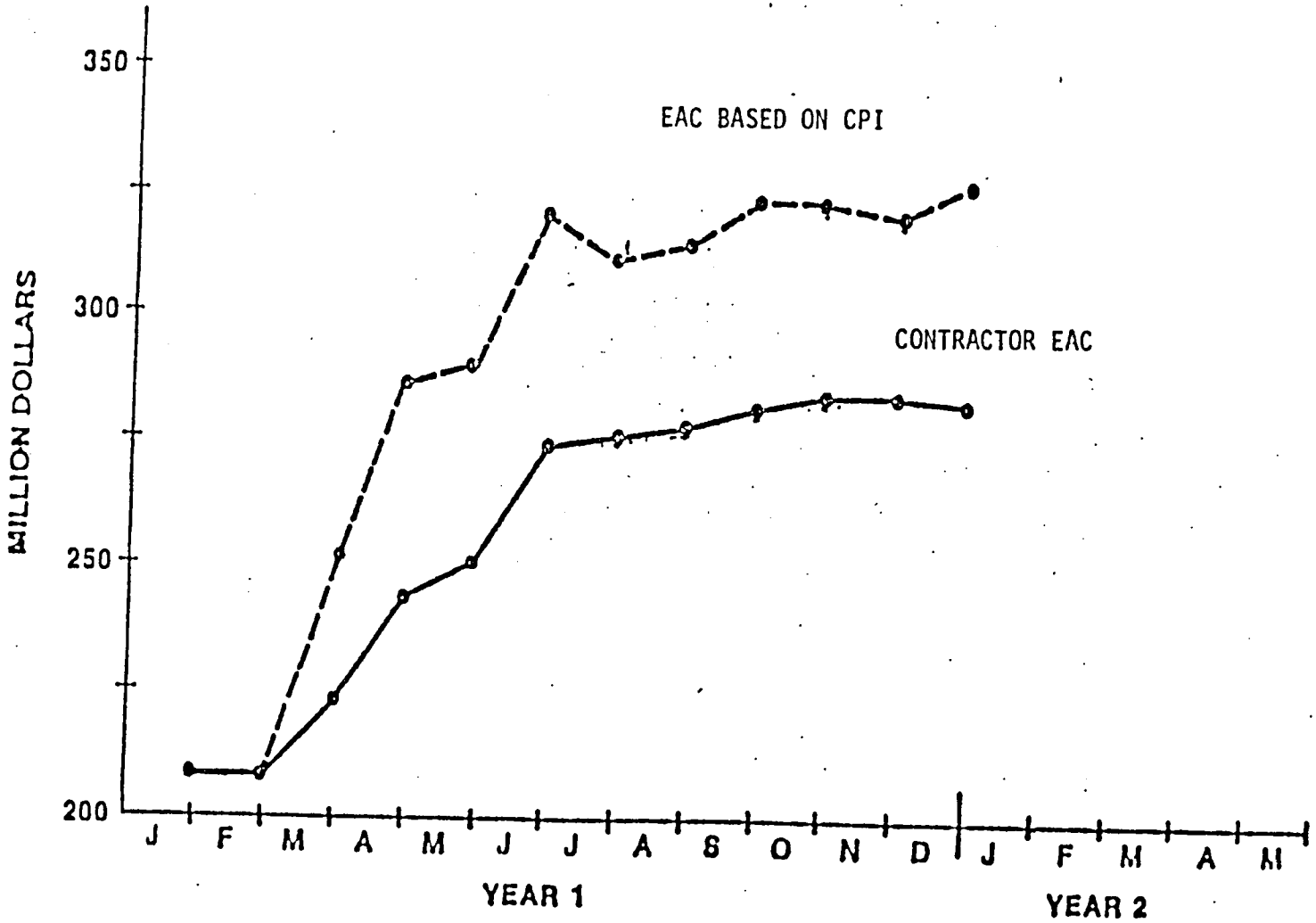


Figure 4-F.33

specified. One set applies to the cost account level, the other to the level of the CWBS at which reporting to NASA/GSFC is required. The use of these two sets of thresholds reflects the recognition by GSFC of a principle of contract cost management which warrants specific mention, namely, that the level at which resources status/plans/problems are reported to a customer should not be at the same level; i.e., at as low a level as the level normally addressed to maintain internal control of the contractual effort. Violation of this principle often results in disruption of the contractor's normal management process and excessive, non-constructive exchanges between NASA and contractor personnel. Figure 4-F.29 illustrates several characteristics of the thresholds typically used for variance reporting, viz, (1) a combination of dollar and percentage amounts, as well as a minimum dollar amount, apply to the cost and schedule variances, and these amounts are not necessarily the same for the current period vis-a-vis the period from start to current date; (2) a separate threshold for variance at completion is specified; and (3) the thresholds for favorable (positive) and unfavorable (negative) variances often differ. Other elements, such as time period, are also used to define variance thresholds. Figure 4-F.30 contains a summary of GSFC's guidelines for contractor preparation of narrative reports on cost or schedule variances.

Figure 4-F.31 shows the status of management reserve and the cost variance (derived from an Earned Value Assessment) on the same time scale. Notice that the negative cost variance decreased; this occurs when the earned value for a period exceeds the actual cost. Re-baselining, with the application of management reserve, also has the effect of decreasing a negative cost variance. Also notice that management reserve can increase; e.g., when the work in a subarea is completed with less cost than the budgeted amount.

Figures 4-F.32 and 4-F.33 show two reports which have been prepared by GSFC personnel for use in Project and Directorate level reviews.

Figure 4-F.34 shows the format for a summary level report reflecting the Contractor's and NASA's EAC for a contract effort, compared with the contract value. Note that this report includes data regarding cost offsets, cost concerns, and management reserve.

It is likely that the format of one or more of the reports to be prepared periodically by the Analyst will change during the life of a project. However, the Analyst should make an effort to maintain as much standardization as possible as this gives continuity to the reports and usually results in better historical records.

NAS1-XXXXX COST STATUS SUMMARY

PERIOD ENDING (END OF CONTRACTOR'S ACCOUNTING MONTH)

(ALL $ AMOUNTS ARE EXPRESSED IN 000'S AND REFLECT TOTAL COST)

	CONTRACTOR 533 REPORT		NASA ASSESSMENT	
ACTUAL COSTS TO DATE	$XXXX			
REMAINING CONTRACT BASELINE WITHIN CONTRACT VALUE	XXXX			
CONTRACT VALUE	$XXXX	$XXXX	$XXXX	$XXXX
CURRENT MANAGEMENT RESERVE	(XXXX)		(XXXX)	
CURRENT CONTRACTOR PLAN, WITHOUT USE OF CURRENT MANAGEMENT RESERVE		$XXXX		$XXXX[1]
CURRENT COST CONCERNS/OFFSETS [2]				
COST CONCERNS				
IDENTIFYING NO. AND/OR DESCRIP.	($XX)		($XX)	
IDENTIFYING NO. AND/OR DESCRIP.	(XX)		(XX)	
IDENTIFYING NO. AND/OR DESCRIP.			(XX)	
TOTAL COST CONCERNS	($XXX)		($XXX)	
COST OFFSETS				
IDENTIFYING NO. AND/OR DESCRIP.	$XX		$XX	
TOTAL COST OFFSETS	XX		XX	
NET AMOUNT		($XX)		($XX)
ESTIMATE AT COMPLETION		$XXXX		$XXXX
UNENCUMBERED MANAGEMENT RESERVE OR (POTENTIAL CONTRACT OVERRUN)		$XX		($XX)

NOTES:

1. SAME AMOUNT AS REPORTED BY CONTRACTOR.
2. GENERALLY LIMITED TO ITEMS ≥ $50K.

Figure 4-F.34

V. ADMINISTRATIVE FUNCTIONS

A. Purchase Requests (PR's)

The proper title of the document commonly referred to as a "PR" is Purchase Request/Purchase Order (NASA LaRC Form 125, Revised 2/82 Change No. 4). This form is used for procuring goods and services from commercial sources. It is also necessary for certain types of special transactions, including the suballotment of funds to other NASA Centers. Instructions for preparing and processing the PR form are contained in LHB 5000.2, "Basic Guide for Acquisition." Questions regarding the proper use of this form should be addressed to FACS, FMD.

As a general rule the Analyst reviews each PR which goes into the system that involves funds of the project he or she is supporting. The purpose of this review is two-fold. First, to insure that the Program Code and JO shown on the form are correct. This is important to avoid subsequent delay in processing and also to make sure that the financial transactions against the PR are entered into the system under the proper code in accordance with the numbering system the project is using to plan/control/record its financial transactions. Second, the Analyst confirms that the PR applies to goods or services which are reflected in the Project's Baseline Plan. If this is not the case the Analyst should discuss the matter with the Project Manager. In most cases Analysts have found it desirable to establish some type of control in the system to prevent PR's from being processed without his or her review and the approval of the Project Manager. Figure 5-A.1 contains an example of a 2-Way Memo which was prepared for this purpose.

The above-cited LHB addresses the subject of walkthrough PR's. As stated therein, the use of this procedure should be restricted to those cases in which such attention is absolutely necessary. The Analyst should work out guidelines on this subject with the Project Manager so as to control the use of this process and also to establish an understanding as to the role of the Analyst and other project personnel when PR's are to be walked through.

B. Job Orders (JO's)

JO's are the lowest level of accounting in the LaRC system. In an accounting sense they are detailed cost accounts within the lowest level of the Agency-Wide Coding Structure (AWCS). JO'S can be used to segregate financial data below the RTR level; i.e., the nine-digit level of the AWCS. Some of the standard LaRC financial (RMS) reports are structured by JO. In addition, special reports can be generated using the JO-oriented data in the RMS system.

UNITED STATES GOVERNMENT

2-Way Memo

INSTRUCTIONS

Use routing symbols whenever possible.

SENDER (*Originator of message*):
Use brief, informal language.
Conserve space.
Forward original and one copy.

RECEIVER (*Replier to message*):
Reply below the message, keep one copy, return one copy.

Subject: Authorized Signature on Project XYZ-Funded Purchase Requests

To : 380/Property Management Branch, MSD

DATE OF MESSAGE	ROUTING SYMBOL
6/23/83	158

SIGNATURE OF ORIGINATOR

TITLE OF ORIGINATOR
Program Analyst

FOLD FOLD

MESSAGE

It is requested that Purchase Requests under the Project XYZ Program Code 534-01-13 not be processed without the signature of (Name of Analyst), Program Analyst for the XYZ project.

The only exception is RTR 534-01-13-38 for ABC which is under our RTOP but is not considered part of the XYZ Program and therefore does not require my signature. PR's over $10K which cite ABC funds should be sent to (Name of Cognizant PRD Analyst) MS 104, for approval. ABC funds are controlled by the Structures Directorate rather than the Projects Directorate.

Please send only those Purchase Requests which cite XYZ funds and do not have my authorized signature to (Name of Analyst), MS 158. Head, PSB will be my alternate when I am not available.

If you have any questions, please call me.
(Name of Analyst), ext. 1234

cc: 104/PRD Analyst
124/Head, PSB
135/FACS, FMD
158/XYZ Staff

REPLY

From :

DATE OF REPLY	ROUTING SYMBOL

SIGNATURE OF REPLIER

TITLE OF REPLIER

1. RETAINED BY ADDRESSEE

OPTIONAL FORM 27 (Rev. 7-81)
GSA FPMR (41 CFR) 101-11.6
NSN 7540-00-082-2447

Figure 5-A.1

LMI 9100.1 contains instructions for the use of JO's. Questions or problems should be addressed to FACS, FMD.

C. Special Accounts

At the present time two special accounts are being used at LaRC which affect the Analyst, one is for ACD computer usage and the other is for fab work. These accounts are administered by SPAS of ACD and RCO of FD, respectively. Questions regarding requirements and procedures relative to these two accounts should be addressed to the appropriate organization.

Once each year budgets are established for both the computer and fab accounts by RTR. The Analyst normally provides the input for these budget baselines in response to informal "Calls" from the above organizations. The Analyst should provide accurate input for both computer usage and fab as these data are used for Center-wide planning.

In the case of fab work, the need for accurate accounting is especially important as this work is charged directly to the RTR which has been used to identify the work and work cannot be performed unless a budget exists under that RTR. The dollar charge for fab work is the same irrespective of whether the work is performed "in house" by civil service personnel or "out-of-house" on contract. The hourly rate, which is currently $14.00, is subject to change. During the year the Analyst should monitor fab activity against the RTR budgets to ensure that the charges are consistent with the project's plan and to see that appropriate budget balances are maintained. If necessary, additional amounts should be added to the original budgets in a timely manner to prevent unnecessary work and/or delays.

The Analyst should comply with any instructions or guidelines issued by PRD regarding the computer or fab accounts.

D. Record Keeping

The Analyst is responsible for seeing that a record of the Project's financial transactions, status, and periodic and special reports is maintained and readily accessible. This is not meant to imply that the Analyst must maintain duplicate records of documents elsewhere in the official Project or LaRC system; e.g., LaRC RMS reports.

The Analyst normally finds it necessary to maintain personally certain files in order to have immediate access. These "working files" typically include: (1) a delineation of the project WBS, indicating the names of responsible individuals; (2) PR's; (3) JO's; (4) RTOP's and RTR's; (5) POP's; (6) COP's; (7) Special Accounts; (8) Contractor Financial Management Reports; (9) Recurrent Project Resources Status Reports prepared by the Analyst; (10) MICS reports;

(10) MICS reports; (11) Recurrent reports prepared for the LaRC Director; and (12) Special Reports; e.g., Joint Assessments of Contractor Performance or Cost Concern/Cost Offset Reports.

One area of record keeping that is often overlooked is the overall project financial history. Understandably, a Project's emphasis is typically placed on dealing with immediate or short-term financial problems, and, consequently, the overall changes in plan are often not well documented. The key documents for maintaining a good historical record are: RTOP's, POP's, MICS reports, and the Analyst's Project Resources Status Reports. The Analyst's narrative comments and/or tabular data addressing changes in RTOP's or POP's versus previous submittals and recurrent reports showing the status of Management Reserve and Cost Concern/Cost Offsets are especially valuable for historical purposes. Reports showing contract cost status, such as the report in Figure 4-F.34, are also very good for maintaining a cost history.

In summary, the Analyst should make sure that he or she has ready access to the necessary documents, reports, and data to meet any and all requirements in a timely manner. In some cases this requires the preparation of special reports by the Analyst. Reports containing the project's cost history should be prepared and placed in the official project files.

VI. REPORTING FUNCTIONS

A. Program Operating Plan (POP)

The POP is a financial planning document required by NASA Headquarters comprised of time-phased estimates of the obligations and costs on a certain subprogram or RTOP. The POP provides NASA Headquarters important data for several purposes including: (1) a budget performance baseline for monitoring progress during the year, (2) data for consideration of possible reprogramming; i.e., the redistribution of funds among the subprograms and RTOP's, and (3) the timing of the funds authorization. The specific requirements of a given POP vary in accordance with the cognizant Headquarters office which requires the submittal. As a general rule, detail by month is required for the next several months as well as detail by quarter for the ensuing periods. OAST does not normally require data for the out-years; i.e., beyond the next fiscal year, whereas OSSA requires data for all remaining years of a project. Normally, POP's are required twice each fiscal year.

The cognizant NASA Headquarters office issues a POP Call to each Center specifying what information must be submitted and the format of the report. It also contains the funding guidelines, by AWCS, for each effort considered to be part of the "official" programs; i.e., those having the support of Headquarters. The R&D Branch of PRD issues an LaRC Call providing detailed instructions for preparation of the POP as well as a schedule for submittals and reviews.

The Analyst should prepare for the POP prior to receipt of the Call. Data should be prepared at an appropriate level, time-phased in a manner which will meet the POP requirements. Data should be prepared at the RTR or a lower level of detail. Management Reserve, major contracts, and suballotments should be shown as separate line items. In some cases Job Orders (JO's) can be used to segregate data; e.g., the planned and actual data for a certain hardware subsystem could be identified by a discrete JO. Data should also be segregated by funding categories; e.g., Net R&D and Program Support. Analysts have sometimes found it necessary to segregate data regarding special accounts, such as Fab.

The Center-wide preparation, review, and submittal of POP's are the responsibility of the R&D Branch of PRD. Typically, the Lead Analyst in that branch for the cognizant Headquarters office requesting a POP acts as the coordinator of these efforts. The preparation and directorate level reviews of the POP's for the various LaRC directorates are coordinated by the branch analyst permanently assigned to support the directorate. In the case of the Projects Directorate this function is performed by the Head, Project Support Branch, PRD.

The Analyst should also prepare a summary report, if necessary, to identify any of the following: (1) significant changes made in the POP versus the previous POP, (2) unusual trends or conditions, and (3) potential resources problems. The Analyst should present the completed POP as well as any appropriate narrative and/or verbal comments to the Project Manager and be present at the Directorate level review to participate, as required.

The Analyst should discuss with the Head, PSB, any problems he or she has regarding the preparation of the POP, to include schedule problems for completion, as well as the content and format of the POP.

B. Commitment and Obligation Plan (COP)

The COP is an LaRC internal document, used to help plan and effect the timely commitment and obligation of funding authority. The R&D Branch of PRD issues a Call for COP preparation in the Fall of each year after most programs have been established for the fiscal year; i.e., Headquarters has determined the RTOP's which will be implemented and the amount of funds to be provided.

The COP contains special instructions as to the data required, which includes the identification of all significant procurement actions and the schedules for these actions. The Analyst must work with the cognizant technical leads, and in some cases with the appropriate Contract Specialists as well, in order to obtain the necessary information. Since these data will be used by the R&D Branch of PRD for at least several months to monitor actual performance versus plan, it is important for the Analyst to do as thorough a job as possible on the COP.

Responsibilities for coordination of COP preparation and reviews are similar to those identified above for the POP.

C. RTOP's and RTR's

An RTOP documents the work to be performed during a specific year and the new funding authority to be provided to support that work. It is the document evidencing agreement between the cognizant Headquarters Program Office and the Director of the Center which is responsible for work reflected in the RTOP.

Instructions and guidelines for the preparation and review of RTOP's are contained in NMI 7100.12, "Standard RTOP Management System", and LHB 7100.1, "Research and Development Program Management Procedures." The latter document also contains material relating to RTR's. An RTR typically reflects an agreement between a Center Program Director and a line

organization (usually a Division) to perform the task defined by the RTR, and is not submitted to NASA Headquarters. In the case of a major R&D project, RTR's often reflect agreements between a Center Program Director and a Project Manager for one or more of the subareas of a project rather than representing the work of a particular division or branch.

RTR's should be coordinated with the Division Chiefs and Program Directors of performing organizations when they reflect a significant amount of work by "their" people. The Project Manager should review all RTR's comprising the RTOP for a project prior to review by the Program Director.

The cognizant NASA Headquarters Program Office issues an RTOP Call about March of each year with a due date in July. PRD issues a Call containing instructions and a schedule for the preparation and reviews of RTOP's. Normally RTR's are reviewed by the cognizant Program Director but not by the Center Director. Responsibilities for coordination are similar to those identified above for POP's.

D. Project Resources Status Report

Applicability

As a general rule, Resources Status Reports (hereafter referred to as RSR's) should be prepared on all approved projects supported by a PSB analyst. However, there is no one criterion for determining when such reporting should commence. In the early phase of a project, when the occurrence of decisions or events/activities with significant resources implications are infrequent, it is inappropriate to prepare an RSR on a monthly basis. As a general rule, if a PSB analyst is assigned responsibility for providing resources support to a project on a continuing basis an RSR should be prepared at least once every three months. The Project Manager, or Deputy Manager for Management (if applicable), should make the final decision as to when the preparation of RSR's on a monthly basis should commence. Thereafter, in the event that very little of significance has happened during a given month a very short report should be prepared containing at least a Summary section and Attachment(s) as discussed herein under Contents. Two examples of RSR's are contained in Figures 6-D.1 and 6-D.2.

Timing

RSR's should be prepared and distributed prior to monthly management reviews if at all possible. This timing permits consideration of the report contents in the preparations for such reviews. Preparation of the RSR should be scheduled so as to minimize work schedule conflicts with preparations of MICS reports and Contract Assessments.

National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia
23665

NASA

Reply to Attn of 158(79-921)

September 19, 1979

TO: 158/Manager, Project C

FROM: 158/Program Analyst, Project Support Branch, PRD

SUBJECT: Project C Resources Status Report, August 1979

This report is based on data in the LaRC Resources Management System (RMS) as of the end of the August 1979 accounting period. The planned and actual obligations and costs for August and the cumulative planned and actual obligations and costs through August are shown in Enclosure 1. All plan figures represent POP 79-2.

PY 79 506W Authority

NASA Headquarters has approved the reprogramming of $472K of PY 79 Net R&D funds from RTOP 514-55-03 (Project L) to RTOP 734-01-13 (Project C), reference warrant ser. #181/79 dated 9/13/79. It is understood that this amount will be repaid in FY 80 with PY 80 506W Authority. As a result of this action the PY 79 NOA Net R&D for RTOP 734-01-13 is now $13,996K.

Obligations

Two major contracts were incrementally funded as planned during August as follows:

NAS1-XXXXX Contract Effort A - $400K
NAS1-XXXXX Contract Effort B - $700K

Unobligated NOA now stands at $2.3M. This available funding will be obligated in September on Project C contracts in a manner which will cover estimated costs for approximately the same period of time into FY 80 for each contract.

Costs

As shown in Enclosure 1, costs were under the POP 79-2 estimate in August by approximately $800K with a cumulative variance of nearly $1.3M underplan. As a result of this variance, it is now estimated that PY 79 funds will cover costs through the first three months of FY 80 as compared to the two months estimated at the time POP 79-2 was established. Costs continue to be significantly under plan on Contracts B1 and B2 because of the prevailing strike at Contractor B's Plant X. Costs on Contract R1 are under plan because of limited activity pending investigation of the engineering model test failure in July 1979.

Name of Analyst
ext.
Enclosure

PROJECT C (734-01-13) AUGUST 1979 ACTUAL vs. PLAN (POP 79-2)

9-17-79

(DOLLARS IN THOUSANDS)

RTR	J.O.	PA	OBLIGATIONS						COSTS					
			PLAN	ACTUAL	DELTA	CUMPLN	CUMACT	CUMDEL	PLAN	ACTUAL	DELTA	CUMPLN	CUMACT	CUMDEL
734011301 PROG MANG														
MISC EXP	R5670	NOTE 1	0	1	-1	128	128	0	1	1	0	128	126	2
SPPT SERV	R6171	**	0	-2	2	45	43	2	8	5	3	38	45	-7
DURA STUDY	R7001	**	0	0	0	365	365	0	0	0	0	0	0	0
--SUBTOTAL		**	0	-1	1	538	536	2	9	6	3	166	172	-6
734011310 SEC STRUCT														
NAS1-	R5629	**	0	0	0	7907	7907	0	53	0	53	7314	7769	45
NAS1-	R5630	**	0	0	0	312	312	0	0	0	0	312	312	0
NAS1-	R5631	**	400	400	0	3500	3500	0	241	169	72	2884	2753	131
NAS1-	R5966	**	0	0	0	1480	1480	0	10	4	6	1471	1477	-6
--SUBTOTAL		**	400	400	0	13199	13199	0	304	173	131	12481	12312	169
734011320 MED SZ STR														
NAS1-	R5632	**	0	0	0	10700	10700	0	493	234	259	10508	10099	409
NAS1-	R5633	**	700	700	0	8965	8965	0	763	548	215	8590	8215	375
NAS1-	R5635	NOTE 2	0	0	0	14255	14255	0	507	320	187	13351	13030	321
--SUBTOTAL		**	700	700	0	33920	33920	0	1763	1102	661	32449	31344	1105
7340113 RTOP														
--SUBTOTAL		**	1100	1099	1	47657	47655	2	2076	1281	795	45096	43827	1269
--SUBTOTAL	RESERVE	**	0	0	0	0	0	0	0	0	0	0	0	0
--SUBTOTAL	IMS	**	10	7	3	255	249	6	10	7	3	255	249	6
RTOP GRANDTOTAL		**	1110	1105	5	47912	47904	8	2086	1288	798	45351	44076	1275

NOTES: 1–INCLUDES $96K FOR CONTRACTOR G SUPPORT SERVICES CONTRACT NAS1-XXXXX THRU FY 78
2–DOES NOT INCLUDE $1446K PY75 NOA UNDER 510-52-01

Enclosure 1

National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia
23665

NASA

Reply to Attn of 158(79-1184) November 14, 1979

TO: 158/Manager, Project C

FROM: 158/Program Analyst, Project Support Branch, PRD

SUBJECT: Project C Resources Status Report, October, 1979

Effective October 1, 1979 (start of FY 80), the RTOP code for Project C has been changed from 734-01-13 to 534-03-13. Beginning with this report and in subsequent monthly reports, Enclosure 1 reflects planned and actual obligations and costs with those codes combined so that the resources status will continue to reflect the total C Project.

Program Operating Plan (POP) 79-3 for Project C was completed and submitted to the R&D Branch, Programs and Resources Division (PRD) on October 26, 1979. Details of the POP are included below in this report.

506W Authority/Obligations

The R&D Branch of PRD has informed us that LaRC has received $5.5M of Net R&D FY 80 506W Authority at the 534-03 level. However, because of the funding constraints placed on LaRC by the continuing resolution clause, incremental funding of Project C contracts must be held to lower than planned amounts. The Contracting Officer has decided to fund the Project C contracts to cover the expected costs through November, 1979, plus $500K to cover potential termination liability for each of the active contracts. These increments, which total $1.05M, will be reflected in the November status of the Resources Management System (RMS). The amounts of the next incremental fundings will depend upon the federal funding situation.

Costs

Since POP 79-3 was referenced to the October actuals, the cost variance in October was zero with two exceptions (shown in Enclosure 1) as follows:

> NAS1-XXXXX, Contract R1, was erroneously charged $3K of costs by the Financial Management Division. This will be corrected in the next accounting period.
>
> There were no IMS charges shown in the October report because of a difference between the cutoff dates for IMS and the month-end report period for October. These charges will be accrued along with November charges.

Figure 6-D.2

POP 79-3

The Project C POP 79-3 shows a funding requirement which is $2M over the revised Net R&D guideline of $10.928M. A funding level of $12.928M would cover estimated costs of the Project C contracts through the first four months of FY 81 and, in addition, provide a $500K reserve.

The POP 79-3 reflects realistic anticipated obligations and costs for the Project C contracts. The plan includes-

- NAS1-XXXXX, Contract R1 - An additional $73K of PY 80 funds over the current contract value which is the Project Office's current assessment of the contract EAC.

- NAS1-XXXXX, Contract R2 - An additional $39K of PY 80 funds over the current contract value to cover an overrun of that amount (ref. PR #8600.2034).

- NAS1-XXXXX, Contract S1 - Reflects the contractor's current operating plan which became effective September, 1979. The EAC equals the contract value.

- NAS1-XXXXX, Contract S2 - Reflects the contractor's current operating plan which became effective October, 1979. The EAC equals the contract value including contract modification #21 which added high strain durability test specimens.

- NAS1-XXXXX, Contract T1 - The contractor's budget and EAC which was the outcome of the negotiation of a Contractor T cost overrun proposal (contract modification #11). The near term monthly budget appears to be adequate; however, the EAC could prove to be low based on the outcome of future project office performance assessments.

- NAS1-XXXXX, Contract T2 - An FY 80 monthly budget which was estimated prior to the availability of the revised Contractor T baseline of 10/29/79. Although the POP 79-3 cost estimate for FY 80 exceeds the revised baseline for that period by approximately $700K, it is not an unrealistic estimate. The POP EAC is equal to the revised baseline EAC which exceeds the government's share of the contract value by $3,463K. Negotiations of this cost overrun will be conducted after Contractor T submits an overrun proposal.

Name of Analyst
ext.

Enclosure

PROJECT C

COMPONENTS (734-01-13, 534-03-13) OCTOBER, 1979 ACTUAL vs. PLAN (POP 79-3)

(DOLLARS IN THOUSANDS)

RTR	JO	OCT PLAN	OCT ACTUAL	VARIANCE	CUM PLAN	CUM ACTUAL	VARIANCE	OCT PLAN	OCT ACTUAL	VARIANCE	CUM PLAN	CUM ACTUAL	VARIANCE
534-03-13-01 Program Mgt.													
Misc Exp.	R5670	0	0	0	128	128	0	0	0	0	127	127	0
Sppt. Serv.	R6171	0	0	0	43	43	0	0	0	0	43	43	0
Dura. Stdy.	R7001	0	0	0	365	365	0	0	0	0	0	0	0
Subtotal		0	0	0	536	536	0	0	0	0	170	170	0
534-03-13-10 Secondary Structures													
NAS1-XXXXX	R5629	0	0	0	7909	7909	0	53	53	0	7822	7822	0
NAS1-XXXXX	R5630	0	0	0	312	212	0	0	0	0	312	312	0
NAS1-XXXXX	R5631	0	0	0	3500	3500	0	205	205	0	3067	3067	0
NAS1-XXXXX	R5966	0	0	0	1480	1480	0	0	3	(3)	1477	1480	(3)
Subtotal		0	0	0	13199	13199	0	258	261	(3)	12678	12681	(3)
534-03-13-20 Med. Size Prim. Struct.													
NAS1-XXXXX	R5632	0	0	0	11700	11700	0	474	474	0	10828	10828	0
NAS1-XXXXX	R5633	0	0	0	9965	9965	0	446	446	0	9259	9259	0
NAS1-XXXXX	R5635	0	0	0	14555	14555	0	619	619	0	13917	13917	0
Subtotal		0	0	0	36220	36220	0	1539	1539	0	34004	34004	0
FS-4 Subtotal		0	0	0	49956	49956	0	1797	1800	(3)	46852	46855	(3)
IMS Subtotal		7	0	0	264	257	7	7	0	7	264	257	7
RTOP Grand Total		7	0	7	50220	50213	7	1804	1800	4	47116	47112	4

Content

As a general rule an RSR should contain, as a minimum, information regarding Funding Authority, Obligations, and Costs. Information regarding Commitments should be included if deemed significant. Comments should be included regarding significant variances, problems, plans, and outlook as well as any significant events/activities relative to resources which have occurred or are either on-going or planned. Examples are status of POP's or RTOP's, special reviews with Headquarters personnel, replans of major contractual efforts, and status/plans relative to the funding authority for a particular year(s).

Regarding Funding Authority, it is important to include the amount requested and/or approved, the amount received, any problems or plans, or actions since the previous report. Regarding Obligations, Costs and Commitments (optional), the following data should be included: (1) amounts incurred during the past month and cumulative from inception, (2) amounts planned for corresponding periods, and (3) the differences between these data; i.e., Actual vs. Plan. Each major variance should be discussed as to cause, plans, and forecast. If the situation is so uncertain that it precludes a meaningful forecast as to the outcome/consequences with respect to resources this should be indicated.

Format

As a minimum, an RSR should contain a Summary section plus at least one enclosure which reflects the data specified above under Content.

The Summary should be no more than one-half page and should be the first major "section" of the report. However, this should not preclude appropriate introductory comments. Minor items should not be discussed in the Summary. For example, if obligations and costs are proceeding close to plan a statement to that effect, identifying the specific plan; e.g., POP 83-2, is sufficient.

The enclosure(s) should reflect actual data traceable to the LaRC RMS. As a general rule amounts should not be shown as actuals unless the LaRC RMS EOM report includes the same. The only exception to this rule which applies across-the-board is the rare case where amounts shown in the RMS are in error. In this case the correct amounts, with a descriptive footnote, should be shown. Plan data should always be identified; e.g., POP 83-2.

Enclosures containing data other than what has been identified above should also be included if use thereof adds value to the report. As a general rule, all enclosures should be referenced at least once in the body of the RSR.

Other than for the above-cited requirements, the format of the RSR is optional and should be determined by the Analyst. The best format is the one which is most useful to the Analyst for the purpose of providing the Project Manager with a meaningful, understandable report.

Distribution

The RSR should be addressed to the Project Manager. Distribution of copies to other project management or staff personnel should be coordinated with the Project Manager or Deputy Manager for Management. Copies should also be sent to the Head, PSB. As a general rule distribution of the RSR should be limited and controlled. The Project Manager should control the distribution list. Relatively wide distribution often results in a more comprehensive report than was intended in order to satisfy all readers.

E. Management Reports

It may be assumed that on all major projects, Center management and NASA Headquarters will require some form of resources reporting on a periodic basis. Typically monthly reports are required by both levels of management.

1. MICS Reports

It is standard procedure for NASA Headquarters to require monthly submittal of resources reports on major R&D projects in accordance with the NASA OAST/OART Project Management Information and Control System (MICS), NHB 2340.2. This requirement is usually specified in the Project Approval Document (PAD). It is also specified in the project RTOP. Typically the monthly MICS report includes the following resources reports: (1) a project level Financial Status report, (2) a project level Manpower Status report, and (3) Contract Financial and Manpower reports for each major, active contract. Examples and instructions for the completion of these reports are contained in Figures 6-E.1-4. The formats and instructions for the two project level reports differ somewhat from those in the NASA Handbook. However, the formats and instructions for these reports in Figures 6-E.1 and 6-E.2 have proved to be more useful than those in the Handbook and have been acceptable to NASA Headquarters.

LANGLEY RESEARCH CENTER

RESPONSIBILITY

APPROVAL 1 JANET S. POWELL

ACCOMPLISHMENT 2 BENJAMIN T. RHODES

FINANCIAL STATUS

3 MODULAR THERMOMETER DIAGNOSTER (MTD)

RTOP 999-53-03 4

5 (2 COPIES)

APPROVED PLAN 7-78 (POP 78-21)

7 ACTUAL OBLIG. & COST AS OF JAN 31, 1979

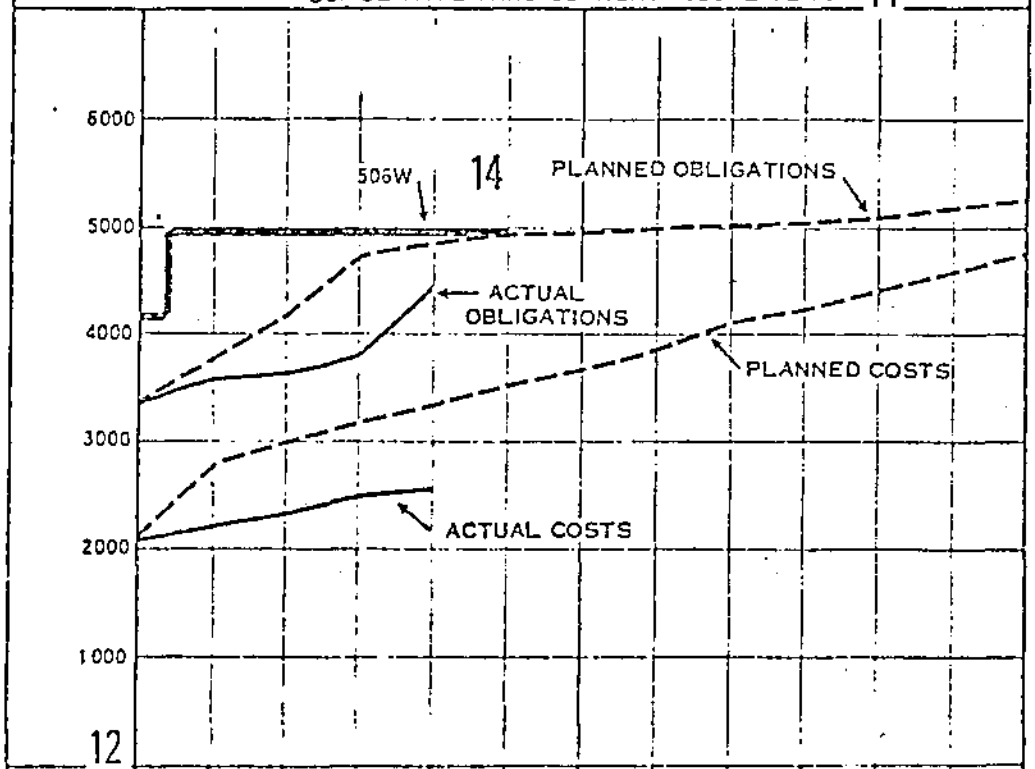
STATUS AS OF MAR 1, 1979

8

TOTAL R AND D DOLLARS 9

DOLLARS IN THOUSANDS 10

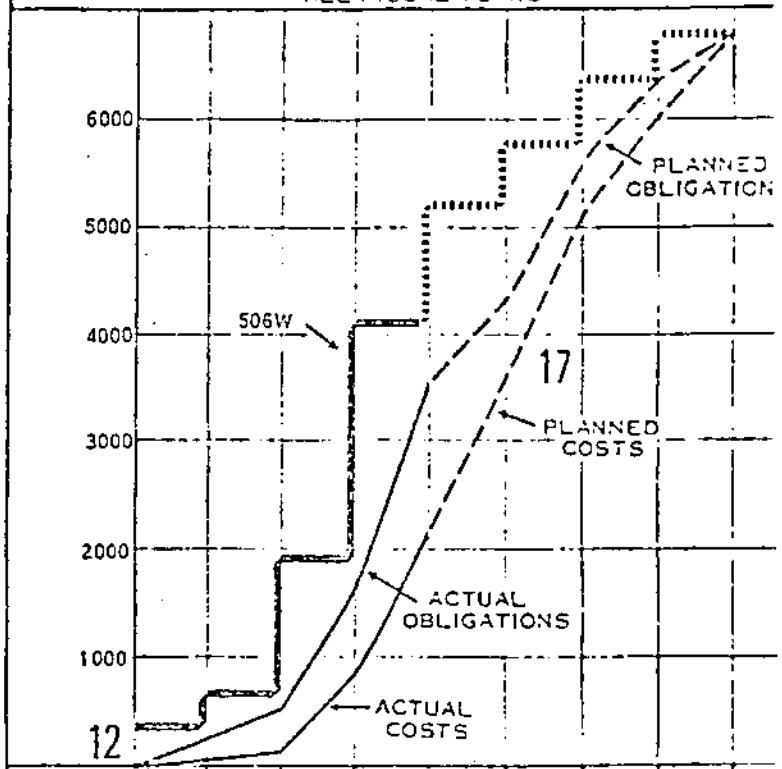
CUMULATIVE THRU CURRENT FISCAL YEAR 11



12

MONTHS		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
13	506W AUTHORITY	5000											
13	OBLIG PLAN	3813	4174	4762	4899	4967	4999	5025	5050	5080	5130	5200	5250
	OBLIG ACTUAL	3617	3653	3843	4474								
13	COSTS PLAN	2827	2997	3177	3357	3537	3717	3900	4100	4217	4417	4600	4761
	COSTS ACTUAL	2217	2320	2495	2597								

ALL FISCAL YEARS



12

FY		76 & PRIOR	76T	77	78	79	80	81	82	TOT
15	506W AUTHORITY	400	300	1250	2200	1100	550	600	425	6
	OBLIG PLAN					798	1300	766	425	6
16	OBLIG ACTUAL	282	233	1107	1914					
	COSTS PLAN					1465	1512	913	794	6
16	COSTS ACTUAL	40	63	759	1379					

NOTES

LEGEND

ACTUALS

APPROVED PLAN

CURRENT ESTIMA

18

Figure 6-E.1

INSTRUCTIONS FOR PREPARATION OF

PROJECT LEVEL FINANCIAL STATUS CHART FOR MICS

1. State the name of the cognizant Center Program Director who will sign the cover sheet for the complete MICS report.

2. The Project Manager should sign each report.

3. State the full project name; and also, in parentheses, the acronym (if applicable).

4. State the seven digit RTOP number.

5. Indicate Level 2.

6. State the month and year of the latest official plan, and indicate in parentheses the control document containing this plan. The plan must have received approval of the LaRC Director. In the event it reflects overguidelines 506W Authority, this fact plus an appropriate note identifying the overguideline amount(s) must be stated in the notes section.

7. State the last day of the calendar month for which obligation and cost data has been incorporated into this chart.

8. State the date of the project level review, i.e., the review by the person with approval responsibility.

9. Include IMS as well as Net R&D dollars.

10. Indicate the dollar units of the numbers shown on the chart. As a general rule, dollars should be shown in even thousands (e.g., $32,600 as 33).

11. State the current fiscal year, i.e., the year for which cumulative from inception data is shown in the left-hand histogram, in the parentheses.

12. A zero-suppressed scale should be used if necessary to show clearly the range of data plotted in the left-hand and/or the right-hand histogram.

13. 506W authority, obligation and cost data shown below, and plotted in the left-hand histogram are to reflect inception-to-date cumulative amounts for all program year (PY) funds. The actual obligations reported should in all cases agree with the data in the LaRC Resources Management System (RMS). If these data are not correct, an explanatory note should be included. As a general rule, the actual costs reported should agree with the data in the LaRC RMS; however, this is not mandatory. If actual costs reported do not agree with the RMS, an explanatory note should be included. If POP-1 format is used in item 6 above, obligation and cost plan are "X"-ed in through the date that "actuals" were used as a start point for POP preparation. If POP-2 format is used in item 6 above, obligation and cost plan are "X"-ed through the date (usually June) that "actuals" were used as a start point for POP preparation. At the

commencement of a new fiscal year, using POP-2 format, a complete plan for obligations and costs will be shown.

14. As a general rule, a plan for receipt of 506W should not be shown. In exceptional cases where it is appropriate to show a plan, e.g., when an agreement exists between a project and Headquarters as to the phasing of 506W authority, an explanatory footnote should be included.

    In the first report reflecting 506W authority not previously included in the amount shown, the new increment should be stated in the notes section. Changes (increases or decreases) should be plotted so as to reflect the approximate date on which the authority was received, rather than using the end of the month in which the authority was received.

15. 506W authority shown below, and plotted in the right-hand histogram are the amounts by fiscal year either: (1) received during prior years or (2) planned for the current or future fiscal years per the approved project plan. The 506W data below the histogram are incremental for the fiscal year(s) indicated. The amounts shown by fiscal year are the amounts received or planned irrespective of the program year of the 506W authority. If amounts shown reflect a plan which supersedes the original project plan, an explanatory note is required.

16. Obligations and cost data shown below the right-hand histogram are to reflect amounts incurred (i.e., actual) or planned for each fiscal year, irrespective of the PY authority involved.

17. Three sets of data for all years of activity are required in the right-hand histogram, 506W authority, obligations and costs. All of the actual and plan data shown below the histogram should be plotted on a cumulative-from-inception basis.

18. As a general rule, current estimate data should not be shown on either the left-hand or right-hand histogram and in no event should current estimate data be used in lieu of plan data (as herein defined). In exceptional cases where current estimate of 506W authority and/or obligations is essential for accurate portrayal of the financial status, such data should be plotted on the left-hand and/or the right-hand histograms and an explanatory note should be included.

LANGLEY RESEARCH CENTER

RESPONSIBLE: 1

APPROVED: JANET S. FORREST

ACCOMPLISHMENT: BENJAMIN T. BROOKS 2

MANPOWER STATUS

4 MODULAR THERMOMETER DIAGNOSTER (MTD) 3

RTOP 767-53-03

5 (2 LEVEL)

APPROVED PLAN: 5/83 POP 83-1 6

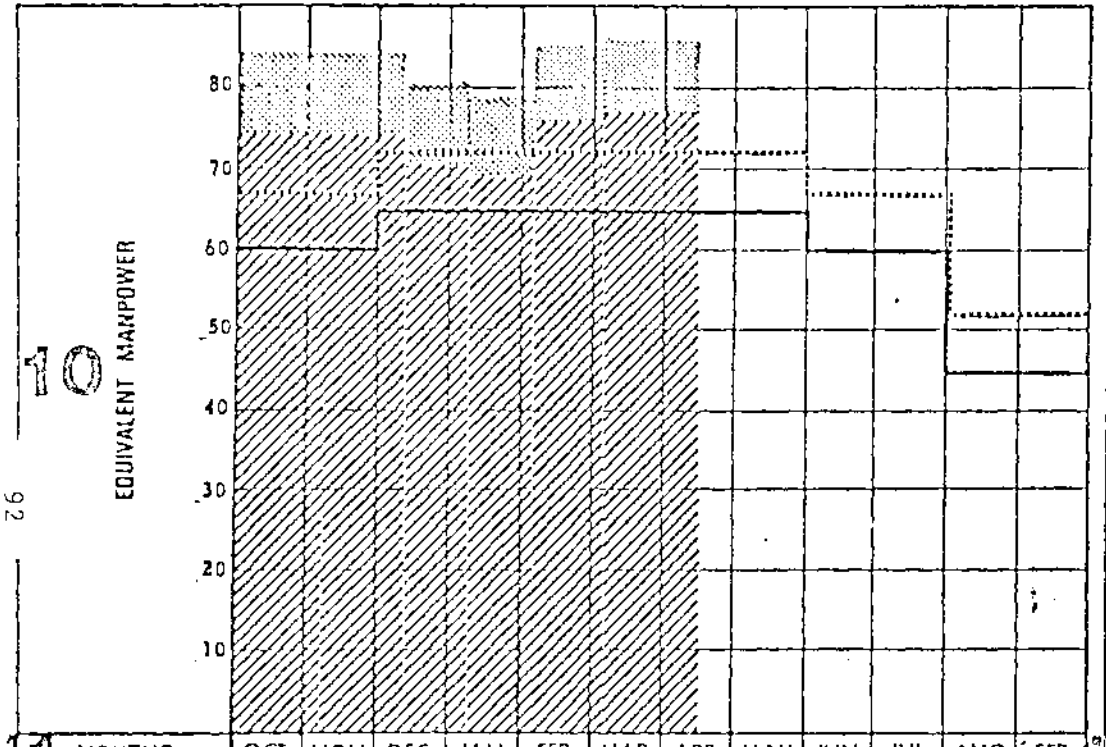
ACTUALS THRU (DATE): 7 APRIL 16, 1983

PERIOD ENDING (DATE): STATUS AS OF: MAY 25, 1983 8

CURRENT FISCAL YEAR (83) 9

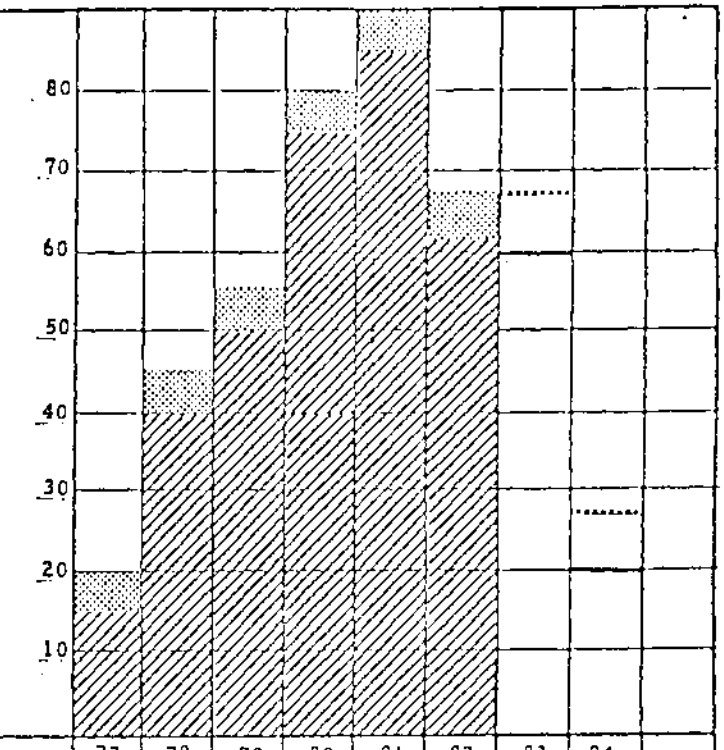
ALL FISCAL YEARS

10 EQUIVALENT MANPOWER



MONTHS		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
IN-HOUSE	PLANNED	60	60	65	65	65	65	65	65	60	60	45	45
	ACTUAL	74.2		70.3	68.9	75.1	76.2						
SUPPORT SERVICES	PLANNED	7	7	7	7	7	7	7	7	7	7	7	7
	ACTUAL	10		10	10	10	10						

EQUIVALENT MANPOWER



FY		77	78	79	80	81	82	83	84
IN-HOUSE	PLANNED							60	10
	ACTUAL	15	40	50	75	85			
SUPPORT SERVICES	PLANNED							7	0
	ACTUAL	5	5	5	5	5	5		

LEGEND:

- PLANNED SUPPORT SERVICE
- ACTUAL SUPPORT SERVICE
- PLANNED IN-HOUSE
- ACTUAL IN-HOUSE

NOTES:

Figure 6-E.2

INSTRUCTIONS FOR PREPARATION OF PROJECT

LEVEL MANPOWER STATUS CHART FOR MICS REPORTING

1. State the name of the cognizant Center Program Director or designee on the line.

2. The Project Manager's signature should be shown each time the report is prepared. The Project Manager's name should be shown below the line.

3. State the full Project name; and also, in parentheses, the acronym (if applicable).

4. State the seven digit RTOP number(s) for the project, both for current and previous years.

5. Indicate Level 2.

6. State the month and year of the latest official plan, and indicate in parentheses the control document containing this plan. With few exceptions the plan will be either the original (or revised) project plan, an RTOP or POP. The plan must have received approval of the LaRC Director. In the event it reflects overguideline 506W Authority, this fact plus an appropriate note identifying the overguideline amount(s) must be stated in the notes section.

7. State the end date of the management reporting period for which actual manpower data has been incorporated into this chart. These dates are established each fiscal year by FMD.

8. State the date of the review by the cognizant Center Program Director or designee.

9. State the current Fiscal Year in parentheses.

10. All in-house (i.e., civil service) manpower data on this chart are expressed in terms of equivalent full-time personnel, and are consistent with the manpower data in the LaRC Resources Management System. The actual in-house manpower data are obtained from the last monthly manpower report in the LaRC RMS under the column entitled "Current X-WK Period Equivalent People." These data reflect all applicable overhead factors. If the amounts shown are not consistent with the RMS an explanatory note should be included.

11. Planned in-house manpower data shown below, and plotted in the left-hand histogram typically are based on either fiscal year or monthly planning estimates rather than the "Management Reporting Periods" used in the LaRC Resources Management System. If only a fiscal year planning estimate is available (e.g., 60 man-years for FY 80) then this amount should be shown for each month; however, if a monthly plan is available these data should be used.

12. Actual equivalent full-time in-house manpower data are shown below and plotted in the left-hand histogram by the management reporting periods designated by FMD.

13. Inclusion of support service manpower data is optional, unless specifically required by NASA Headquarters. The guidelines stated in 11 above apply for planned support service manpower data. The actual support service manpower shown should be based on the most current available data plus knowledge of the support received for the period. It is recognized that precise data for the periods used for actual in-house manpower are normally not obtainable.

14. Actual equivalent full-time personnel data shown below, and plotted in the right-hand histogram should be the same amount as the "Cumulative Manpower Annual Rate" number in the LaRC RMS report at the end of the fiscal year.

CENTER _____	CONTRACT FINANCIAL AND MANPOWER STATUS (MONTHLY)	533 ESTIMATE AS OF _____ (Date)
RESPONSIBILITY:	PROJECT:	533 ACTUAL AS OF _____ (Date)
APPROVAL _____	CONTRACTOR:	STATUS AS OF _____ (Date)
ACCOMPLISHMENT _____	CONTRACT NO:	

3 LEVEL

OBLIGATIONS & COSTS (THOUSANDS)

CURRENT FISCAL YEAR		SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL FOR YEAR
NO. OF WORK DAYS IN REPORTING PERIOD															
CUMULATIVE OBLIGATIONS	POP 6 ·	XXX													
	CURRENT ESTIMATE	XXX													
	ACTUAL														
CUMULATIVE ACCRUED COSTS	POP 6 ·	XXX													
	CURRENT ESTIMATE	XXX													
	533 ESTIMATE	XXX													
	ACTUAL TOTAL														
	ACTUAL IN-HOUSE														
	ACTUAL SUBCONTRACT														
MONTHLY COST RATE	POP 6 ·	XXX													
	CURRENT ESTIMATE	XXX													
	ACTUAL COST														
UNFILLED ORDERS OUTSTANDING															

MANPOWER (IN EQUIVALENT MAN-MONTHS)

TOTAL DIRECT MANPOWER	CURRENT ESTIMATE	XXX												
	533 ESTIMATE	XXX												
	ACTUAL													

NUMBER OF SHIFTS _____ PERCENT OVERTIME _____

NOTES:

NASA FORM 1206 MAY 77 PREVIOUS EDITION IS OBSOLETE.

Figure 6-E.3

INSTRUCTIONS FOR PREPARATION OF

CONTRACT FINANCIAL AND MANPOWER STATUS (MONTHLY)

1. Title Block. In the center section, state the project name and 3-digit unique number, the contractor name (including division or other distinguishing identification), and contract number. In the right hand section, state the "533 Estimate as of date", "533 Actual as of date", and Status as of date." Dollar data will be expressed in millions, to the nearest tenth. Manpower data will be expressed to the nearest whole number. Dollar data in the two upper sections are cumulative. Data in the two lower sections are month-by-month, not cumulative.

2. The "533 Estimate as of date" is that of the 533 source of the estimates being reported, and should be the same as the 533 Source cut-off date in the corresponding yearly contract status report, ordinarily one to three months preceding the "Status as of date." The "533 Estimate" (of Cumulative Accrued Costs, and of Total Direct Manpower) will be by month or quarter, according to the requirements established for Form 533 reporting.

3. The "533 Actual as of date" is the end of the period through which the latest Form 533 source has stated accrued costs as actual. (Such statements in practice ordinarily include an estimated amount of costs over a short interval at the end of an accounting period, and may in practice even include an estimated amount of costs over the following accounting period).

4. The "Status as of date" is the same as for the corresponding yearly report, ordinarily about the 20th of each month.

5. The "Actual (of Cumulative Accrued Cost, and of Monthly Cost Rate, and also of Cumulative Obligations) should agree with the in-put data for the agency-wide Financial Status of Programs Report. Where this is not the case, explanatory notes will be included. The "Actual" (of Cumulative Obligations) reported by JPL will be in terms of internal Laboratory performance, and consistent with the R&D Financial Activities Report.

6. The POP estimates wil be the same as submitted for the latest POP which has been approved.

7. The Current Estimates need not be shown unless there is a significant variance from the POP estimates. Current Estimates need not be shown for months for which Actuals are shown.

CENTER RESPONSIBILITY	CONTRACT FINANCIAL AND MANPOWER STATUS (YEARLY)	3 LEVEL	533 SOURCE CUTOFF (Date)
APPROVAL	PROJECT:		STATUS AS OF (Date)
ACOMMPLISHMENT	CONTRACTOR:		
	CONTRACT NO:		

OBLIGATIONS & COSTS (THOUSANDS)

		FY 19 THRU FY 19	FY 19	FY 19 CURRENT YEAR	FY 19	FY 19	FY 19	FY 19	FY 19	FY 19	FY 19 THRU FY 19	TOTAL
UNCOSTED OBLIGATIONS		XXX										XXX
OBLIGATION TO CONTRACTOR												
TOTAL AVAILABLE												XXX
ACCRUED COSTS DURING PERIOD	CENTER ESTIMATE	XXX	XXX									
	533 ESTIMATE	XXX	XXX	( )	( )	( )	( )	( )	( )	( )	( )	( )
	ACTUAL			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
UNFILLED ORDERS (YEAR-END)											XXX	XXX
ADVANCE FUNDING (YEAR-END)											XXX	XXX
MONTHLY COST-RATE (YEAR-END)											XXX	XXX

MANPOWER (IN EQUIVALENT MAN-YEARS)

DIRECT MAN-POWER	CENTER ESTIMATE	XXX	XXX								XXX	XXX
	533 ESTIMATE	XXX	XXX								XXX	XXX
	ACTUAL			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

NOTES:

NASA FORM 1207 (MAY 66)

Figure 6-E.4

INSTRUCTIONS FOR PREPARATION OF

CONTRACT FINANCIAL AND MANPOWER STATUS (YEARLY)

1. Title Block. In the center section, state the project name and 3-digit unique number, the contractor name (including division or other appropriate distinguishing identification), and contract number. In the right hand section, state the "533 source cut-off date", and the "Status as of date." Dollar data will be expressed in millions, to the nearest tenth. Manpower data will be expressed to the nearest whole number.

2. The "533 source cut-off date" is that of the Form 533 source of estimated accrued cost, unfilled orders, and manpower. This ordinarily is one to three months preceding the "Status as of date." The "Status as of date" is the approximate date of assessment of contract status, ordinarily about the 20th of each month.

3. This report rolls-up and rolls-over, after reporting the completion of each fiscal year. All data are actuals, or estimates, for the time periods specified, not cumulative.

4. The Center Estimate of accrued costs (JPL estimate, in the case of JPL subcontacts) will be used in deriving Uncosted Obligations. The 533 Estimate will be shown in the parentheses for comparison purposes. Significant variances between the 533 Estimate and the Center (or JPL) Estimate, for the current or following fiscal year, will be explained either in the Notes block, or in the Narrative Analysis (or addendum thereto).

5. Uncosted Obligations in each column will be derived by taking the difference between the Total Available and Center Estimate as shown in the preceding column. Advance Funding in each column will be derived by taking the difference between the Unfilled Orders shown in that column and the Uncosted Obligations shown in the next column.

6. Significant variances between Center (or JPL) and 533 Estimates of direct manpower will be explained either in the Notes block, or in the Narrative Analysis (or addendum thereto).

The above reports are excellent for maintaining a historical record of project resources and also for communicating with NASA Headquarters personnel as to financial status and plans. To insure that these reports can be used for these purposes, emphasis must be placed on the positive identification of the plans reflected in the reports and on the use of footnotes explaining special conditions or irregularities; e.g., withdrawal of Funding Authority or termination of a major contract.

Other resources reports sometimes included in MICS reports include (1) Cost Concerns/Offsets, (2) Contractor Manpower (actual vs. planned), and (3) Project Level Cost Narrative. Samples of these reports are contained in Figures 6-E.5, .6, and .7.

2. LaRC Director Reports

The Analyst supporting a major R&D project is usually responsible for the preparation of summary level financial reports for use in recurrent reviews with the LaRC Director. The three reports which are currently used for this purpose address (1) funding authority by program year, (2) a comparison of the current (POP) obligation plan versus the previous plan, and (3) Contingency (Management Reserve) Status. Examples of these three reports are shown in Figures 6-E.8, .9, and .10, respectively. Note the extensive use of footnotes to explain data, including reasons for changes and explicit identification of what is included.

Preparation of these reports is coordinated closely with the Project Manager, and the finished product is given to the Project Manager in time to allow modifications, if necessary, prior to the Director's Review.

Project Contingency (Management Reserve) Report

The following commentary describes the process by which a large LaRC project prepared and utilized special charts to depict the status of the project's Contingency to the Project Manager and higher levels of management.

The project, which will herein be referred to as Project F, utilized a prime contractor, Contractor Y, for the design/build/test/delivery of the Project F flight instruments and the costs attendant to this contractual effort constituted a very high percentage of the overall costs of the project. Periodically, the cognizant Technical Representative of the Contracting Officer (TRCO), Schedule Analyst, and Cost Analyst met to perform a Joint Assessment Group (JAG) analysis of Contractor Y's current cost status and estimate-at-completion (EAC). The JAG examined the current actual costs against work accomplished to date and estimates of future expenditures in the

LANGLEY RESEARCH CENTER
RESPONSIBILITY
APPROVAL _____
ACCOMPLISHMENT _____

COST CONCERNS / OFFSETS

PROJECT F

PLAN January 1982 (POP 82-1)

STATUS AS OF April 30, 1982

DOLLARS IN THOUSANDS

REFERENCE NUMBER		ESTIMATED COST IMPACT	ACTUAL IMPACT
1	SHUTTLE BAY/FTBS BOOST THERMAL ENVIRONMENT		65
2	FLIGHT SOFTWARE UPDATE/MICROPROCESSOR MEMORY MODIFICATION		75
3	WEIGHT		
4	ACCUMULATED SCHEDULE SLIPS AT THE END OF DECEMBER 1981		308
5	AZIMUTH DRIVE ENCODER FIX	50	
6	SCANNER MAM DOOR MECHANISM FIX	40	
7	NON SCANNER NOISE TROUBLE SHOOTING/MODIFICATIONS	75	
8	ADDITIONAL COMPUTER TIME FOR CALIBRATION DATA REDUCTION	15	
	TOTAL	180	448
	TOTAL		

Figure 6.E.5

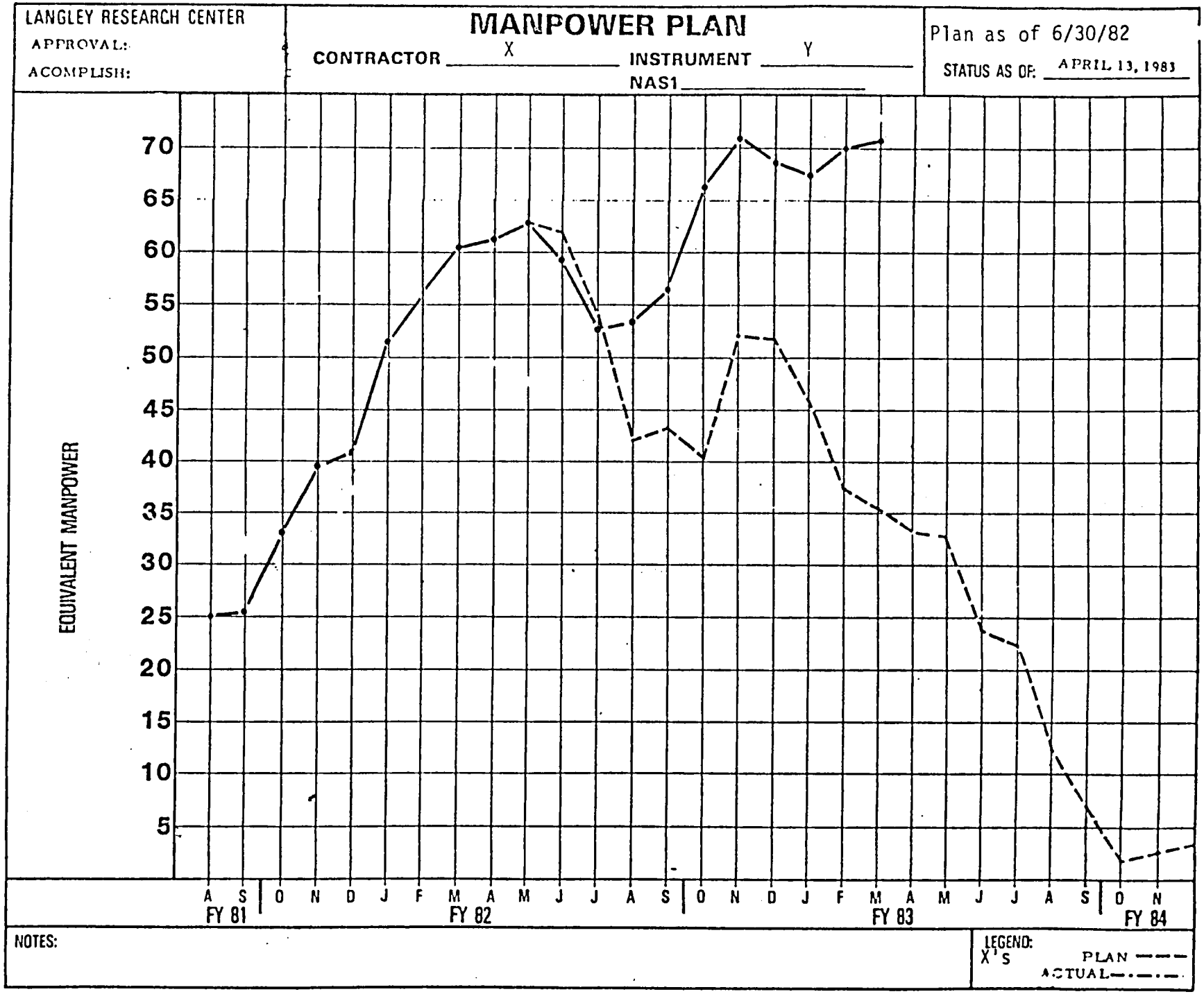

LANGLEY RESEARCH CENTER
APPROVAL:
ACOMPLISH:
MANPOWER PLAN
CONTRACTOR X
INSTRUMENT Y
NAS1
Plan as of 6/30/82
STATUS AS OF: APRIL 13, 1983
EQUIVALENT MANPOWER
70
65
60
55
50
45
40
35
30
25
20
15
10
5
A S O N D J F M A M J J A S O N D J F M A M J J A S O N
FY 81
FY 82
FY 83
FY 84
NOTES:
LEGEND:
X'S
PLAN
ACTUAL

Figure 6-E.6

LANGLEY RESEARCH CENTER	NARRATIVE ANALYSIS	
RESPONSIBILITY:	LEVEL	
APPROVAL:	COST NARRATIVE	
ACCOMPLISHMENT:	PROJECT F	STATUS AS OF April 13, 1983 (DATE)

All obligation and cost plans are based on POP 83-1 informally transmitted on February 28 and March 1, 1983. POP 83-1 was reviewed and approved by the Center Director on March 28.

We are continuing levels of activity in all phases of the project to minimize FY 83 cost without postponing any activity on the prime instrument contracts. We are also attempting to minimize any uncosted carry-over into FY 84 in order to make use of all available FY 83 funding. However, we are proceeding with the described plan which is highly contingent on receipt of the $1.5M FY 83 Headquarters APA. This plan is in consonance with the Project F cost review meeting at Center A on January 19, 1983.

Higher than anticipated manpower at Contractor X continues due to unanticipated development problems as we proceed through instrument checkout and testing. Our latest performance assessment which took place on April 11, 1983, was based on Contractor X's February actuals and his cost forecast dated March 20, 1983. This forecast is $296K above that shown in POP 83-1. Our Contingency, therefore, is reduced to $35K with Cost Concerns as shown in page 3.4 exceeding that amount. In addition, our concern over Contractor X's forecasted manpower fall-off continues to grow.

Figure 6-E.7

FUNDING AUTHORITY BY PROGRAM YEAR

PROJECT XYZ 3/31/83

RTOP 534-01-13

NOA BREAKDOWN ($M) (REF. POP 83-1, DATED 3/31/83)

	PY 81 & P	PY 82	PY 83	PY 84	PY 85	TOTAL
SYSTEMS EVALUATION	8.6	-	-			
HIGH SPEED WTT	1.6	.4	-			
LEADING EDGE FLIGHT TEST	7.0	4.2	.6			
PREL. DSGN. LF WING FLT. RESEARCH	-	-	-			
VARIABLE SWEEP FLIGHT TEST	-	.1	.4			
WING SURFACE PANEL DEVELOPMENT	2.7	-	.6			
LF CONCEPTS INTEGRATION	-	-	-			
LFC RESEARCH	-	.2	.1			
SUPPORTING R&T	2.0	.2	-			
MANAGEMENT	.6	.1	.1*			
PROGRAM SUPPORT & FAB	2.6	1.0	.2			
RESERVE		-	.5			
TOTAL LARC	25.1	6.2	2.5			
NON-LaRC PROG SPT. & FAB	.1	*	.1			
TOTAL PROGRAM	25.2	6.2**	2.6**			

ACTUAL REPORT CONTAINS NUMBERS

*ROUNDING ADJUSTMENT

**REVISION OF PY82 AND PY83 NOA DISTRIBUTION REFLECTS PROGRAMMATIC ADJUSTMENTS COMPLETED IN MARCH 1983.

Figure 6-E.8

CURRENT vs. PRIOR POP

EFG UPN 534

POP 83-1 vs FY 84 RTOP

OBLIGATION $M

DATE	EVENT	ELEMENT		FY 81 & PRIOR	FY 82	FY 83	FY 84	FY 85	EAC	DELIVERY DATES	FLIGHT DATES
3/31/83	POP 83-1	SYSTEMS EVALUATION		8.6	-	-					
		HIGH SPEED WT TEST		1.1	.7	.2					
		L.E. FLIGHT TEST		5.7*	3.6	2.5					10/83-5/85
		WING SURFACE SYST. DEV.		4.1	(1.4)	.6					
		VARIABLE SWEEP FLT TEST		-	-	.5					
		LF CONCEPTS INTEG.		-	-	-					
		LFC RESEARCH		-	-	.3					
		P.D. LF WING FLT. RESEARCH		-	-	-					
		SUPPORTING R&T		2.0	.2	-					
		MANAGEMENT		.6	.1*	.1*					
		RESERVE		-	-	.5					
		IMS		2.6	.8	.4					
		TOTAL LaRC EFG		24.7	4.0	5.1					
5/25/83	FY 84 RTOP	SYSTEMS EVALUATION		8.6	-	-					
		HIGH SPEED WT TEST	(1)	1.1	.7	.3					
		L.E. FLIGHT TEST	(2)	5.7*	3.6	2.6					10/83-5/85
		WING SURFACE SYST. DEV.	(3)	4.1	(1.4)	.6					
		VARIABLE SWEEP FLT TEST	(4)	-	-	.5					
		LF CONCEPTS EVAL.		-	-	-					
		LFC RESEARCH	(5)	-	-	.3					
		SUPPORTING R&T		2.0	.2	-					
		MANAGEMENT		.6	.1*	.1*					
		RESERVE	(6)	-	-	.3					
		IMS		2.6	.8	.4					
		TOTAL LaRC EFG FROM POP 83-1	(7)	24.7	4.0	5.1					

ACTUAL REPORT CONTAINS NUMBERS

(1) ADDITIONAL FUNDING IS REQUIRED IN FY 83 + FY 84 TO SUPPORT THE EFFORT.
(2) LEFT: FY 83 INCLUDES OBLIGATION OF $1.9M PY 82 FUNDS FOR XXX ($0.9M) AND CDEFG ($0.8M) CONTRACTS AND LMNO SUBALLOTTED FUNDS ($0.2M)
(3) WSSD CONTRACTS WITH CDEFG AND ABC WILL BE RESTARTED IN FY 83 TO COMPLETE REPORTING OF DESIGN STUDIES AND JOINT AND PANEL DEVELOPMENT
(4) VARIABLE SWEEP FLIGHT TEST INCLUDES $124K OF PY 82 FUNDING OBLIGATED IN FY 83
(5) LFC RESEARCH UTILIZES $206K PY 82 & $94K PY 83 IN FY 83 TO SUPPORT AERO DIRECTORATE REQUIREMENTS
(6) RESERVE AS SHOWN REFLECTS CURRENT PROJECTED RESERVE THROUGH FY 85
(7) TOTAL FUNDING REFLECTS FY 84 RTOP SUBMISSION

Figure 6-E.9

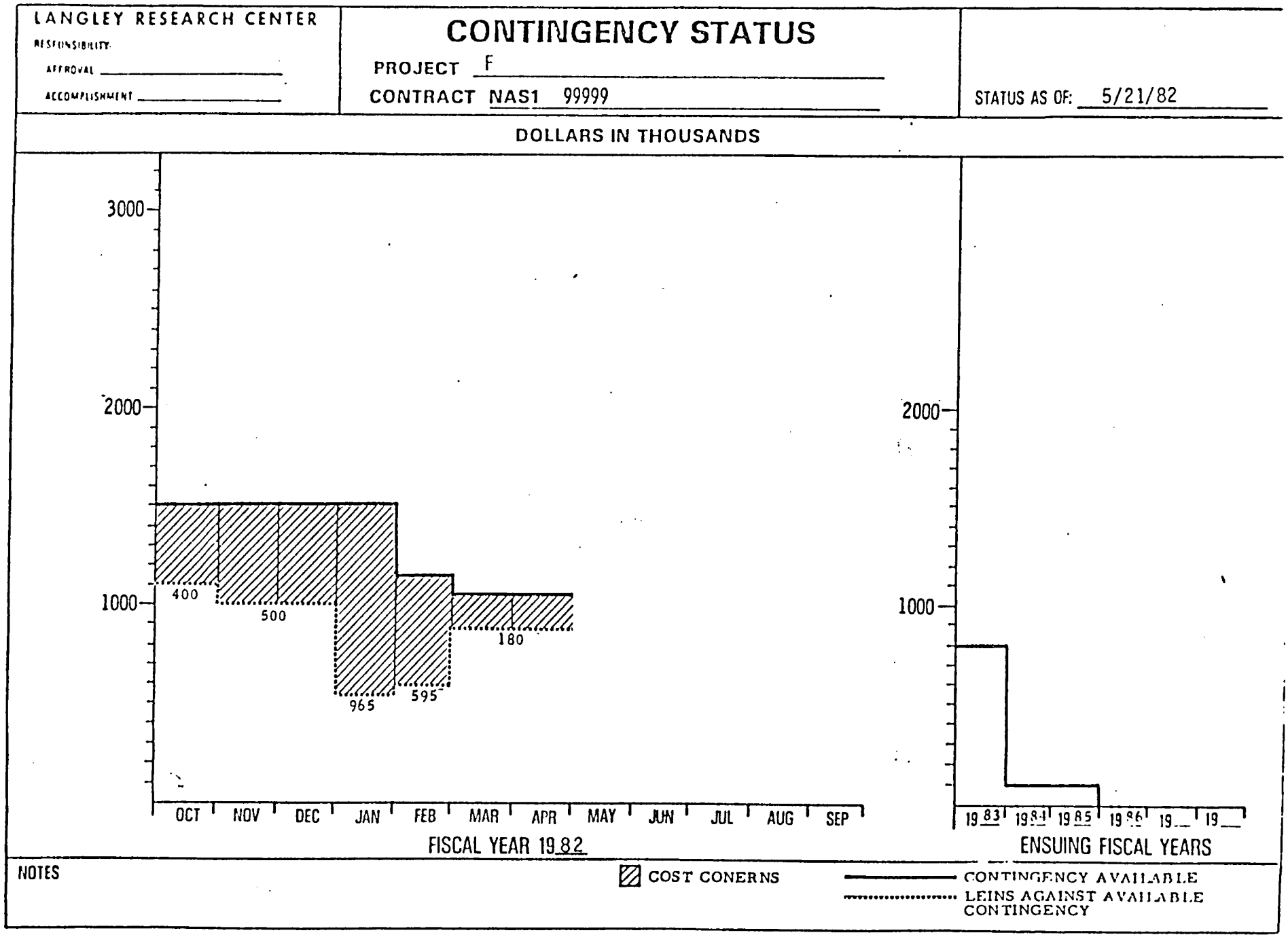

LANGLEY RESEARCH CENTER
RESPONSIBILITY
APPROVAL
ACCOMPLISHMENT
CONTINGENCY STATUS
PROJECT F
CONTRACT NAS1 99999
STATUS AS OF: 5/21/82
DOLLARS IN THOUSANDS
3000
2000
1000
400
500
965
595
180
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
FISCAL YEAR 1982
2000
1000
19 83
19 84
19 85
19 86
19__
19__
ENSUING FISCAL YEARS
NOTES
COST CONERNS
CONTINGENCY AVAILABLE
LEINS AGAINST AVAILABLE CONTINGENCY

Figure 6-E. 10

Contractor's Forecast Expenditure Plan (FEP) at CWBS levels 2 and 3, and also, when necessary, at level 4 or 5. Adjustments to Contractor Y's EAC were then made based on the JAG assessment. The JAG's assessment often addressed cost items which were not yet recognized by Contractor Y.

Twice yearly the current JAG assessment of Contractor Y's effort became the basis for the prime contract cost spread in the Program Operating Plan (POP). The difference between the funding requirements for that contract, based on the cost spread, and the total dollars available for the instrument in each year was identified as "Contingency," time-phased by fiscal year. Changes in the JAG's assessment of costs to be incurred by Contractor Y during the current or subsequent fiscal years were documented vis-a-vis the amount of Contingency. Figures 6-E.5 and 6-E.10 illustrate the relationship between Contingency and the JAG's cost assessment. In Figure 6-E.5, the dollar amounts in the far right column reflect cost history, viz, amounts which had already been made a part of Project F's cost baseline for the prime contract. The amounts in the column entitled, "Estimated Cost Impact," relate to costs anticipated to exceed the amounts in the current baseline. These amounts, totaling $180K, can be thought of as liens against that Contingency. Notice that this $180K is shown graphically in the Contingency Status Report (Figure 6-E.10), which is divided into two parts. The left hand chart depicts the status of the Contingency by month for the current fiscal year, while the right hand chart depicts the Contingency for ensuing fiscal years to completion. In both charts the solid black line depicts the current Contingency level. The cross-hatched area represents unresolved liens against that Contingency. This chart shows that Project F started the fiscal year with Contingency of $1.5M for F.Y. 1982. In October, there were liens of $400K against those funds leaving $1.1M completely unencumbered as denoted by the space below the cross-hatched area. The Contingency remained at the $1.5M level through January even though the Cost Concerns grew to $965K. In February, several Cost Concerns were resolved; their costs reduced the Contingency to $1.15M, with outstanding liens of $595K. By the end of March this Contingency had been reduced to $1.052M with liens of $180K.

F. Special Reports

1. Trip Reports

Guidelines for the preparation of trip reports by Analysts are contained in Figure 6-F.1. An example of a Trip Report is contained in Figure 6-F.2.

National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia
23665

NASA

Reply to Attn of: 124

May 16, 1983

TO: 124/Project Support Branch Staff

FROM: 124/Head, Project Support Branch, PRD

SUBJECT: Trip Report Requirements

Project Support Branch staff members will prepare and submit a trip report to the Head, PSB with copies to the Chief, PRD, and to any project personnel deemed necessary by the writer, for each official business trip taken. The report should consist of a brief summary of the following information:

1. Time period and purpose of trip
2. People contacted
3. Major topics discussed, problems revealed, decisions made, etc.
4. Open action items

The trip report should be as brief as possible consistent with the above requirements and should not exceed one page. Details should be retained in the traveler's notes for reference or included in other reports, as required, such as the monthly resources status and contract assessment reports.

Head, Project Support Branch
ext.

Figure 6-F.1

National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia
23665

NASA

Reply to Attn of. 158(83-413)

July 18, 1983

TO: 124/Head, Project Support Branch

FROM: 158/Program Analyst, Project Support Branch, PRD

SUBJECT: Trip Report, July 12-13, 1983

On July 12-13, 1983, members of the XYZ PO and the undersigned visited Contractor L, Somewhere, Georgia to review the status of the RIGHT Program.

While there we visited with (Names of Contractor Personnel). The discussions which I participated in were related to: rates; cost and schedule through current contract end date; contract extension for acceptance ground and flight tests (Contractor L estimates versus NASA estimates of requirements and personnel involved); and future plans for the RIGHT Program.

It was decided that:

(1) Contractor L will submit an overrun proposal as soon as possible to cover the work scheduled to be completed through Flight Readiness Review (FRR)

(2) NASA will weigh Contractor L's preliminary estimates for the contract extension against the total available program funds and determine which option is most feasible

(3) Contractor L will prepare a proposal to cover the acceptance ground and flight tests.

Name of Analyst
ext.

Figure 6-F.2

VII. CONCLUDING REMARKS

Research and Development (R&D) projects vary in many ways; e.g., the number and types of organizations involved, total cost, risk level, and duration. Even individual projects often change significantly during their lifetime. Consequently, it is not possible to identify any one "best" set of fixed methods and procedures for resources planning and control. Nevertheless, there has been sufficient experience at Langley Research Center (LaRC) in this functional area to permit the assemblage of instructional guidelines which should be helpful on future projects.

An Analyst, working in support of a Project Manager, can provide valuable assistance in the areas of resources planning and control. To do so, the Analyst should establish and maintain a close, working relationship with the Project Manager, commencing early in the planning phase of the project. This will facilitate the development of procedures and methods for resources planning and control which are appropriate to the special needs of the individual project.

It is very important that a project have a recognized detailed resources plan, viz, an Operating Plan, at all times which is consistent with the approved, overall Project Plan. The use of a disciplined method for effecting changes to the Operating Plan, such as the system described in Section IV-B., is recommended.

The Analyst should insure that resources reports received from Contractors and other organizations are sufficient both in quality and timeliness to meet the needs of the project; also, that appropriate reports are prepared, and distributed or presented to cognizant LaRC personnel. The use of special reports, such as those discussed in Sections IV-C., IV-D., and VI-D., should be considered for use, as appropriate.

In the event that a project includes a major cost-type, contractual effort(s), special consideration should be given to the contractor's resources control system and the reports to be submitted to NASA by the Contractor. There should be a clear understanding as to what is required of the Contractor from the outset of the Contractor's effort, which should be documented in a manner similar to the examples discussed in Subsection IV-F.3.

On very large, cost-type R&D contracts, or those with only a moderate total estimated dollar value but a high dollar risk, strong consideration should be given to the use of a contractor reporting requirement based on a Performance Measurement (earned value) type resources planning and control system, as discussed in Subsection IV-F.8.

Anyone involved in the difficult task of planning and controlling resources on R&D projects or interested in understanding this subject must never lose sight of the fact that systems do not control costs. In the final analysis, it is clear that only people control costs--people who are motivated to do so, and who have adequate competence, time, and management support.

APPENDIX A

LIST OF ACRONYMS

ACD	ANALYSIS AND COMPUTATION DIVISION
ACWP	ACTUAL COST OF WORK PERFORMED
APA	ALLOWANCE FOR PROJECT ADJUSTMENT
AWCS	AGENCY-WIDE CODING STRUCTURE
BAC	BUDGET AT COMPLETION
BCS	BUDGET CHANGE SYSTEM
BCWP	BUDGETED COST FOR WORK PERFORMED
BCWS	BUDGETED COST OF WORK SCHEDULED
BDSD	BUSINESS DATA SYSTEMS DIVISION
CC/CO	COST CONCERNS/COST OFFSETS
CAM	COST ACCOUNT MANAGER
CO	CONTRACTING OFFICER
COP	COMMITMENT AND OBLIGATION PLAN
CPI	COST PERFORMANCE INDEX
CS	CIVIL SERVICE
C/SCSC	COST/SCHEDULE CONTROL SYSTEMS CRITERIA
CWBS	CONTRACTOR WORK BREAKDOWN STRUCTURE
DOD	DEPARTMENT OF DEFENSE
DOE	DEPARTMENT OF ENERGY
DMM	DEPUTY MANAGER FOR MANAGEMENT
DRD	DATA REQUIREMENT DESCRIPTION
EAC	ESTIMATE (OF TOTAL COSTS) AT COMPLETION
EOM	END OF MONTH

LIST OF ACRONYMS (CONT'D)

ETC	ESTIMATE (OF COSTS) TO COMPLETE
EV	EARNED VALUE
FACS	FUND ACCOUNTING AND CONTROL SECTION, ACCOUNTING BRANCH, FMD
FMD	FINANCIAL MANAGEMENT DIVISION
FS	FUND SOURCE
FY	FISCAL YEAR
FYTD	FISCAL YEAR TO DATE
GSFC	GODDARD SPACE FLIGHT CENTER
IEAC	INDEPENDENT ESTIMATE AT COMPLETION
IMS	INSTITUTIONAL MANAGEMENT SYSTEM
JAG	JOINT ASSESSMENT GROUP
JO	JOB ORDER
LaRC	LANGLEY RESEARCH CENTER
LOE	LEVEL OF EFFORT
MA	METHOD OF (FUNDING) AUTHORIZATION
MICS	PROJECT MANAGEMENT INFORMATION AND CONTROL SYSTEM
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NOA	NEW OBLIGATIONAL (BUDGET) AUTHORITY
OAST	OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY
OP	OPERATING PLAN
OSSA	OFFICE OF SPACE SCIENCE AND APPLICATIONS

P_f	(COST) PERFORMANCE FACTOR
PM	PROJECT MANAGER
PMS	PERFORMANCE MEASUREMENT SYSTEM
POP	PROGRAM OPERATING PLAN
PR	PURCHASE REQUEST
PRD	PROGRAMS AND RESOURCES DIVISION
PSB	PROJECT SUPPORT BRANCH, PRD
PWBS	PROJECT WORK BREAKDOWN STRUCTURE
PY	PROGRAM YEAR
RCO	RESOURCES CONTROL OFFICE, FABRICATION DIVISION
R&D	RESEARCH AND DEVELOPMENT
RMS	RESOURCES MANAGEMENT SYSTEM
RSR	(PROJECT) RESOURCES STATUS REPORT
R&T	RESEARCH AND TECHNOLOGY
RTOP	RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS
RTR	RESEARCH AND TECHNOLOGY RESUME
SC	SCHEDULE CORRELATION
SEB	SOURCE EVALUATION BOARD
SOW	STATEMENT OF WORK
SPAS	SYSTEMS PERFORMANCE ANALYSIS SECTION, COMPUTER MANAGEMENT BRANCH, ACD
SPI	SCHEDULE PERFORMANCE INDEX
TCPI	(COST) TO COMPLETE PERFORMANCE INDEX
TM	TECHNICAL MEMORANDUM
TRCO	TECHNICAL REPRESENTATIVE OF THE CONTRACTING OFFICER

LIST OF ACRONYMS (CONT'D)

VAC	(COST) VARIANCE AT COMPLETION
V_f	(COST) VERIFICATION FACTOR
WBS	WORK BREAKDOWN STRUCTURE
WBSE	WORK BREAKDOWN STRUCTURE ELEMENT

APPENDIX B

BIBLIOGRAPHY OF SELECTED DOCUMENTS

NMI 5101.12E	Policy and Procedures Concerning Procurements Requests
NMI 7121.1C	Planning and Approval of Major Research and Development Projects
NMI 9501.1D	NASA Contractor Financial Management Reporting System
NHB 2340.2	NASA OSSA/OART Project Management Information and Control System (MICS)
NHB 5610.1	Handbook for Preparation of Work Breakdown Structures
NHB 9501.2A	Procedures for Contractor Reporting of Correlated Cost and Performance Data
NASA TM 83108	Guidelines for Cost Control and Analysis of Cost-Type Research and Development Contracts
NASA TM 83090	The Planning and Control of NASA Programs and Resources
LMI 9100.1	Job Orders
LMI 9500.1	Contractor Financial Management Reporting (NASA Form 533 Series)
LHB 7121.1	Project Management
LHB 7100.1	Research and Development Program Management Procedures
LHB 5103.6A	Source Evaluation Boards (SEB)
LHB 2310.1	RMS Reference Manual
LHB 5000.2	Basic Guide for Acquisitions
PROC./P-104	Guidelines for Technical Representatives - Cost Type Contracts

APPENDIX C

GLOSSARY OF TERMS

ACCRUED COST - The cost recognized for material used or provided or a service rendered at the time of application, regardless of whether payment is made before the event, concurrently with the event, or will be made at a later time.

ACTUAL COST OF WORK PERFORMED (ACWP) - The costs actually incurred and recorded in accomplishing the work performed within a given time period.

ACTUAL DIRECT COSTS - Those costs identified specifically with a contract, based upon the contractor's cost identification and accumulation system as accepted by the cognizant DCAA representatives. (See Direct Costs.)

ALLOCATED BUDGET - (See Total Allocated Budget.)

APPLIED DIRECT COSTS - The amounts recognized in the time period associated with the consumption of labor, material, and other direct resources, without regard to the date of commitment or the date of payment. These amounts are to be charged to work-in-process in the time period that any one of the following takes place:

(1) When labor, material, and other direct resources are actually consumed, or

(2) When material resources are withdrawn from inventory for use, or

(3) When material resources are received that are uniquely identified to the contract and scheduled for use within 60 days, or

(4) When major components or assemblies are received on a line-flow basis that are specifically and uniquely identified to a single serially numbered end item.

APPORTIONED EFFORT - Effort that by itself is not readily divisible into short-span work packages but which is related in direct proportion to measured effort.

AUTHORIZED WORK - That effort which has been definitized and is on contract, plus that for which definitized contract costs have not been agreed to but for which written authorization has been received.

BASELINE - (See Performance Measurement Baseline.)

BUDGET - A dollar translation of the resources required during stated periods of time for the accomplishment of a work plan or plans intended to achieve one or more goals.

BUDGETED COST FOR WORK PERFORMED (BCWP) - The sum of the budgets for completed work packages and completed portions of open work packages, plus the appropriate portion of the budgets for level of effort and apportioned effort.

BUDGETED COST FOR WORK SCHEDULED (BCWS) - The sum of budgets for all work packages, planning packages, and so forth, scheduled to be accomplished (including in-process work packages), plus the amount of level of effort and apportioned effort scheduled to be accomplished within a given time period.

BUDGETS FOR WORK PACKAGES - (See Work Package Budgets.)

CONTRACT BUDGET BASE - The negotiated contract cost plus the estimated cost of authorized unpriced work.

CONTRACTOR - An entity in private industry which enters into contracts with the Government. In some situations, the word may also apply to Government-owned, Government-operated activities which perform work on major programs.

COST ACCOUNT - A management control point at which actual costs can be accumulated and compared to budgeted costs for work performed. A cost account is a natural control point for cost/schedule planning and control, since it represents the work assigned to one responsible organizational element on one contract work breakdown structure (CWBS) element.

COST VARIANCE (CV) - The difference between BCWP and actual costs for a specific entity of work. BCWP - ACWP = CV

DIRECT COSTS - Any costs which can be identified specifically with a particular final cost objective.

EARNED VALUE CONCEPT - A systematic method whereby the value of the progress (work accomplished) on an effort is measured based on predetermined values for the subelements comprising the effort and/or other procedures for assigning values. At any point in time, the earned value equals BCWP.

ELEMENT OF COST - An object, thing, or service (used to accomplish work) classified by its characteristics rather than by the end purpose which it serves, such as: direct labor - engineering and direct labor - manufacturing, direct materials, major cost-type subcontracts, burden or overhead, General and Administrative expense, and so forth.

ESTIMATED COST AT COMPLETION OR ESTIMATE AT COMPLETION (EAC) - Actual direct costs, plus indirect costs allocable to the contract, plus the estimate of costs (direct and indirect) for authorized work remaining.

ESTIMATED COST TO COMPLETE (ETC) - The estimate of costs, direct and indirect, for authorized work remaining.

FORWARD FUNDING - Uncosted obligations less unfilled orders outstanding.

INDIRECT COSTS - Costs, which because of their incurrence for common or joint objectives, are not readily subject to treatment as direct costs.

INITIAL BUDGET - (See Original Budget.)

INTERNAL REPLANNING - Replanning actions performed by the contractor for remaining effort within the recognized total allocated budget.

LEVEL OF EFFORT (LOE) - Effort of a general or supportive nature which does not produce definite end products or results.

MANAGEMENT RESERVE - (Synonymous with Management Reserve Budget). An amount of the total allocated budget withheld for management control purposes rather than designated for the accomplishment of a specific task or set of tasks. It is not a part of the Performance Measurement Baseline.

NEGOTIATED CONTRACT COST - The estimated cost negotiated in a cost-plus-fixed-fee contract, or the negotiated contract target cost in either a fixed-price-incentive-fee contract or a cost-plus-incentive-fee contract.

OBLIGATIONS - Amounts of orders placed, contracts awarded, services received, or other similar transactions which require disbursement of money. Includes disbursements not preceded by the recording of obligations, and reflects adjustments for differences between obligations and actual disbursements. Obligations are the sum of undelivered orders, liabilities, and disbursements.

OBLIGATIONS, UNCOSTED - Obligations incurred for materials and services which have not been accrued as costs. Usually represents materials or services ordered but not received or placed in use.

ORIGINAL BUDGET - The budget established at, or near, the time the contract was signed, based on the negotiated contract cost.

OVERHEAD - (See Indirect Costs.)

PERFORMANCE MEASUREMENT BASELINE - The time-phased budget plan against which contract performance is measured. It is formed by the budgets assigned to scheduled cost accounts and the applicable indirect budgets. For future effort, not planned to the cost account level, the performance measurement baseline also includes budgets assigned to high level WBS elements, and undistributed budgets. It equals the total allocated budget less management reserve.

PERFORMING ORGANIZATION - A defined unit within the contractor's organization structure, which applies the resources to perform the work.

PLANNING PACKAGE - A logical aggregation of work within a cost account, normally the far term effort, that can be identified and budgeted in early baseline planning, but is not yet defined into work packages.

REPLANNING - (See Internal Replanning.)

REPROGRAMMING - Replanning of the effort remaining in the contract, resulting in a new budget allocation which exceeds the contract budget base.

RESPONSIBLE ORGANIZATION - A defined unit within the contractor's organization structure which is assigned responsibility for accomplishing specific tasks.

SIGNIFICANT VARIANCES - Those differences between either (1) planning and actual performance or (2) current ETC and budgeted cost of authorized work remaining, which require further review, analysis, or action. Appropriate thresholds should be established as to the magnitude of variances which will require variance analysis.

SUBDIVISION OF WORK - A work package which serves as a basic common denominator for correlation of financial data with related schedule and performance data (both planned and actual).

TOTAL ALLOCATED BUDGET - The sum of all budgets allocated to the contract. Total allocated budget consists of the performance measurement baseline and all management reserve. The total allocated budget will reconcile directly to the contract budget base. Any differences will be documented as to quantity and cause.

UNFILLED ORDERS OUTSTANDING - For NASA contractor financial management reporting, NASA Form 533, Unfilled Orders Outstanding is the balance of the amounts designated to the sellers as the fund limitation of subcontracts, purchase orders, and other firm

orders issued by the contractor which have not been included in costs incurred to date.

UNDISTRIBUTED BUDGET - Budget applicable to contract effort which has not yet been identified to CWBS elements at or below the lowest level of reporting to the Government.

VARIANCES - (See Significant Variances.)

WORK BREAKDOWN STRUCTURE (WBS) - A product-oriented family tree division of hardware, software, services, and other work tasks which organizes, defines, and graphically displays the product to be produced, as well as the work to be accomplished to achieve the specified product.

WORK PACKAGE BUDGETS - Resources which are formally assigned by the contractor to accomplish a work package, expressed in dollars, hours, standards, or other definitive units.

WORK PACKAGES - Detailed short-span jobs, or material items, identified by the contractor for accomplishing work required to complete the contract. A work package has the following characteristics:

(1) It represents units of work at levels where work is performed.

(2) It is clearly distinguishable from all other work packages.

(3) It is assignable to a single organizational element.

(4) It has scheduled start and completion dates and, as applicable, interim milestones, all of which are representative of physical accomplishment.

(5) It has a budget or assigned value expressed in terms of dollars, manhours, or other measurable units.

(6) Its duration is limited to a relatively short span of time or it is subdivided by discrete value-milestones to facilitate the objective measurement of work performed.

(7) It is integrated with detailed engineering, manufacturing, or other schedules.

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TM-86339		

4. Title and Subtitle	5. Report Date
PROJECT RESOURCES PLANNING AND CONTROL	November 1984
	6. Performing Organization Code 023-10-01-01
7. Author(s) Charles W. Sibbers	8. Performing Organization Report No.
9. Performing Organization Name and Address NASA--Langley Research Center Hampton, VA 23665	10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546	13. Type of Report and Period Covered Technical Memorandum 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report contains instructional guidelines for the resources planning and control of research and development (R&D) projects managed by NASA's Langley Research Center (LaRC). Although written to serve primarily as a practical guide and reference for those LaRC personnel who perform resources planning, analysis, control, and reporting functions, it should also be meaningful to other NASA personnel who are directly or indirectly involved in or affected by these functions, especially project technical managers whose responsibilities include resources management. Certain sections should help Contractor personnel to better understand what resources information must usually be submitted on LaRC projects and what use is made of such information.

The Project Manager of a large R&D project typically receives support from an Analyst in the area of resources management. The Analyst provides assistance in four functional areas: Planning, Analysis/Control, Administration, and Reporting. Each of these functions are discussed in detail. Examples of techniques used effectively on LaRC projects have been included where applicable.

A considerable amount of information has been included on the use of Performance Measurement (Earned Value) Systems for contract cost control and reporting as little information is currently available on this subject in NASA publications.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Project Cost Control Project Cost Management Project Management Project Planning and Control Contract Cost Management Contract Cost Analysis	Unclassified - Unlimited Subject Category 81

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	144	A07

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