NASA Technical Memorandum 83108 NASA-TM-83108 19810017326

Guidelines for Cost Control and Analysis of Cost - Type Research and Development Contracts

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MAY 1981

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 NASA POLICY - CONTRACTOR FINANCIAL MANAGEMENT REPORTING . . . 3

3.0 PURPOSES OF CONTRACTOR FINANCIAL MANAGEMENT REPORTING 5

4.0 NEED FOR SPECIALLY TAILORED REPORTING REQUIREMENTS 10

5.0 ROLE/FUNCTIONS OF RESOURCE ANALYST - OVERVIEW 12

6.0 REPORTING REQUIREMENTS 13
- 6.1 BASIC DESIGN APPROACH 13
- 6.2 REPORTS DO NOT CONTROL COSTS 13
- 6.3 CONTRACTUAL ASPECTS 13
- 6.4 GENERAL TYPES OF DATA REQUIRED 15
- 6.5 INITIAL REPORT 15
- 6.6 COST BASELINE(S) 16
- 6.7 CONTENTS OF RECURRING REPORTS 20

7.0 GUIDE FOR REVIEW AND ANALYSIS OF 533 REPORTS 24
- 7.1 UNDERSTANDING THE CONTRACTOR'S REPORT 24
- 7.2 REVIEW AND ACCEPTANCE OF CONTRACTOR PLAN 25
- 7.3 VARIANCE ANALYSES 26
- 7.4 SCHEDULE IMPACTS 34
- 7.5 MANAGEMENT RESERVE 35
- 7.6 COST CONTROL TECHNIQUES 36
- 7.7 TREND ANALYSES 38

8.0 ANALYST'S REPORT 40

9.0 CONCLUDING REMARKS 42

10.0 APPENDIXES A-G 45

11.0 GLOSSARY OF TERMS 65

1.0 INTRODUCTION

NASA policy stipulates that a minimum level of financial management reporting by contractors be invoked, but that adequate information be obtained to properly manage the effort. The NASA Contractor Financial Management Reporting System provides a great deal of flexibility for the use of various types/levels of reporting in order to effectively implement this policy. This approach provides opportunities for minimizing costs for obtaining the appropriate visibility into the financial status of a contractual effort. However, in order for this approach to be effective, the cognizant NASA personnel responsible for contractor cost performance must be highly knowledgeable as to cost control systems and the NASA system for contractor cost reporting, or have the support of personnel who have the requisite knowledge and experience. This paper covers material considered relevant to a proper understanding of these two subjects. It has been written primarily to serve as a guide at the working level for personnel of the Langley Research Center's (LaRC) Project Management Systems Division (PMSD) or other NASA personnel providing cost analysis and control support on major cost-type R&D contracts. However, the author has tried to present the subject material in a way that would also be meaningful to any NASA technical personnel who have responsibilities which encompass contractor cost performance (either as a Technical Representative of the Contracting Officer or a manager of a portion of a contract effort) and other personnel who have a need for a general understanding of contractor cost status, for example, contract negotiators, administrators, price analysts, and budget analysts. It reflects the experiences of not only the author but many others, principally current and former personnel of Langley Research Center, who have worked on R&D projects involving major contracts. It also reflects a basic approach and some specific methods/techniques which have worked well on LaRC projects.

It should also be noted that the focus of this paper is the cost control of major research and development efforts involving cost-type contracts. Although much of the material is generally relevant to cost control of other types of contracts, all of the cited examples, opinions, and recommendations relate to the above type of contract. Likewise, the author's comments are focused on the cost control of large, multimillion-dollar contracts in a project environment, where a specialist provides cost control support to the NASA lead for the contract effort. Although the same principles as discussed herein apply on smaller contracts, it should be recognized that many of the requirements and methods discussed would not normally be cost effective on smaller contracts.

Lastly, it is important to note that the NASA Handbook, NHB 9501.2A, "Procedures for Contractor Reporting of Correlated Cost and Performance Data," contains the official guidelines (including NASA policies, procedures, and instructions to contractors and NASA personnel) for the administration of the Contractor Financial Management Reporting System. Therefore, the guidelines contained herein should be viewed as supplemental to those contained in NHB 9501.2A.

2.0 NASA POLICY - CONTRACTOR FINANCIAL MANAGEMENT REPORTING

The regulatory framework for Contractor Financial Management Reporting by NASA contractors is contained in three documents: NASA Management Instruction (NMI) 9501.1B, dated March 25, 1974, NASA Handbook (NHB) 9501.2A, dated October, 1971, and NASA Procurement Regulation 7.104-53.

NMI 9501.1B, subject: Contractor Financial Management Reporting System, stipulates that "the NASA Form 533 series of Contractor Financial Management Reports shall be the basic financial medium for:

(1) Reporting correlated information needed by NASA project management for the evaluation of contractor cost as it relates to schedule and technical performance;

(2) Reporting actual and projected data necessary for assuring that contractor performance is realistically planned and supported by dollar and labor resources; and

(3) Inputting contractor cost information into the NASA cost accounting system as set forth in the Financial Management Manual 9240."

NMI 9501.1B, which is contained in Appendix A, also states that the instructions and procedures relative to contractor financial reporting are set forth in NHB 9501.2A, dated October, 1971, (hereafter referred to as the Handbook), and on the reverse side of the NASA forms used for such reporting.

The Handbook, entitled "Procedures for Contractor Reporting of Correlated Cost and Performance Data," is a comprehensive document which, as stated in its preface, "sets forth NASA policies, procedures, and instructions to contractors and NASA Project Managers

for the administration of the (NASA) Contractor Financial Management Reporting System." This document is available to NASA employees through the cognizant functional organization of any NASA installation, to NASA contractors through NASA installation Contracting Officers, and to other interested parties through the Government Printing Office, Washington D.C., 20402. The Handbook does not represent an ironclad, specific approach to contractor financial management reporting. In fact, it clearly recognizes (Ref., Section 103) the appropriateness of exceptions "due to unique reporting requirements or capabilities of the contractor's management system (which) may be approved at the installation level in accordance with local management procedures." More will be said later as to the number of specific instructions regarding reporting requirements which the Handbook itself stipulates be determined by the user. Though it does contain requirements, a very significant portion of it can best be described as guidance for the development of appropriate, specific requirements. Section 104 of the Handbook specifies a set of minimum criteria for the use of the NASA Form 533 series of reports, including the specific reports which shall be required, as a minimum. This series of reports will be referred to as "533 reports."

Procurement Regulation (PR) 7.104-53, entitled "NASA Financial Management Reporting," contains the applicable standard contract clause(s) to be used when 533 reports are required. Appendix B contains a copy of this PR. It should be noted that the standard contract clause(s) does not contain a complete set of specific requirements applicable to all contracts or types/classes of contracts. The basic clause states clearly that Financial Management Reports shall be submitted by the contractor on 533 reports in accordance with the instructions set forth in NHB 9501.2A and on the reverse side of the form, as supplemented in the schedule of the contract. The clause, therefore, provides for the inclusion of any reporting requirements deemed appropriate by cognizant NASA personnel, subject only to the limitations specified in this clause, namely, that NASA

"will give due regard to the contractor's established Financial Management Information System" and the restriction contained in the Handbook, namely, that the NASA-imposed reporting requirements "shall be limited to the minimum data necessary for effective management."

In summary, NASA, in the above cited regulations and Handbook, requires the use of specified reports for certain types of contractual efforts, but has made provision for cognizant NASA personnel to impose special reporting requirements as long as these do not violate the two restrictions identified above.

Department of Defense (DOD) policies and procedures pertaining to contractor financial management reporting requirements do not apply to NASA. However, much of the DOD instructional material and guidelines are relevant to the problems/issues encountered by NASA, and much valuable information can be obtained from DOD documents on this general subject. The two principal DOD documents are Instructions 7000.2 (Performance Measurement for Selected Acquisitions) and DAR 7000.10 (Contract Cost Performance, Funds Status, and Cost/Schedule Status Report).

3.0 PURPOSES OF CONTRACTOR FINANCIAL MANAGEMENT REPORTING

The data submitted by a contractor in response to the Contractor Financial Management Reporting Requirement should be sufficient to meet the needs of cognizant NASA personnel with respect to their responsibility for the effective management of the contract, and also the needs of NASA's accrued cost accounting system. Data to satisfy the latter purpose are simple by-products of the data required to satisfy the first-stated purpose. The term "cognizant NASA personnel," as used herein would in all cases include the

Contracting Officer (CO) and the Technical Representative of the Contracting Officer (TRCO), and would also include project or line management or functional support personnel (e.g., Resource Analyst) if such personnel are assigned duties related to a given contract. The term "Analyst" will be used to identify the NASA person responsible for the resources planning and control functions on the subject contract.

Let us look at the needs of these NASA personnel. We should first consider that a given contract is typically a part of a larger programmatic entity, for example, the Research and Technology Objectives and Plan (RTOP) or a project. As a general rule, if a requirement for 533 reporting has been established on a contract, it is reasonable to assume that the resources required for the effort are large enough that the effort has a significant bearing on resources planning and control at the RTOP or project level. If such a contract is part of a project effort, it would normally be a discrete "line item" in a detailed all-years resources plan for the project which would be developed and maintained by a Resources Analyst or someone assigned this task by the Project Manager. These plans are normally prepared for obligations and costs, as well as for commitments if deemed appropriate for control purposes. The analysis of status and outlook relative to such plans is extremely important to the Project Manager; this is essential to the development of funding requirements, the project-level decision-making process, and for effective communications with NASA Headquarters personnel. These data are also necessary to meet certain externally-imposed requirements such as the Program Operating Plan (POP's), RTOP's, Management Information and Control System (MICS) reports, special Headquarters' requests, and periodic audits.

The validity and, therefore, the utility of the above cited data at the project (or comparable organizational level) is a direct function of the validity of related data at the contract level. In this regard, the analysis of 533 reports is essential for overall

project planning and control. Proper analysis of a contractor's 533 reports in conjunction with other related information also provides the TRCO and the Project Manager with important information for making decisions at the contract level. A reasonably accurate assessment of a contractor's resources status and outlook will permit NASA to consider options and exercise prerogatives which would in some instances otherwise not be possible. In this regard the subject of overruns warrants specific comment. The early detection of potential overruns permits the TRCO and his management to address such questions as whether certain work areas should be modified or cancelled in view of (1) the results achieved/ problems encountered to date vis-a-vis the project level cost status/outlook, or (2) changes in external factors (e.g., new Headquarters' plans/constraints). As a general rule, the identification of a potential contract cost overrun is a signal that a contract warrants special management attention. Even if a management decision is made not to take actions to eliminate or minimize the foreseen overrun, this should be the result of a review of all aspects of the situation, not the least of which is the financial status/ outlook.

Analysis of 533 reports at levels 2 and 3 can help to size known or potential resources problems. The TRCO will generally be aware of the areas where the contractor is currently having significant technical or schedule problems as a result of his close interaction with contractor technical management personnel. However, the resources status/outlook in subareas is not always visible to these technical personnel. As a general rule, these personnel are unlikely to volunteer such information even if it is known to them. The 533 reports, with appropriate narrative information, are designed to bring together all of the elements which quantify the resources picture by subarea as well as for the total contract. To the extent that there is an understanding and agreement as to the resources status and outlook at the subarea level of the contractual effort, decisions can be made by NASA and contractor project management personnel which have been consciously developed to effect optimal results regarding technical, schedule, and cost performance.

The 533 reports (with appropriate narrative information) provide a common reference for effective communication between NASA and contractor management personnel. For example, if several options are presented by a contractor at a management review of a contract immediately prior to the start of flight hardware fabrication, the presentation should include an assessment regarding the cost, effects, and implications of each option. If the contractor recommends additional destructive system level testing, NASA personnel must consider the cost as well as technical performance/risk and schedule implications. In a case such as this, if the contractor had been submitting good cost information on 533 reports, with appropriate narrative comments, NASA personnel would have knowledge of, or ready access to, relevant cost data. This would facilitate their understanding of the contractor's recommendation, and give them a reference for judging the reasonableness of the contractor's proposal relative to the cost impact. NASA personnel would have more confidence that sufficient information was available to make a timely decision rather than sending the contractor "home" with instructions as to additional information required for NASA to consider their recommendation. In many instances, such delays are very costly.

It has been mentioned that the cost data submitted by the contractor must meet the needs of NASA's accrued cost accounting system. This requires timely submittal of accurate bottom-line cost data - the actual costs to date and the costs expected to be incurred during the remaining periods of contract performance. The Analyst should make sure that valid data are provided to the cognizant LaRC office in a timely manner to satisfy this requirement. If the Analyst has reason to believe that the data submitted are not valid, he should see that the cognizant office receives the best cost data available to meet their current needs and initiate corrective action with respect to subsequent contractor submittals. In this way, the Analyst can be assured of understanding the cost data forwarded to NASA Headquarters by LaRC's Financial Management Division. At times, this is important in order to communicate effectively with the cognizant Headquarters Program Office as to the financial status and needs of the contract or project.

It should also be noted that 533 reports can have value as historical data. Future programmatic decisions regarding activities in the same or related area(s) as a given contract effort can be enhanced if reliable, understandable cost data are available.

There is a need to place 533 reports in a proper perspective relative to other means of reporting and cost analysis as these reports can be misused if an attempt is made for these reports to provide all of the cost-related information needed by NASA personnel. When appropriate, special or periodic comprehensive cost reviews should be conducted with the full participation of key contractor and cognizant NASA personnel. The possible use of cost modeling techniques for cost estimating should also be considered. This is especially appropriate at key points in a hardware development program, for example, critical design review, or when a major reprogramming occurs. Specialists within LaRC's Projects Directorate (PPCO/PMSD) are available to provide any needed support in this area.

It should also be recognized that for the purposes of real-time management by NASA, a considerable amount of important cost-related information will be obtained initially in the form of verbal reports from cognizant contractor personnel or in written form prior to the receipt of 533 reports. Verbal inputs are often obtained by regular periodic, typically weekly, teleconferences involving key personnel of the NASA and contractor project teams, as well as from one-on-one discussions between the NASA and contractor managers and subordinate counterparts, and between the NASA and contractor personnel with functional responsibility for project cost management. In addition, important information is often obtained from copies of current contractor reports, for example, problem or variance reports, cost offset or cost concern reports, and weekly manpower reports pertaining to critical work areas.

In summary, the 533 reports, with appropriate narrative comments, should be thought of as the formal medium for cost reporting, providing an appropriate structure and the

necessary continuity for cost analysis and cost-related management considerations during the period of contract performance.

4.0 NEED FOR SPECIALLY TAILORED REPORTING REQUIREMENTS

The above identified NASA regulatory documents clearly indicate that the NASA 533 series of reports is the backbone of the NASA Contractor Financial Management Reporting System. However, as previously stated, these documents do not constitute a complete, detailed set of reporting requirements for any given contract. Contracts of the size and type requiring "533 Reporting" vary in many respects. A list of the possible differences which affect the appropriate "specification" for Contractor Financial Management Reporting would include (1) total estimated cost of the contract effort and subefforts, (2) nature of the effort relative to cost risk, (3) degree to which the cost of the effort and/or subefforts is controllable, (4) the duration of the effort and subefforts, (5) criticality of the effort or subeffort relative to other dependent efforts, and (6) the contractor's internal management control system(s) and organizational structure. It is only after due consideration is given to these factors, as well as any others that can be identified as being significant, that a definitive statement of reporting requirements can be prepared for a given contract.

In the case of a competitive procurement, the request for proposal will contain a reporting requirement based on the best judgment of the cognizant NASA personnel without regard as to which contractor will be performing the effort. Upon selection of a contractor for negotiation, the cognizant NASA personnel should reevaluate the stated requirement considering all available information regarding the selected contractor's internal management control system(s) and organizational structure. If additional,

relevant information is obtained from the contractor during negotiations, this should also be considered before the final determination of the reporting requirements. In the case of a sole source procurement, it may be possible for NASA personnel to make such considerations at the time the Request for Proposal (RFP) is prepared. This will usually facilitate negotiations.

Why is it so important for consideration to be given to the contractor's internal management control system(s) and organizational structure? Because of the prevailing inertia within a given contractor's organization to manage their efforts "their" way. This includes methods, hardware/software and organizational arrangements for collecting information regarding technical/schedule/resources status and plans, preparing reports, reviewing status, working problems, and interfacing with customers. When a customer imposes a requirement that runs counter to the natural grain of a contractor's established system, rough going can be anticipated. Often a contractor will accede to such requirements in order to avoid delays or complications in the overall negotiation process. In some instances, contractors take the position "if that's what they want, that's what we'll give them," with the best of intentions. The end product will usually be very expensive, and create new problems. In other cases, NASA personnel are successful in selling such requirements to one or even a few of the contractor's key personnel with the result that at negotiations the contractor signs up for these requirements with the intent of changing or augmenting significantly the existing internal system(s). In order for this approach to be effective, the individual(s) on the contractor's team who was sold the NASA approach must then be successful in overcoming the inertia in the contractor's organization/system. In many instances, one organization, for example, Finance or Manufacturing, can prevent the successful implementation of changes necessary to meet requirements agreed to by contractor project personnel. The reassignment of key contractor personnel will also make it difficult to effect significant changes in the way a contractor does business.

It is recommended that consideration be given to the use of selected contractor internal documents to meet reporting requirements. Reports reflecting the status of or plans for selected procurements, drawings, critical items, problem areas, change orders, and deviations from plan(s) might be used effectively on either a regular or as-needed basis. It is often desirable to receive supplemental reports during a particularly cost-sensitive period of a contract effort. An agreement should be reached in advance as to whether an internal report(s) will satisfy NASA/LaRC's reporting requirements.

5.0 ROLE/FUNCTIONS OF RESOURCE ANALYST - OVERVIEW

On a major project, one or more Analysts will normally be assigned to support the Project Manager in the areas of resources planning, control, analysis, and reporting. The Analyst is part of a project team which in the case of a major contract involves a TRCO who has overall responsibility for contractor performance (technical, schedule, and cost). The Analyst supports the TRCO(s) on the project team as well as the Project Manager. Normally, support is provided to the TRCO(s) during both the preaward period and the period of contract performance. Initially, the Analyst helps to develop NASA's position as to the reporting requirements. In some instances, the Analyst, in concert with the TRCO, interacts with contractor personnel during the period between contractor selection and contract award. The purpose of any such discussions during this period would be to ensure there is a mutual understanding of (1) NASA's requirements, as stated in the NASA-proposed contract, (2) the contractor's proposal relative to these requirements, and (3) how (1) and (2) relate to the contractor's established internal systems. After contract award, the Analyst normally provides support to ensure timely implementation of the negotiated reporting requirements by the contractor and adequate reporting during the period of performance, as well as performing analyses of the submitted reports. These functions are discussed in the remaining sections of this paper.

6.0 REPORTING REQUIREMENTS

6.1 Basic Design Approach

There are several principles and concepts which should be kept in mind by the Analyst in addressing the subject of reporting requirements. These requirements can be thought of as a design intended to meet the purposes (performance specifications) of 533 reporting as stated above. This design should be as simple as possible, using consistent, understandable methods to provide valid, timely, appropriate data. As discussed above, the Analyst is the individual on the NASA team with functional responsibility for achieving this design objective.

6.2 Reports Do Not Control Costs

It is important that the Analyst recognize the fundamental principle that cost control systems and cost reporting systems do not control costs. People control costs. No control system, no measurement of performance, no cost estimate, no report of status, is ever an end in itself. The Analyst can provide a valuable service by ensuring that this principle is honored in practice. Cost control systems, if properly designed and implemented, aid people in controlling costs by providing pertinent, useful information in easily understandable form in a timely manner. If the appropriate information is obtained, it will lend itself to meaningful analysis, meaningful in the sense that it provides the TRCO with insights which help him or her to manage the effort.

6.3 Contractual Aspects

The official reporting requirements should be included in the contract. Gentlemen's agreements to receive, on an informal basis, data which cognizant NASA personnel consider

necessary should be avoided. If at any time the Analyst feels this principle is being violated, the matter should be taken up with the TRCO, and Project Manager, if necessary, to correct the mode of reporting. Any communications with the contractor regarding such problems should be made either through or with the full knowledge of the Contract Administrator. The TRCO should coordinate matters of this nature with the Contract Administrator.

If 533 reporting is made a contractual requirement, it is standard practice at NASA/LaRC for the appropriate clause in NASA PR 7.104-53 to be set forth in the contract. Generally, details regarding all contractual reporting requirements are included in an exhibit to the contract schedule entitled "Data Requirements List and Data Requirement Description (DRL/DRD)." The DRL identifies the required reports, indicating submittal requirements, that is, frequency and dates, and what action is required of NASA/LaRC. The DRD contains the instructions for the preparation of each required report. The DRL and DRD for financial management reports contain instructions which supplement those contained in the Handbook and the 533 forms. The instructions are necessary to fulfill the intent of the 533 reporting requirement. There are a number of specific instructions which must be provided to the contractor when 533 reporting is involved. Appendix C contains a checklist of these items. In addition, there are generally several subjects on which supplemental instructions or guidelines are advisable in order to ensure a mutual understanding of the reporting requirement. Appendix D contains an example of a typical DRD, covering several of the subjects on which supplemental instructions are often required, including the content of narrative analyses, changes to baselines, and the use of management reserve.

6.4 General Types of Data Required

In all cases where 533 reporting is required, the contractor must submit reports showing (1) actual (accrued) costs, (2) an original contract baseline plan, identified in the Handbook as the "Initial Report", (3) his current best estimate as to the costs to be incurred in the future, (4) any revisions to his baseline plan, (5) appropriate narrative remarks, and (6) a reconciliation from the original contract value to the present contract value. These data are submitted on 533M and/or 533Q formats or reports submitted with these formats. One additional type of data which is optional under the 533 reporting system is the "Performance" data submitted on the 533P format. All of these types of data, as well as the possible substitution of formats containing the same data as the 533 formats, will be discussed in detail.

6.5 Initial Report

As stated in the Handbook: "An 'Initial Report' in complete detail, 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 unless otherwise specified by the Contracting Officer. This 'Initial Report' will reflect the original contract value detailed in terms of the negotiated reporting categories and shall be the original contract baseline plan." It should be noted that the amounts shown on this report below level one for subdivisions of work, or at any level for elements of cost, or for any particular time period other than the total period of performance are <u>not</u> normally amounts which have been negotiated with NASA. The total dollar amounts are not "priced line items" representing a binding agreement between the contractor and the Government. It is important to recognize that contractors generally submit this Initial Report prior to the development of a comprehensive, detailed budget plan. After the completion of negotiations,

the contractor must perform a number of tasks before a comprehensive, detailed, time-phased budget plan can be finalized. Negotiations will often impact the contractor's tentative resources, schedule, and technical plans. Typically, further coordination with supporting line organizations is required in order for the contractor's Project Manager to establish budgets at the level at which specific individuals will be held accountable for performance. The contractor's Project Manager will normally attempt to retain an amount (typically between 5 and 10 percent of the total contract value) in a "management reserve" account that is then available to cope with any major cost problems not provided for in the assigned budgets (management reserve is discussed further in Section 7.5). In addition to establishing a reserve, the Project Manager often has to adjust his plans to reflect changes in projected direct and indirect rates based on official corporate revisions which must be used. The importance of establishing a detailed, time-phased budget as early as possible after contract award is generally recognized by NASA's prime contractors. However, cognizant NASA personnel must allow the contractor adequate time to develop, coordinate, and approve such a plan.

6.6 Cost Baseline(s)

The instructions for the 533M report state that if planned costs are shown (which is optional), these data "are obtained from the time-phased baseline plan which includes the original contract value plus authorized changes." In the same instruction, the term "planned cost" is equated to "budgeted cost." These terms are not always given the same meaning by different contractors, and there is an even greater probability that a particular contractor does not give these terms the same meaning as they have in NASA's 533 reporting system. Therefore, it is imperative that an agreement be reached as to the meaning of these as well as any related terms as early as possible during the pre-contract-award period.

The Handbook does not make provision for any changes to the detailed, time-phased plan submitted by the contractor in the Initial Report unless there is a contractual action which changes the contract value. This is very desirable and should be adhered to unless there is strong evidence that the circumstances on a given contractual effort are such that this would not be in the best interest of NASA. It is generally in the best interest of NASA for a contractor to establish and maintain a detailed, time-phased budget in a manner which will best contribute to effective management of the contract effort. The application of this principle supports the practice of NASA not just permitting but actually desiring a contractor to make certain changes to the original baseline under conditions other than contract changes. Good judgment and effective communications between NASA and contractor personnel are essential in this regard. In consideration of the importance of this subject, a few examples are appropriate.

It is not a rare occurrence for a major change in approach or design to be made on a research and development effort without having a change in contract value. For example, changes in the predicted environment in which a system will have to function could require a basically different structural design and/or control system than what had originally been planned. Similarly, the unavailability of test facilities essential for the conduct of the original test program could result in significant changes in the schedule and/or major changes in test fixtures or equipment. Changes such as these can significantly affect the cost estimates for various reporting categories and sometimes necessitate additional categories. Other types of changes which frequently affect the anticipated costs in particular categories are direct and indirect rate changes and corporate level make or buy decisions. There are many times when changes such as these are in no way related to the performance of the individual or organization responsible for budgets that have been significantly impacted. As a general rule, companies try to follow the principle that a budget should reflect only those amounts which are controllable by the individual

who is being held accountable, and therefore would make the appropriate budget changes. This preserves the integrity of the budget as a tool for cost control.

Another example of a situation that would normally dictate that budgets be revised is the occurrence of a major change in contractor project management followed by a major review of project status and plans with contractor and NASA management which provides considerable evidence that the original, detailed, time-phased budget baseline is basically invalid, irrespective of whether the effort can be accomplished within the original contract value. At this point, the original baseline has very little meaning as a frame of reference for future management actions. What is needed is a new plan, which is understood and endorsed by the contractor and NASA personnel responsible for the remaining tasks.

It is not possible to set a hard and fast rule as to how frequently a contractor should be permitted to change his cost baseline under circumstances not involving a contract change. The sample DRD in Appendix D reads: "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 extraordinary conditions necessitate such action." This has proved to be a sound general rule on the contracts managed by the LaRC/Projects Directorate. Judicious use of baseline revisions is recognized by the DOD system, as evidenced by the fact that DOD's Cost Performance Report (Form DD 1164) provides for changes in original budgets due to internal replanning and the application of management reserve as well as from contract changes. Industry has long recognized the need for controlled revisions of original budgets, even for highly structured efforts. For example, Bechtel Power Corp., as a standard practice develops a "Definitive Estimate which is the most comprehensive estimate prepared for a project and forms the basis for all detailed cost and schedule budgets. It is prepared prior to the start of construction when engineering is approximately 40-50

percent complete and equipment and materials are approximately 50 percent committed. It replaces all previous estimates and budgets." The author maintains that an equally strong case can be made for revising the detailed budget plan for a complex R&D effort if and when knowledge as to the work to be done differs significantly from what was known when the original detailed plan was developed. A budget is essentially a tool for the use of management in planning and controlling an effort. The best budget is the one which is most useful to management at a point in time.

The 533P report is based on an earned value concept (discussed in Section 7.3) which necessitates the measurement of work accomplished in terms of the value originally assigned to subdivisions of work in the baseline plan. Consistent with this methodology, the 533P report makes no provision for updating of the original baseline during the period of performance other than for the purpose of reflecting contractual changes. Much of what has been discussed above also applies to performance baseline. If possible, it should not be changed unless the total contract value changes; however, under situations such as discussed above it might be necessary to revise it in order for it to remain a meaningful tool. If the work which is currently planned to be performed in various areas has changed significantly from what had originally been planned, it becomes very difficult to assign values to the work accomplished which are based on the original detailed plan. In such cases, consideration should be given to updating the performance baseline plan.

In order to deal effectively with the general subject of cost baseline, it is also necessary to understand its function in a contractor's management control system, vis-a-vis his current "operating" plan and best estimate of future costs. As a general rule, the data obtained as a result of requiring a 533P report will only be worth the attendant cost if the methods used to develop the data are an integral part of the contractor's management control system.

It can be inferred properly from the above comments that the subject of cost baselines is a classic problem in cost control, reporting, and analysis. There are no pat answers or solutions. The 533 reports, per se, do not provide the specifics for handling the range of situations which are encountered. The best guideline for the Analyst to keep in mind is the principal purpose for cost reporting requirements, that is, to provide appropriate visibility as to cost performance and plans for NASA personnel to properly manage the contract effort with respect to cost as well as technical and schedule performance. The approach to a cost baseline (including definition, methodology for development and changes, and relationship to management reserve) which best serves the above purpose is the best approach for NASA.

6.7 Contents of Recurring Reports

Too much attention is often given to the total number of reporting categories, that is, the subdivisions of work within the Work Breakdown Structure (WBS) on which NASA will receive cost data. A preferable approach to this subject is to address two questions: first, whether the reporting categories give NASA appropriate data for the previously identified purposes, and secondly, whether the reporting categories are natural elements of the contractor's management cost control systems, including the manner in which he establishes areas of responsibility/accountability, plans his resources, accumulates resources data, and reviews/approves status and plans.

The Handbook contains a considerable amount of information on work breakdown structures which is directly relevant to the subject of what data should be received from the contractor. Additional guidance can be obtained from the NASA Handbook, NHB 5610.1, "Handbook for Preparation of Work Breakdown Structures." Both documents state that the WBS should be product- or task-oriented, and should be structured in terms of the Statement of Work,

that is, the identified tasks which constitute the contractual effort. This is an excellent general rule. For the purposes of negotiating contract changes, it is of the utmost importance for NASA to have contractor cost data - actuals and estimates - structured in this manner. It is recommended that in all cases, such data be maintained by the contractor and be readily accessible to NASA upon request. It is recommended that 533 reports be structured in a like manner unless a condition exists which clearly indicates that an alternate structure of these reports would be in the best interest of NASA and the Government. In some instances, this will be appropriate because the contractor is managing the effort in a manner which does not correspond to all of the end items. As stated in NASA's WBS Handbook: "The WBS must reflect and represent the way work efforts are to be organized, managed and accounted for." In some instances, it is possible to structure 533 reports in a way that is oriented toward both end items and the contractor's functional organization, for example, breaking out (1) Engineering, and (2) Manufacturing, under a Level 3 hardware system. There is no simple way to determine when circumstances warrant deviating from end-item type 533 reporting. The NASA WBS Handbook contains considerable guidance on this subject. In summary, NASA should get the information needed to properly manage a contract from a cost performance standpoint, and this should be the guiding principle when considering making an exception to the above general rule (i.e., end-item orientation).

The appropriate number of reporting categories is essentially a function of (1) the amount of cost involved, (2) rate of cost incurrence, and (3) relative cost risk. As a general rule, the reporting categories (subdivisions of work) should be in the range of $100K-$500K. It is relevant to note that the NASA requirement for 533 reporting is applicable to all cost-type or fixed-price-incentive contracts with a value over $100k with a period of performance of one year or more. In a sense, the reporting categories on a major contract can be viewed as "mini-contracts." If subdivisions of work are selected

which are in consonance with the above, the number of items, per se, will rarely result in inordinate reporting costs.

It is extremely important that the cost data in 533 reports be organized in the same way, that is, the same entities within the WBS, as schedule data. This permits the correlation of these data for a given subarea of work. It is also extremely important that NASA maintain control of the contract Work Breakdown Structure (WBS). The initial WBS should be reviewed to ensure that it is consistent with NASA needs and approved only when this has been determined. Subsequent changes should be held to a minimum, and the contractor should not be permitted to make any changes without first obtaining NASA's approval. Before granting approval of a WBS change, NASA should obtain information from the contractor as to the effects of the proposed change, including the costs in affected subdivisions of work under the present WBS and the proposed WBS.

In addition to the types of quantified data cited above, it is imperative that appropriate, timely written comments be obtained from the contractor. The Handbook provides guidelines regarding the narrative content to be prepared and submitted by the contractor. However, it is usually advisable to provide the contractor supplementary guidance to ensure that the proper information is received. One approach for doing this is the use of a Data Requirement Document (DRD) which is made an exhibit to the contract. Appendix D contains an example of a DRD which addresses the requirements for narrative comments on several subjects including incurred or potential cost variances, cost concerns and related recovery plans, potential cost offsets, use(s) of management reserve, changes in direct or indirect rates, and baseline revisions. Timely narrative comments on these subjects are extremely valuable to cognizant NASA personnel.

The Handbook specifies the conditions under which 533M and 533Q reports must be received from a contractor. It should be understood that these are NASA's minimum

requirements, and in no way constrain the use of these reports under other conditions when such use is considered to be in the best interest of NASA. On the other hand, it should be understood that NASA's policy, as expressed in the Handbook, is that certain sets of financial data must be received from a contractor under certain conditions. Although these sets of data are identified by reference to forms 533M and 533Q, there is sufficient flexibility in the policy to permit the use of a different format(s), assuming this would provide all of the required data. Thus, there is the possibility of using contractor reports to satisfy NASA's needs and requirements. As contractors make greater use of sophisticated automated systems for financial planning and control, the possibilities of using contractor's reports become much greater. In some instances, the data identified in the Handbook as "533M" and "533Q" data can be combined in one report. There are inherent advantages to the use of contractor reports. However, there is a risk as well. When a contractor employs a "company system" to satisfy NASA's reporting requirements, a certain amount of control is lost. For example, a major change might be made in the system which precludes the preparation and display of data in the same manner as before, or higher priority work might preclude timely completion of the report. Therefore, it is important that NASA obtain a clear understanding with a contractor when his reports are to be used to meet NASA requirements that such reports are acceptable substitutes for the NASA form(s) only as long as all of the data called for on the NASA form(s) are contained therein and the contractor's report is submitted in a timely manner. If such an agreement is reached and is then honored, it is likely that the resultant cost reports will be more valuable than what would have been received if NASA had insisted the contractor either use a separate automated system to generate 533 reports or manually prepare 533 reports using data abstracted from existing internal reports. The above approach is implemented by the use of the expression "533M (or Q, or P, as appropriate) or equivalent" in the contract. No change is made to this contractual language regardless of whether a substitution is permitted.

7.0 GUIDE FOR REVIEW AND ANALYSIS OF 533 REPORTS

7.1 Understanding the Contractor's Report

It is very common for misunderstandings to exist and not unusual for time-consuming problems to arise because a contractor's 533 reports aren't understood. The most basic requisite for understanding the contractor's reports is the use of terminology which is mutually understood by contractor and NASA personnel. The Handbook (Ref., Section 403) and the 533 formats provide some guideline in this respect. It is usually advantageous to adopt a more comprehensive glossary of terms than what is contained in the Handbook. Maximum consideration should be given to any glossary which the contractor currently uses. Section 11.0 contains a glossary of terms which should be useful to the reader in understanding this report. In addition, it can be provided to NASA and contractor personnel as a first step toward achieving an understanding of these terms. In all cases, the definitions in the glossary are consistent with the NASA Handbook.

It is impractical if not impossible to compile a checklist to ensure that 533 reports are totally understandable. However, a few items which seem to cause a great deal of confusion are worth noting, namely: (1) the constituents and dateline of the plan reflected in the 533, that is, what the contractor has included in the plan, (2) the method used by the contractor to correct errors in previously reported plan or actual data, (3) the method used to reflect subcontractor cost data, (4) the rate bases for actual and plan data and how they are updated, (5) the methods used by the contractor to update his estimate of costs to complete the effort, and (6) the status of management reserve.

The Analyst should have a contractor counterpart who either has first-hand knowledge as to what is in the 533 reports or can easily obtain necessary clarifications. It is

usually not cost/time effective for the above kinds of information to be obtained by the Tech Rep through the contractor's Project Manager or technical leads. The Analyst, however, should take the necessary actions to ensure that he understands the contractor's 533 reports, and keeps the NASA TRCO and other cognizant personnel properly informed. In some instances, it is extremely desirable or even imperative for the Analyst to visit the contractor's plant to obtain data or jointly review aspects of the contractor's financial status or plans. If the Analyst has a good understanding of the reports previously prepared by the contractor, it will be much easier to accomplish the objective of such a visit. The Analyst should at all times work in concert with the TRCO and other cognizant members of the project team. With respect to understanding the contractor's 533 reports, this would normally include discussing the report to verify the reasonableness of the contractor's estimates and assessment of status/outlook, and to obtain additional information to enhance his own understanding of the cost status/outlook. In practice, there is normally a considerable amount of two-way communication between the Analyst, the TRCO, and subordinate technical leads as well on very large contracts.

7.2 Review and Acceptance of Contractor Plan

The contractor's Initial (533) Report, containing his "original contract baseline plan" should be reviewed by the Analyst, TRCO, and other appropriate personnel. As a general rule, the TRCO, with the support of the Analyst, should determine who will review each subarea of the contractor's plan, establish a schedule for the completion of these reviews, and provide guidelines and assistance to these reviewers, as required. These reviews should ensure that the contractor's plan is consistent with the contractual Statement of Work and the baseline schedule. The Analyst will usually examine the direct and indirect rates reflected in the plan to make sure these are reasonable, or in any

event are understood vis-a-vis the rates considered reasonable by NASA. The amounts and types of direct labor hours and dollars for materials, subcontractors, and other direct costs should be consistent with the results of negotiations. Special attention should be given to any significant changes since negotiations in contractor estimates for subareas of work, and/or those subareas which presented a significant amount of difficulty during negotiations. The TRCO should establish the approach to be taken with respect to communications between the reviewers and contractor personnel for the purposes of obtaining clarifying information or informing the contractor that certain data, as submitted, are not considered adequate. As a general rule, the latter type of communication should be made by the TRCO, with proper coordination with the cognizant NASA Contract Administrator. The Analyst often supports the TRCO by collecting the inputs of the technical reviews, and integrating the results into a report to the TRCO. This report should identify any deficiencies in the plan that warrant contractor action. The final step in the process is the action taken by the TRCO with the contractor, either indicating that the plan is an acceptable initial baseline plan or identifying the deficiencies which the contractor must correct.

7.3 Variance Analyses

The Analyst should be "on top of" several sets of cost variances on the contract. The term "on top of" is used because of its broad connotation. In this context, it implies not just the knowledge of the significant variances, past and present, but also the existence of any trends, the principal reasons for the variances, what is being done about them, and what the cost forecast is for the affected areas.

The first of these sets of key variances is generally referred to as a budget variance, that is, the difference between actual accrued costs and planned accrued costs

for a period of time or cumulatively to a point of time. The second set is generally referred to as a performance variance, that is, the difference between actual accrued costs and the amounts which would have been accrued if everything that had been accomplished to date had cost what it was estimated to cost in the plan. The third set of key variances is an EAC variance, that is, the difference between what it is now estimated will be expended in total to complete the entire task, including costs incurred to date, and the total estimated cost in the baseline plan. Each of these sets of variances is important for certain resources planning and control functions.

Before discussing each of these types of variances, it might be well to first comment as to what should be considered a "significant" variance. There just isn't any simple definition or set of criteria which can be used to determine whether a given variance is significant. It is safe to say that a variance is significant if the amount is great enough to affect contract level planning. However, some variances are clearly significant which are not large dollar amounts, for example, when a critical resource is involved or a cost is first incurred in a subarea of work which was not in the baseline plan. Consequently, it is usually not advisable to define a "significant variance" solely in terms of one quantified value such as dollar amount or number of manhours or even a combination of such an absolute value and a percentage, for example, a positive or negative variance of either $50,000 or 10 percent of the total budget for any subarea. It should be noted that significant variances can be favorable (positive) as well as unfavorable (negative). For example, poor initial planning with an unreasonably large amount of effort budgeted in the near term (called front-end loading) can produce "favorable" variances which have no bearing on the true cost outlook.

Budget Variances. - The "budget" variance is by far the simplest to obtain from the contractor and normally is the most easily understood of the three types of variances. If

the baseline plan is understood, the data used to determine the budget variance normally do not present major problems. A potential problem in time phasing of actual costs exists where significant subcontract or materials costs are involved. In such cases, the same criteria should apply for the incurrence of actual costs as in the development of the time-phased baseline plan. Guidelines for determining when various types of costs should be considered to have been incurred and reflected as actual accrued costs are contained in Section 301.4 of the Handbook. Budget variance data are useful in assessing whether the contractor has a viable near-term plan. These variances identify specific areas where resources are not being used according to the plan. This can be helpful in identifying or sizing current or potential schedule and/or resources problems.

Performance Variances. - The Analyst must also keep informed as to any "significant" performance or EAC variances. The contractor's assessment must be understood, and a government position should be developed regarding each of these sets of variances. Proper assessment of performance variances requires considerable knowledge and skill. The Handbook contains some guidance on this subject in its coverage of the optional 533P report. However, additional guidelines are required for a contractor to implement a control system which will generate valid performance variances. Several major considerations must be made if an earned value type of assessment is going to be used, including how values will be determined for ongoing efforts as well as the method of baseline maintenance (or revision), which has been discussed. If at all possible, the value of work performed should be determined by an objective criteria, for example, drawings completed or parts assembled. However, this is often not possible. As a general rule, NASA/LaRC contracts do not include a high percentage of repetitive work. To the contrary, they typically contain a high percentage of engineering design and analysis and experimental shop types of efforts which are only performed once and do not lend themselves to detailed advanced planning, much less the assignment of predetermined values for all required

subefforts. The traditional, production-oriented approach to performance evaluation (utilizing established standards for various tasks) is typically relevant to only a small percentage of the total effort. One approach for assigning values for subefforts which cannot be planned in detail at the outset of the effort involves the use of a "Performance Measurement" milestone schedule. Such a schedule contains the values to be assigned when the specified intermediate milestones within the subeffort are completed. This type of approach requires thorough coordination by the Analyst with the TRCO and subordinate technical leads, if applicable, in order to be successful. A popular method for assigning values for in-process work is often referred to as the "50/50 rule." By this approach, as soon as effort commences on a work package (the lowest unit of work which has been assigned a budget for purposes of performance measurement), 50 percent of the total value is assumed to have been earned, and when the effort is concluded, the remaining 50 percent is considered earned. This method is simple to implement, and if the work packages are of short duration, the results are reasonably accurate. As a general rule, work packages being used for this purpose should rarely exceed two months.

If the TRCO makes a decision to require a contractor to provide a performance (i.e., earned value type) assessment, it is highly recommended that an existing contractor system be used. If this approach is taken, it is imperative that the Analyst understand the contractor's system, including how the contractor will determine the dollar values to be credited for the work which has been accomplished and how the contractor will apply the derived experience factor to future work. (The latter subject will be discussed below.) The Analyst should keep in mind that performance variances are only meaningful to the extent that they can rightfully influence future management decisions. The relatively high costs attendant to developing and maintaining a comprehensive performance assessment system make it especially important to keep this principle in mind.

EAC Variances. - The performance variance is actually an element of the EAC variance. In one sense, the EAC variance is the sum of the performance variance, as defined above, and the difference between the estimated cost of the efforts not yet accomplished, as reflected in the reference plan, and the current estimated cost to accomplish these remaining tasks. The EAC variance is more commonly thought of as the difference between the current EAC (the sum of the cumulative accrued costs and the estimate to complete) and the contract value. Each concept has advantages and disadvantages. The latter concept is simpler, which is a plus in its favor. It is usually more congruous with the resources planning and control methods employed by contractors on R&D efforts. For this reason, its use by NASA provides a means for assessing EAC variances in a form which is usually more readily understood by contractor personnel than performance variance data. This is a distinct advantage; to the extent that key NASA and contract project personnel can talk the same language regarding variances, the decision-making process is enhanced with respect to resources considerations.

ETC Variances. - The estimate to complete (ETC) can be derived in several ways. First, it can be projected on the basis of the efficiency rate to date. This is an extension of the earned value concept. For example, if the contractor expended $125K to accomplish work that was planned to cost $100K, his efficiency rate was 100/125 or 80%; if the work remaining to be performed was planned to cost $200, the ETC would be $250K (200K/.8). The simplicity of this approach is appealing. However, considerable caution should be taken with respect to its application since it is very likely not a valid indicator if the remaining work differs from the work performed to date or if major changes in methods and/or personnel have been recently effected. Its best usage is probably to identify what future costs are likely to be <u>if</u> the past repeats itself with further identification (and discussion) of cost impacts which might be experienced under different circumstances, for example, higher productivity due to change in machinery or design.

In recent years, the various DOD service components utilizing the Cost/Schedule Control Systems Criteria (C/SCSC) have developed ways to overcome the disadvantages of a direct application of the performance or efficiency factor to future work. The principal method used has been to make an adjustment to the above factor for the purposes of estimating the cost of the remaining effort. It should be noted that in certain cases a valid ETC can only be developed by a comprehensive bottoms-up review by the contractor personnel responsible for each remaining subeffort, with proper coordination with the NASA/LaRC TRCO and the members of his team. In some cases, it is appropriate to develop an ETC by more than one method, even if a bottoms-up ETC is developed. For example, if several hardware units have been completed, and several more are in various stages of completion, it might be possible to develop an ETC based on unit costs using existing data. Likewise, in some cases cost data for similar efforts on other contracts can be used.

As a general rule, the ETC variance analyses become more important as the contractual effort progresses toward completion although it deserves attention throughout the project life. When the big unknowns in design are finally a thing of the past, and the remaining effort can be addressed and sized on a periodic basis without an inordinate amount of time by cognizant personnel, the reasons for the variances incurred to date (i.e., since the very beginning of the contract effort) usually are not directly relevant to the resources-related issues/problems that NASA personnel are currently faced with. By way of contrast, during the early phases of a typical R&D effort, it is not cost/time effective for the NASA project team to make a monthly EAC assessment based on a comprehensive review of all of the remaining tasks. The improvement in the resultant EAC versus the last EAC which was developed from a bottoms-up review of each subarea of the effort would not normally justify the time which would have to be put into the update. The contractor would normally not change his internal plans or budgets on a monthly basis for the same reason. It should be noted that the instructions for completion of the NASA 533 reports often

require clarification in this regard. The 533M provides (optionally) for a contractor update of all of his forecasts, by time period, for all reporting categories (both subdivisions of work and elements of cost, including subcontracts) on a monthly basis. It is usually not cost/time effective for a contractor to do this every month in a controlled, consistent, traceable, well-documented manner.

One approach to ETC reviews which warrants consideration (based on past successful applications) is for the TRCO and his team to comprehensively review all remaining efforts at several key points during a contract effort, for example, design reviews and start of manufacturing. The duration between such ETC reviews will vary considerably but will typically be three to nine months. During the interim period, the NASA team will review monthly, in detail, the contractor's near-term plans, as well as current status, problems, and so forth. In addition, as part of the monthly review, the team will also consider areas of cost concerns and possible cost offsets, including possible impact on future costs. This will be discussed in detail in a subsequent section.

It is important that the contractor provide appropriate narrative comments regarding both performance and EAC variances. The Analyst should consolidate these inputs with any information he obtains from other sources, especially the comments of cognizant NASA personnel, in making his own assessment.

Rate Variances. - In addition to the three types of variances discussed above, the Analyst should look at any other types of variances which might be useful for resources planning or control. As a general rule, both direct and indirect rate variances should be examined. Direct labor variances should be looked at in terms of rates and quantity (hours). These two components of the labor dollar variances can easily be identified by comparisons of actual data and projections with the corresponding rates and quantities in

the reference plan. Causes of any significant incurred or projected variances should be understood including recent or planned actions such as wage agreements. Changes in skill mix and the cost impact of the rephasing of efforts should also be addressed.

Because of the relative size of indirect costs, typically more than 60 percent of total contract costs, an Analyst must also be on top of this element of cost. The bases for the indirect rates in the "actual" and planned costs reported by the contractor should be known as well as the reasonableness of these rates. The latter objective should be met, if possible, by working through the cognizant LaRC Contract Specialist (CS) in the Acquisition Division, normally LaRC's designated contact point with the Contract Administration Services Components, the Government offices which administer contractor indirect rates in regard to contracts with the Federal Government. However, if the CS does not provide the necessary information, the Analyst should make direct contact with the cognizant field office. On cost-reimburseable type efforts, contractors will sometimes use provisional, indirect rates which are really estimates in the preparation of their 533 reports. These rates are, of course, subject to adjustment when the final rate determination for a given year is completed. In some instances, the difference between these rates can represent a significant amount of dollars. The indirect rates used by contractors to estimate future costs can have an even greater effect on the EAC. Contractors will sometimes overstate indirect rates in "out years," that is, beyond the current year, because of basic conservatism in estimating their future business base. However, it is also possible for business conditions to change significantly, for example, when a major contract is cancelled or does not materialize as anticipated, which could result in higher actual rates than those used by the contractor for estimating his future costs.

It should be noted that there are only a few exceptional cases where the indirect rates charged against NASA contracts should be different from the rates generally

applicable to Government contracts. If the Analyst feels that a preferential, that is, lower than standard, rate should apply, this should be pursued with the cognizant LaRC Contract Specialist. This should only be done if a very substantial dollar amount is involved since what is at issue is the allocation of costs among Government agencies and not the total costs charged to the Government.

7.4 Schedule Impacts

The Analyst should know of any actual or anticipated major schedule changes, especially schedule delays, as the time-phasing of cost incurrence can have a substantial effect on the total cost of a given effort. There are three potential factors to be considered: (1) general wage and price escalation, (2) nonproductive direct labor charges, and (3) the indirect rate time profile. Virtually all major costs on cost-type contracts are affected by general price escalation. On multimillion-dollar contracts, schedule delays often result in substantial additional costs due solely to such escalation. For example, if efforts estimated to cost $10M are accomplished an average of 6 months later than planned and are impacted by an average escalation rate of 10 percent per year, cost growth of more than $500,000 will be experienced. It is important for the Analyst to have a general understanding of the schedule(s) on which the contractor's cost estimates are based. If the NASA project team's schedule assessment is different from the contractor's, this must also be considered by the Analyst. The second-mentioned schedule-related factor, nonproductive direct labor charges, is often described as the taximeter effect, that is, when charges are being incurred irrespective of the amount of progress being made. This is generally due to the need for the contractor to maintain continuity in the staffing of an effort. Key project management personnel and personnel who possess critical skills or knowledge as a result of their previous participation in the effort

often must be retained on a full-time basis during a period in which they cannnot make a contribution commensurate with their abilities. The resultant cost variance appears as a negative performance variance since little is being accomplished for the amount of dollars expended. Lastly, it is important to know whether changes in the time of cost incurrence will result in signficantly different indirect costs due to the application of different rates.

7.5 Management Reserve

Management reserve is a subject which has in the past caused some misunderstandings and confusion on NASA/LaRC contracts. It is an important tool for project management, and should be understood by cognizant NASA personnel. For discussion purposes, let us use the definition of management reserve in DOD's Defense Acquisition Circular No. 76-17, dated September 1, 1978: "An amount of the overall contract budget withheld for management control purposes rather than for the accomplishment of a specific task or set of tasks.... (It) is an amount set aside as a part of the budget process, from within the negotiated (total) contract costs.... (It) need not be identified as a part of the contractor's pre-negotiation program planning or the negotiation phases of system acquisition." DOD's C/SCSC permits the use of a management reserve provided that adequate identification and controls are maintained, and the DOD procedures for a pre-contract-award review of a prospective contractor's internal management system cover this subject. The NASA Handbook does not address management reserve; therefore, it is especially important that this subject be covered in supplemental instructions.

If a contractor has an effective cost management system, he will normally establish a management reserve on a cost reimbursement R&D contract as well as procedures for the use

of this reserve. The information submitted by the contractor regarding the use of this reserve, in concert with information as to current cost concerns/cost offsets (discussed below), provides a great deal of quantified as well as narrative information relevant to the contractor's assessment of the financial health of the effort.

7.6 Cost Control Techniques

It is standard practice for the instructions accompanying a RFP pertaining to a major cost-type contractual effort to require a prospective contractor to submit information regarding his system(s) for controlling costs. One of the essential components of an effective system is a method of identifying, in a timely manner, potential cost problems or areas in which costs could possibly be reduced, and reviewing these items in a systematic manner that results in appropriate management decisions. In LaRC's project environment, this is generally referred to as a Cost Concern/Cost Offset (CC/CO) system or discipline. A CC/CO discipline should identify problem areas with significant potential, adverse impact on cost (cost concerns), or potential cost reduction items (cost offsets) in a timely manner so that management attention can be directed to these areas. At any point in time, it should be possible to determine a meaningful EAC based on (1) actual costs to date, (2) the reference plan recognized by NASA and contractor project management, and (3) an assessment of the current cost concerns and cost offsets. Such an assessment requires that each cost concern and cost offset be considered individually and pro forma judgment made as to whether the item is valid, that is, whether it will happen, and if so, the amount of increase or decrease in cost which will result. In some cases, this entails hypothetical decisions necessitating out-of-scope contract changes or "acceptance" of in-scope growth which will result in an overrun condition. It must be recognized that this method of EAC determination is not, as a general rule, intended to produce a set of EAC numbers at each sublevel of the WBS. In some instances, this will be a natural fallout of

the above approach; for example, when all of the costs related to a specific CC or CO are within one subdivision of work and one element of costs. However, there will often be CC's and CO's which involve more than one subdivision of work or element of costs, for example, indirect rate variances or major technical problems during a systems level test which will necessitate hardware changes. It should also be noted that both cost concern(s) and cost offset(s) could apply to the same subdivision(s) of work. For a subdivision of work covering hardware fabrication, there could be a cost concern due to an inordinately high rejection rate resulting from tooling problems and also a (potential) cost offset item based on a reduction in the number of units to be fabricated which could be made if a proposed change in the test plan was approved. If both of these items have significant resources implications, each should be identified, one as a cost concern and the other as a cost offset.

A cost concern/cost offset discipline should have continuity on a month-to-month basis. There should be narrative comments by the contractor explaining what actions have been taken or are planned regarding the items in the previous month's report or any new items. In the latter case, there should also be narrative regarding causes of concerns or the rationale for any potential offsets. In either case, items should be quantified as to their probable resources impact at the earliest possible point in time.

The specific procedures and guidelines for a cost control system such as the cost concern/ cost offset should be tailored to meet the needs of a given project considering its management structure, roles and functions of various participating government agencies and contractors, amount of dollars involved, and schedule criticality of the effort. Appendix E, page 1, contains an example of a cost offset item. This is a copy of a specific cost offset from NASA/LaRC's Project Viking, except that actual names have been removed. The names of both the NASA and prime contractor responsible managers appeared on

the form, and the items were coordinated at that level prior to being entered into the CC/CO system. Note that this example reflects the recommendation of the cognizant NASA/LaRC manager to the NASA/LaRC Level 2 manager. This item would then be reviewed by the Project Change Control Board, if the proposed change met the criteria for its review. It should also be noted that this example involves potential cost savings in two different Level 3 subdivisions of work. Appendix E, page 2, contains the form used to document a specific cost concern on Project Viking, including the actions taken to resolve the problem. The results of the disposition of both cost offsets and cost concerns were reflected in a record of management reserve status, which was reviewed frequently by both the contractor and NASA Project Managers.

7.7 Trend Analyses

The Analyst should identify any significant trends in a contractor's 533 reports. This requires the collection and arrangement of appropriate data over a period of time. Graphical displays of such data are often more effective than tabular presentations. The data most often used for trend analysis are: (1) actual versus planned cumulative costs, (2) cost variance, by period, in dollars and/or percent, (3) application of management reserve dollars over time, (4) performance indices by period, and (5) direct and indirect rates over time. If the contractor makes use of trend data as a part of his regular management control/review process, these data should be given special attention by the Analyst. Examination of trends in such data can make it much easier to assess the cost outlook of an effort. It can also provide an easily understandable reference for important discussions among NASA and contractor personnel on cost-related subjects.

Appendix F contains three samples of charts reflecting cost performance over a period of time which have proved very effective for discerning trends. The sample chart on

page 1, entitled "Variances," is the standard chart for reflecting the cost and schedule variances determined by use of an earned value type assessment. It should be noted that the cost variance is limited to the difference between actual costs to date and the amount of value which has been credited for what has been accomplished. Any "cost variances" which are projected for the remaining work are reflected in the ETC and, of course, the EAC. It should also be noted that this sample contains a schedule variance expressed in terms of the dollar value assigned to the work packages making up the total contractual effort. A word of caution is in order regarding the use of this variance. It does have meaning for the sake of understanding the reason(s) (other than cost performance) why actual costs are different from planned costs. However, the schedule variance should not be translated into an "equivalent" period of time, for example, three months, and then cited as a valid measurement of schedule status.

Page 2 of Appendix F contains a sample chart entitled "Cumulative and Monthly CPI." The data shown are derived from the basic cost data contained in the standard earned value chart. The cost performance index (CPI) equals BCWP/ACWP, that is, the budgeted cost of the work performed (accomplished) divided by the actual cost. Assuming that the budget plan was established in a consistent manner, the CPI over a period of time is a valid trend indicator of cost performance vis-a-vis the baseline (budget) plan. An alternative method is sometimes used to show the relationship between actual cost and BCWP, namely, the reciprocal of CPI, which is equal to ACWP divided by BCWP. This is sometimes identified as CPI (P), and the former "efficiency" index is sometimes identified as CPI (E). The reader is cautioned that there is not a universally-adopted term(s) for this index(es). Both indexes are meaningful if based on valid data. I recommend that the one which is most easily understood by the users be used.

The sample chart on page 3 of Appendix F entitled "Management Reserve and Cost Variance," is a simple format for showing two key cost parameters which are generally

interrelated. The initial amount of management reserve is the difference between the contract value and the baseline budget plan. Therefore, the changes in the cost variance vis-a-vis changes in the management reserve indicate the amount and rate of change from the baseline plan. It should be noted that there is not a constant relationship between these parameters. Although management reserve tends to decrease over time, there can be increases, for example, when a major test or hardware unit is eliminated from the plan without any decrease in the contract value. Likewise, although the cumulative cost variance tends to increase over time, it can decrease based on favorable cost performance for a given period.

8.0 ANALYST'S REPORT

If data have been received from the contractor consistent with what has previously been discussed, and the Analyst has maintained an effective working relationship with the TRCO, other cognizant NASA personnel, and key contractor personnel, the Analyst should be able to prepare independently (or as an active participant in a joint effort) a meaningful report identifying the resources status and outlook on a contract effort and make appropriate recommendations to the TRCO and/or project management. It is beneficial for the Analyst to work out a mode of operation with the appropriate personnel to ensure proper coordination prior to the preparation of his report. It is not a good idea to specify a particular format for such a report since so many different situations are encountered; however, it is advisable to prepare reports on a given contract in a consistent manner, using the same basic format for each report. As a general rule, the report should, as briefly as possible, indicate the current "health" of the effort from a resources standpoint with reference to the currently recognized baseline plan which should be identified. Variances encountered to date or anticipated in the future should be discussed. Major

changes since the last report, significant plans in the near future (e.g., a comprehensive ETC review), and major cost concerns and/or potential offsets should also be discussed.

It is difficult to generalize as to how the report should address any possible changes in contract value due to change proposals currently in process. In many cases, the discussion of current cost concerns and potential cost offsets will have covered these items. If it is possible for the Analyst to clearly identify the anticipated cost impact of contract changes under consideration, this should be done. However, because of the complexity and sensitivity of some change proposals, this is often not possible. Accordingly, in many instances, it is preferable for the Analyst or another specialist to address the subject of contract changes in a separate report.

The Analyst's Report is enhanced by the use of a standardized summary page of key data such as the sample format shown in Appendix G and the use of such a summary is highly recommended. It should be noted that this format includes data based on assessment(s) by both NASA personnel and the contractor; any differences should be discussed in the body of the report. All of the data contained in this format have been discussed above.

The regular usage of a standard format such as this one makes communications among cognizant NASA personnel much easier, especially for the purposes of keeping higher management informed as to the overall status of the effort. It also facilitates communications between NASA and contractor personnel. In the case of cost concerns and cost offsets, this is especially important since decisions regarding these items often involve NASA as well as contractor personnel. This type of standardized summary also serves the purpose of documenting the current NASA cost analysis at the contract level which can be the backup data for management reports and LaRC-NASA Headquarters' resources control documents, including POP's and RTOP's.

Contract cost analysis is often the most important aspect of the resources planning and control function on major NASA/LaRC R&D projects. Timely, clearly written reports containing valid data, assessments, and appropriate recommendations are a requisite for the effective performance of this important activity.

It should be noted that within the LaRC Projects Directorate, it is a standard practice for a joint (technical, schedule, and cost) assessment to be made monthly on each major R&D effort. Typically, this assessment involves the TRCO and the Analyst(s) providing cost and schedule control support. When this procedure is employed, the Analyst does not prepare a separate report but rather ensures that the above described material is included in the Joint Assessment Report.

9.0 CONCLUDING REMARKS

It should be recognized that the NASA system for contractor financial management reporting, which utilizes the Form 533 series of reports, is extremely flexible and requires a number of decisions to be made by the NASA TRCO in order for it to be used effectively.

The amount and type of cost information required to be submitted by a contractor should be a direct function of the needs of the NASA TRCO and his management.

The amount and type of information required to be submitted by a contractor should take into consideration the contractor's internal management systems. Strong consideration should be given to the use of existing contractor reports to satisfy the NASA reporting requirements.

Contractor resources (cost and manpower) reports should be structured in the same way as technical progress and schedule reports, and should follow the contract WBS.

As a general rule, contractor cost reporting (533 or equivalent) should be mission- or end-item-oriented, and should be compatible with the Statement of Work in the contract. If the contractor's management approach makes reporting in this way less desirable for NASA, then an alternate form, for example, one which reflects the contractor's project management approach, should be adopted, assuming that the resultant reporting is adequate for NASA's purposes. However, in all such cases, the contractor must be able to provide NASA, in a timely manner upon request, cost data which are mission- or end-item-oriented. This is imperative for the purposes of negotiating contract changes, and at times is valuable for the purpose of estimating costs for similar efforts, for example, a follow-on mission.

It is essential that appropriate narrative comments, signed off by the contractor's Project Manager, accompany each cost report (533 or equivalent) submitted in response to NASA's reporting requirements.

The proper design of contractor cost reporting requirements is essential for effective cost control. However, it should be recognized that certain modes of communication, in addition to 533 (or equivalent) reporting, are essential for effective cost management of a cost-type contractual effort. This includes frequent discussions between the NASA TRCO and contractor Project Managers, and timely discussions on an as-needed basis between the NASA and contractor personnel with functional responsibility for cost management.

It is imperative that a contractor have a viable, time-phased cost plan at all times. This plan must be understood by cognizant NASA personnel. Changes to a contractor's cost plan should be held to a minimum, and in all cases should be coordinated with the NASA TRCO.

A contractor's reports should contain narrative comments regarding any significant variances to his cost plan, including causes, actions taken or planned, and anticipated impact.

The NASA Analyst should ensure that the contractor's report is understandable, timely, and valid. The Analyst should consider not just the information submitted by the contractor, but also information from the NASA TRCO and other cognizant NASA personnel, cognizant contractor personnel, and other sources when applicable.

The NASA Analyst should prepare monthly a briefly written report containing the results of his or her analysis. The same basic format should be used each month. The current EAC as well as major cost variances, both existing and projected for the remaining efforts, should be identified and discussed. Appropriate use should be made of graphic presentations to illustrate cost status and possible trends. It should be written for prime use by the NASA TRCO, but should be written in a manner which considers possible use by other cognizant personnel, for example, the NASA Project Manager.

It is essential that 533 reports not be thought of as merely a way of tracking a contractor's costs, but rather as a source of data which can, with proper analysis, provide insights of value to the NASA TRCO, and, as appropriate, other NASA management personnel.

Lastly, anyone involved in the difficult task of controlling costs on cost-type contracts or interested in understanding this subject must never lose sight of the fact that systems do not control costs. It is imperative that the NASA TRCO and his team have appropriate cost information in a timely manner. However, 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.

10.0 APPENDIXES

A. NASA MANAGEMENT INSTRUCTION (NMI) 9501.1B, CONTRACTOR FINANCIAL MANAGEMENT REPORTING SYSTEM

B. NASA PROCUREMENT REGULATION (PR) 7.104-53, NASA FINANCIAL MANAGEMENT REPORTING

C. CHECKLIST FOR THE NASA USER OF THE NASA FORM 533 SERIES OF REPORTS

D. EXAMPLE OF DATA REQUIREMENT DESCRIPTION (DRD) USED IN MAJOR R&D CONTRACT

E. EXAMPLES OF COST OFFSET AND COST CONCERN FORMS

F. SAMPLE FORMATS OF COST HISTORY AND PERFORMANCE CHARTS

G. SAMPLE FORMAT OF ESTIMATE AT COMPLETION (EAC) ASSESSMENT SUMMARY

NMI 9501.1B

March 25, 1974
Effective date

Management Instruction

SUBJECT: CONTRACTOR FINANCIAL MANAGEMENT REPORTING SYSTEM

1. PURPOSE

This Instruction restates NASA policy, responsibility and procedures governing NASA Contractor Financial Management Reporting System.

2. APPLICABILITY

This Instruction is applicable to NASA Headquarters and field installations. For the purposes of this Instruction, "field installations" shall be construed to include NASA Pasadena Office.

3. POLICY

a. The NASA Form 533 series of Contractor Financial Management Reports (see *"Procedures for Contractor Reporting of Correlated Cost and Performance Data," NHB 9501.2A)* shall be the basic financial management medium for:

(1) Reporting correlated information needed by NASA project management for the evaluation of contractor cost as it relates to schedule and technical performance;

(2) Reporting actual and projected data necessary for assuring that contractor performance is realistically planned and supported by dollar and labor resources; and

(3) *Inputting contractor cost information into the NASA cost accounting system as set forth in the Financial Management Manual 9240.*

b. Necessary reporting requirements for the management of a project and for related contracts shall be determined as early as possible in the project planning stage. The requirements, which may vary among projects and contracts, shall be limited to the minimum data necessary for effective management. Firm reporting requirements shall be established by agreement prior to contract award

*Changed by this revision

and shall be included in the contract. These requirements shall be held as firm as possible throughout the ensuing life of the contract in order to insure continuity and consistency of information. However, any required changes in reporting requirements will be accomplished by appropriately negotiated contractual modifications.

c. Generally, the contractors' internal financial management information reporting system will be capable of supplying the detailed and summarized data for the NASA financial management reports. It is recognized, however, that there may be instances when the contractor will abstract selected data from his financial management information system to prepare the NASA reports in a consistent manner. The data reported will be the basis of NASA/contractor communication on financial planning and controls.

d. The instructions for reporting are covered in NHB 9501.2A and on the reverse side of the forms and are normally the maximum requirements for this information. NASA requirements shall be delineated in the contract after being specified by the responsible Headquarters and/or field installation officials through the contracting officer, either in the RFP or prior to completion of negotiations with the contractor.

e. The NASA Procurement Regulation sets forth the standard contract clauses for NASA contractor financial management reporting. Requests for deviations from the financial management reporting provisions of the NASA Procurement Regulation will be submitted to the *Assistant Administrator for Procurement* for approval in accordance with NASA Procurement Regulation 1.109. The *Assistant Administrator for Procurement* will obtain the concurrences of the Director of Financial Management and the Official in Charge of the cognizant Headquarters program office.

4. RESPONSIBILITY

a. The Director of Financial Management, NASA Headquarters, is responsible for the development, implementation, and maintenance of the Contractor Financial Management Reporting System.

b. Officials in Charge of Headquarters program and staff offices are responsible for monitoring the utilization and results obtained from the reporting system and recommending measures for its improvement to the Director of Financial Management, NASA Headquarters.

5. CONTRACTOR REPORTING PROCEDURES

Contractor financial reporting procedures are set forth in NHB 9501.2A. NHB 9501.2A is not to be rewritten or issued in any other form. It is

*Changed by this revision

available to non-NASA personnel from the NASA installation contracting officer or the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

6. INTERNAL NASA OPERATING PROCEDURES

a. The Director of Headquarters Administration Office, NASA Headquarters, and Directors of field installations will issue internal implementation procedures covering:

(1) The analysis and evaluation of the reports content;

(2) The completeness, timeliness, and the adequacy of the reports;

(3) The identification of responsibility for an evaluation of the effectiveness of the contractors' financial management performance; and

(4) The provisions for the necessary actions required to resolve with a contractor any deficiencies noted in the evaluations and analyses.

b. Audit efforts will normally be directed towards establishing the adequacy and reliability of the data generated by the contractors' system.

c. Directors of field installations will forward two informational copies of internal implementing instructions to the Director of Financial Management, NASA Headquarters.

7. CANCELLATION

NMI 9501.1A, dated May 1, 1967.

A. C. Lilly

NASA Comptroller

DISTRIBUTION:
SDL 1

NASA PROCUREMENT REGULATION
CONTRACT CLAUSES

7. 104-53 NASA Financial Management Reporting. When financial management reporting on NASA Form 533 series of reports is required (see NASA Management Instruction 9501.1B. "Contractor Financial Management Reporting System" and NASA Handbook 9501.2B "Procedures for Contractor Reporting of Correlated Cost and Performance Data") such requirement will be set forth in the Procurement Request, and the appropriate clauses set forth in (a) and (b) below shall be set forth in the contract.

(a) The clause set forth below shall be used when the NASA Form 533 series of reports, excluding the optional Monthly Contractor Financial Management Performance Analysis Report (NASA Form 533P), is required from the contractor:

NASA FINANCIAL MANAGEMENT REPORTING
(OCTOBER 1974)

(a) Financial Management Reports shall be submitted by the Contractor on NASA Form 533 series of reports in accordance with the instructions set forth in NASA Handbook "Procedures for Contractor Reporting of Correlated Cost and Performance Data" (NHB 9501.2B) and on the reverse side of the form, as supplemented in the Schedule of this contract. The detailed reporting categories to be used, which shall be correlated with the technical/schedule reporting, will be set forth in the Schedule of this contract. Implementation by the Contractor of reporting requirements under this clause shall include NASA approval of the definitions of the content of each reporting category, and will give due regard to the Contractor's established financial management information system.

(b) Lower level detail, which the Contractor utilizes for its own management purposes to validate information reported to NASA, shall be compatible with NASA requirements.

(c) Reports shall be submitted in the number of copies, at the time, and in the manner set forth in the Schedule of this contract or as designated administratively in writing by the Contractor Officer. 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.

(d) The Contractor agrees to insert the substance of this clause in all first tier cost type subcontracts specifically identified in writing by the Contracting Officer and shall include the cost of such subcontracts in his cost reports.

(e) During the performance of this contract, if NASA requires a change, either an increase or decrease in the information or reporting

requirements specified in the Schedule, or as provided for in (a) or (c) above, such change shall be effected by the Contracting Officer in accordance with the procedures of the "Changes" clause of this contract.

(b) The clause set forth below shall be used in conjunction with the clause in subparagraph (a) above when the optional Monthly Performance Analysis Report is also required from the contractor.

NASA FINANCIAL MANAGEMENT REPORTING (PERFORMANCE ANALYSIS REPORT) (NOVEMBER 1971)

Monthly reporting of contract performance shall be accomplished on the NASA Monthly Contractor Performance Analysis Report (NASA Form 533P) in accordance with the instructions set forth in NASA Handbook "Procedures for Contractor Reporting of Correlated Cost and Performance Data" (NHB 9501.2A) and on the reverse side on the form, as supplemented in the Schedule of this contract.

CHECKLIST FOR THE NASA USER OF THE NASA FORM 533 SERIES OF REPORTS

SUBJECTS TO BE CONSIDERED	COMMENTS
Items 1-6 apply regardless of the type(s) of report(s) required.	
1. Type(s) of 533 report(s) required.	NHB 9501.2A (Chapter 13) stipulates which reporting format(s) is required. Those not required can be thought of as being optional; therefore, a decision(s) must be made re these.
2. Reporting categories for the required report(s).	As stated in the Handbook: "Specific cost and manpower reporting requirements, including the level of detail, shall be delineated in the Contract Schedule or its equivalent." This task should be coordinated with the members of the Project Team involved in resources planning, analysis, and control.
3. Submission dates for the required report(s).	The instructions on the 533 forms specify dates by which reports must be submitted, and the Handbook reads: "The due dates set forth (herein) and on the Reporting Formats are intended to specify NASA's needs." However, the Handbook continues: "If the contractor's internal management system precludes submittal within the specified submittal date, such submittal date will be negotiated" (Ref., Section 104). Thus, the governing rule is one of reason, namely, the earliest date that the contractor can submit the required report(s) without incurring inordinate costs. This determination will often necessitate discussions with contractor personnel.
4. Addressees and number of copies of the required report(s) to be submitted.	Instructions on the Reporting Forms (533 Forms) specify these will be specified by the contractor or by an administrative instruction. To avoid delays, it is advisable to include these in the contract.*

5. Mode of transmitting required data.	When directed or approved by the Contracting Officer, other means than NASA 533 format may be used for transmitting the required data. When appropriate, optional modes should be selected. It is advisable to include instructions regarding the alternate mode in the contract.*
6. Unfilled Orders Outstanding	
a. Definition	As discussed in the Handbook (Section 301.6), there is no one definition of this term applicable to all contractors. A mutually acceptable definition should be agreed upon prior to contract award.
b. Time-Phased Data	The 533M and 533Q formats require the amount as of the report date in columns 10 and 11, respectively. However, receipt of time-phased data is often essential, in which case this should be specified in the contract.
7. If 533M reports are required, the following items may apply in addition to items 1-6:	
a. Use of Columns 7b & 7d	Since the instructions indicate use of these columns is optional, if NASA cognizant personnel want "planned" resources data in this (monthly) report, this should be specified in the contract.*
b. Use of Columns 8a & 8b	The format allows flexibility in determining the type (time periods) of cost projections to be reported (Ref., Handbook, Section 301.5). The appropriate time periods should be specified in the contract.*
c. Data in Column 8c	The instructions read: "where amounts reported in this column exceed one fiscal year, a breakout by fiscal year may be required." If this breakout is needed, this should be specified in the contract.* Normally, this breakout is not necessary if 533Q reports are required and properly prepared as this breakout would appear there.

7. (Continued)

d. Contractor's Remarks	The instructions state that two of the conditions which necessitate narrative commentary are: (1) "Significant differences" between the amounts in Columns 9a and 9b, and (2) "Significant items materially affecting historical or projected cost or performance." Appropriate guidelines or criteria should be specified in the contract.*
e. Contract Reconciliation	The instructions (Ref., 11.C) identify an optional breakout of "changes authorized but not finalized." If this breakout is to be a requirement, this should be specified in the contract.*
8. If 533Q reports are required, the following item applies in addition to items 1-6:	
a. Months of Submittal	The instructions state that the 533Q report is to be submitted on a quarterly frequency, that is, calendar quarter or other designated 3-month interval. If special (non-calendar quarter) dates are required, this should be included in the contract.*
9. If 533P reports are required, the following items apply in addition to items 1-6:	
a. Planned Value of Work Accomplished (PVWA)	As stated in the Handbook: "The method of determining PVWA for effort in process shall be defined in the contract."*
b. Schedular Data	The format and instructions address a "NASA approved schedule." A standard procedure should be established for such schedule approval, including revisions to the original approved schedule. A standard procedure for notifying the contractor as to such approvals should also be established.

9. (Continued)

c. Narrative Content Regarding Variances	The Handbook states that "Field installations will specify in the contract the criteria for determining when variations will require explanations by the contractor," and provides examples of types of variances which might be required (Ref., Section 304.2).
d. Technical Percent Completed	The instructions provide considerable flexibility as to the criteria for determining this percentage. The contractor should be required to identify the criteria used. Otherwise, the data submitted are subject to misinterpretation.

*NOTE: The expression "in the contract" is not limited to the Contract Schedule or the body of the Statement of Work. The types of requirements cited above are often covered in an attachment to the Statement of Work.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DATA REQUIREMENT DESCRIPTION

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

8. PREPARATION INFORMATION

The Contractor's financial management reporting shall be in accordance with HNB 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 extraordinary 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, for example, labor hours, materials, or overhead. This report 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 the cost concern or cost offset. Contractor Narrative Remarks will include 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.

MF-015

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) incorporated into the baseline budget and added to 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 accordnace 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 plan.

3. 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 (Ref., Exhibit 12).

(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) Monthly Performance Report (NASA Form 533P per paragraphs 300, 303, and 304 of NHB 9501.2A or Contractor report which is an equivalent of NASA 533P).

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

MF-015

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, that is, 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, that is, 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:

MF-015

(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.

V'75 PROPOSED OFFSET

79M
MMC Level 3 Manager
#192M

MMA
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 12/18/72, INCLUDING JPL COST SAVING ESTIMATE.

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

WBS NO. AND TITLE	FY-73	FY-74	FY-75	FY-76	FY-77	Total
7.6 STRUCTURAL TEST	$50K	$50K				
7.7 STRESS AND DYN	2MM	2MM				
TOTAL	$56K	$56K				$112K

NOT STATED HERE ARE JPL COSTS AND COST SAVED BY FURTHER REDUCTIONS IN HDWR.

- o OVERALL ASSESSMENT OF MISSION IMPACT:

  ACCEPTABLE

_____ _____
Responsible Manager Date

_____ _____
Responsible "Level 2" Manager Date

VIKING COST CONCERN

No. _____
Date: _____
WBS: _____

DESCRIPTION: _____

_____

_____

ESTIMATED COST IMPACT: _____

PRIMARY RESPONSIBILITY _____

FUNCTIONAL RESPONSIBILITY _____

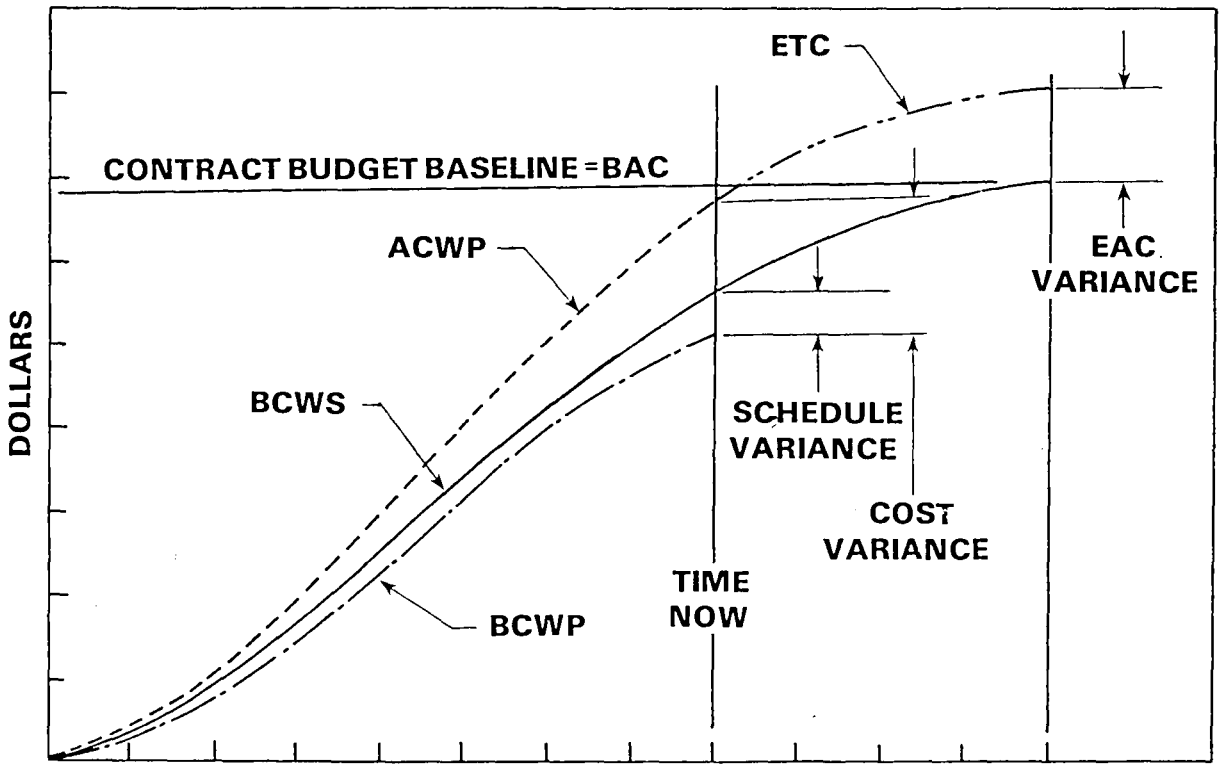
1974	1975

ACTION ASSIGNMENT	ACTION PLAN	SCHEDULE S	SCHEDULE P	SCHEDULE A	REMARKS

_____
MMC

_____
VIKING PROJECT OFFICE

VARIANCES

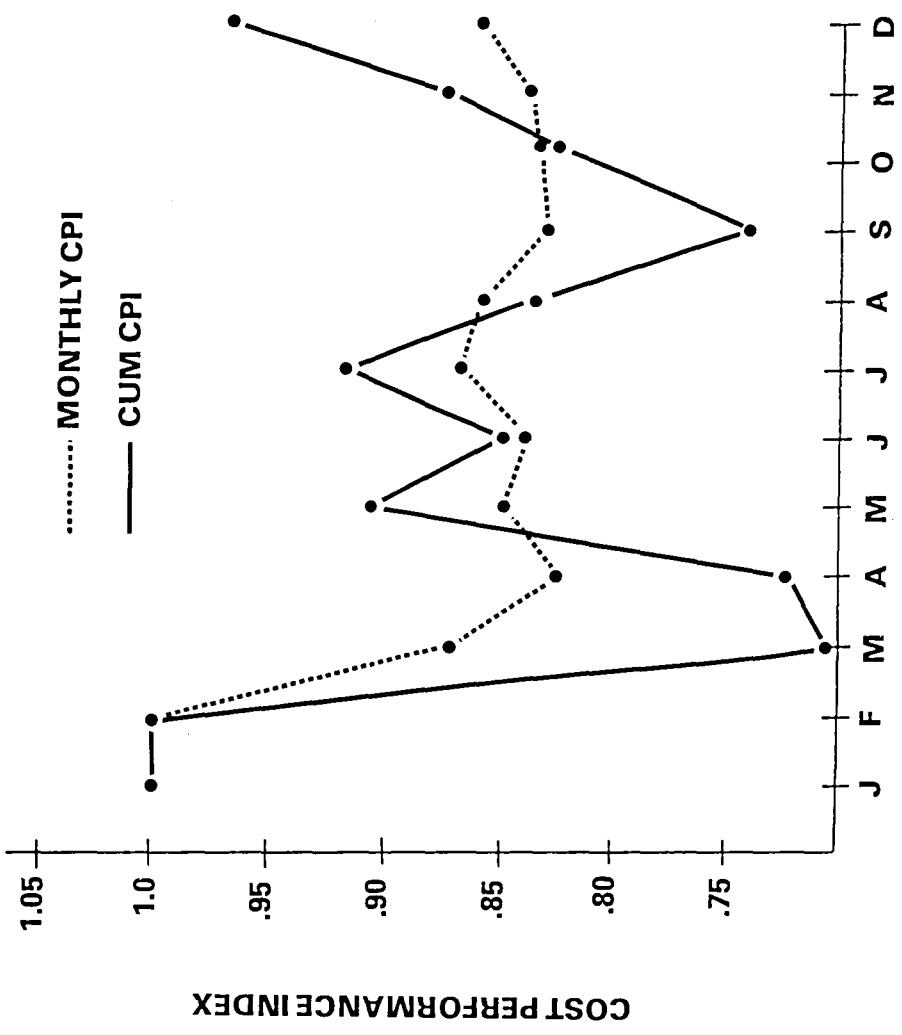


SV = BCWP-BCWS

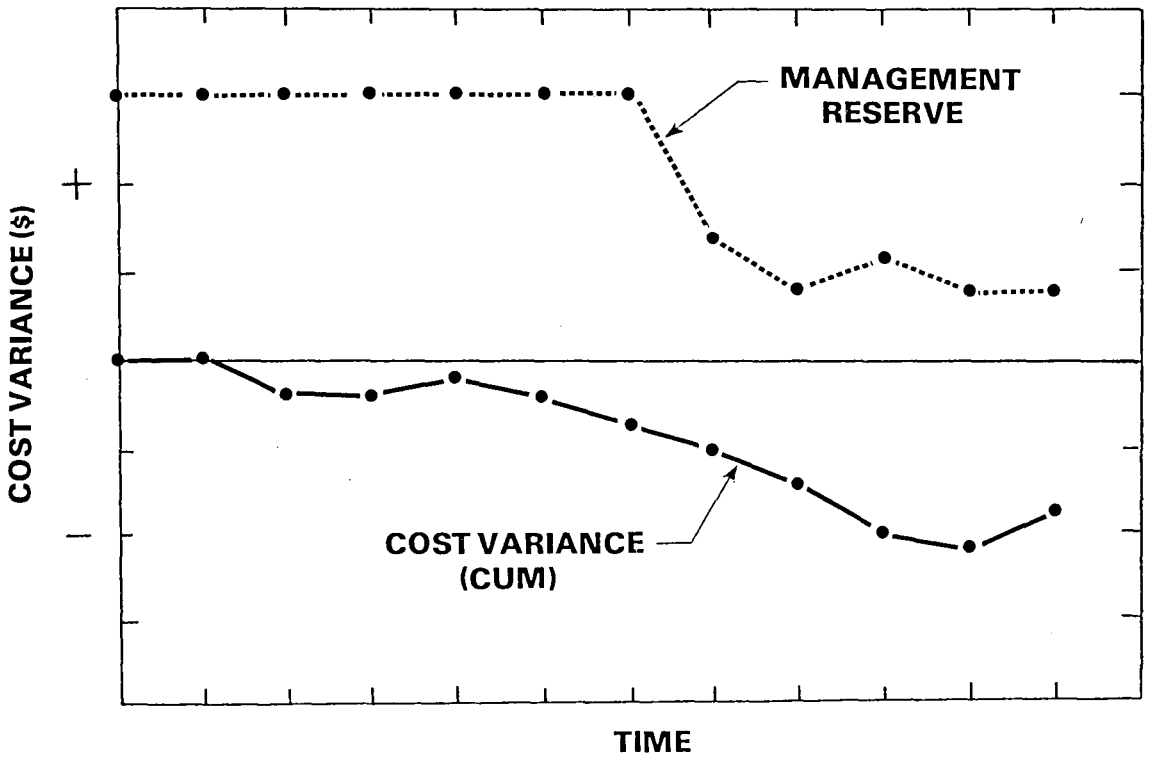
CV = BCWP-ACWP

EACV = BAC-EAC

CUMULATIVE AND MONTHLY CPI



MANAGEMENT RESERVE AND COST VARIANCE



NAS1-XXXXX EAC 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	
Contract Value		$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.

11.0 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 accomplsihed (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 defense 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 (WBS) 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. This term is explained in NPR 15-202.

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. This term is further defined in NPR 3-701.3 and NPR 15-203.

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 establsihed 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. The fund limitation is often less than the total estimated amount to be purchased. More specifically, amounts of open purchase orders, including negotiated changes, on which materials or services have not been received; the firm payment plan (e.g., progress payments) for lump-sum and fixed-price subcontracts, including modifications not taken into cost; and contractually revised firm payment plans from cost-type subcontracts are included.

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, man-hours, 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-83108		

4. Title and Subtitle	5. Report Date
GUIDELINES FOR COST CONTROL AND ANALYSIS OF COST-TYPE RESEARCH AND DEVELOPMENT CONTRACTS	May 1981
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Charles W. Sibbers	
	10. Work Unit No.
9. Performing Organization Name and Address	
NASA--Langley Research Center Hampton, VA 23665	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Technical Memorandum
National Aeronautics and Space Administration Washington, DC 20546	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report contains a detailed discussion of the cost information which should be obtained from a contractor(s) on a major, cost-type research and development contract(s), and the analyses and effective use of these data. Areas discussed include the specific type(s) of information which should be required, methods for analyzing such information, and methods for effectively using the results of such analyses to enhance NASA contract and project management. The material presented is based primarily on the author's knowledge as to the principal methods which have been effectively used in the management of major cost-type R&D contracts awarded by NASA/LaRC.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Project Control Project Cost 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	69	A04

For sale by the National Technical Information Service, Springfield, Virginia 22161

NASA-Langley, 1981

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