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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON REGIONAL OFFICE
FIFTH FLOOR
803 WEST BROAD STREET
FALLS CHURCH, VIRGINIA 22046

MAY 30 1973

Mr. Richard C. McCurdy, Associate Administrator
Office of Organization and Management
National Aeronautics and Space Administration



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Dear Mr. McCurdy:

Congressional interest in the increasing cost of major research and development programs prompted us to initiate a review of the reasons for changes in cost estimates on selected National Aeronautics and Space Administration (NASA) unmanned spaceflight projects. The following projects were included in our review: Applications Technology Satellite--F and G missions; Viking; Earth Resources Technology Satellite--A and B missions; Pioneer--F and G missions; Mariner Mars 1971; Orbiting Solar Observatory--I, J, and K missions; Nimbus--E and F missions; and Orbiting Astronomical Observatory--A, B, and C missions.

We completed the review in February 1972, and in March 1972 requested that NASA officially comment on the proposed report. Over the next several months, meetings were held with NASA officials to discuss the draft report, and in November 1972 NASA provided detailed comments on the draft. NASA's basic objection was to our using initial cost estimates provided the Congress as a base for tracking changes made to the estimates. Since then actions have been taken by NASA and the Congress which directly affect recommendations made in the draft report.

In July 1972 NASA revised its project planning guidelines to include, among other things, a more detailed discussion of cost estimating. The revised guidelines require that all costs, direct or ancillary, related to a project be identified even if some of the costs are not under the direct control of the project manager. The guidelines identify specific types of costs to be considered.

We also suggested in the draft report that the Congress consider requiring NASA to report to it periodically on the status of major projects showing the significant changes in estimated cost and the reasons for such changes. We orally communicated this suggestion in December 1971, to the Subcommittee on NASA Oversight of the House Committee on Science and Astronautics. They subsequently made arrangements with NASA to be provided periodically with project status data.

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Although positive actions have been taken, we believe significant matters still exist in connection with NASA's reporting to Congress which warrant your consideration. In this regard, we believe that additional improvements can be made in estimating and reporting NASA's programs by:

1. Providing a means for the accumulation and reporting of total costs by project.
2. Standardizing the terminology for the various estimates.
3. Requiring that factors for inflation and uncertainties be included.

These matters are discussed in the enclosures. In our opinion, the adoption of the suggestions discussed in the enclosures should aid in tracking project costs and will provide management with greater visibility and control over its projects.

In view of congressional interest in cost estimating and the increasing cost of agency programs, we expect to monitor the actions taken by NASA to improve its cost estimates. If you or your representatives wish to discuss these matters, please contact John P. Carroll, Assistant Regional Manager, Code 167, extension 2151.

Sincerely yours,

H. L. Krieger

H. L. Krieger
Regional Manager

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Office of Organization and Management
National Aeronautics and Space Administration
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NEED TO ACCUMULATE AND REPORT
TOTAL ESTIMATED COST

NASA does not accumulate and report as an aggregate the total estimated cost related to specific projects. Project funds are provided through the various program offices supporting the project and may come from as many as three appropriations. To determine the total estimated cost related to a specific major project, it would be necessary to review a variety of records. Further, since the records do not fully identify costs by project, it would also be necessary to talk with officials in the program offices within NASA which are directly or indirectly supporting the project.

Each program office estimates the costs of its own direct activities by appropriation. The estimated cost of unmanned space-flight activities to be accomplished by a program office other than the Office of Space Science, normally appears as part of the other program office's total cost estimate and is not reflected in or added to project cost estimates of the Office of Space Science. For example, estimated research and development costs of tracking and acquiring data from satellites normally is not reflected in the Office of Space Science's program operating plan estimates because such costs are usually budgeted and funded by the Office of Tracking and Data Acquisition. As a result, the estimates prepared by the Office of Space Science for a project relate only to the amounts to be funded from a specific appropriation and do not include all costs related to the project.

Furthermore, estimated research and development project costs do not include all research and development costs for launch vehicles. We were informed that only those costs for the acquisition of launch vehicle hardware are related to specific projects. Costs not associated directly with the acquisition of hardware--launch vehicle improvement costs and supporting activities costs--are not allocated to specific projects and represent about 50 percent of the total cost of launch vehicles. In November 1971 NASA related \$221 million of estimated launch vehicle hardware cost to the eight projects we reviewed.

Some costs funded from the research and development appropriation and most costs funded from the nonresearch and development appropriations are based on total agency requirements and, in NASA's opinion, it is impractical to attempt precise distribution of these costs to a particular project. Although a precise distribution may not be practical, we believe all costs expected to be incurred in carrying out a project should be identified and related to the project. Unless this is done, management is making major program decisions based on something less than a full knowledge of the economic impact its decisions will have.

Similarly, the Congress would also be in a better position to discharge its responsibilities if it were provided with one estimate for each project which encompassed all sources of funds and all the NASA program offices supporting the project.

STANDARD COST ESTIMATE TERMINOLOGY

It is important that cost estimates be clearly identified and appropriately qualified so the user of the estimate knows at what point in the life of a project the estimate was prepared, how much reliance can be placed on the estimate, and what the estimate is supposed to represent. We recognize that when NASA believes it is necessary, the cost estimates provided to the Congress are explained and qualified. Frequently, however, this necessitates a lengthy detailed discussion of NASA's planning and acquisition process.

We believe NASA should use standard terminology for the various cost estimates to reduce and, possibly eliminate the need for lengthy detailed discussions of the planning and acquisition process. An accepted practice followed by another agency in overcoming this problem was to classify its total program cost estimates as (1) planning estimates, (2) development estimates, and (3) current estimates.

The planning estimate is the total program estimate used in deciding whether to move a program from the conceptual phase to a more advanced validation phase. It is generally considered to be the initial program estimate for acquiring a system.

The development estimate is a refinement of the planning estimate and is made during the period in which preliminary design and engineering are verified or accomplished and in which contract and system management are planned.

The current estimate is intended to be an up-to-date estimate of the cost of acquiring the total approved program. It is adjusted as changes occur in the program.

NASA prepares estimates at the same points in time as those described above; however, NASA has not classified its estimates. The estimates currently prepared by NASA which correspond to the planning, development, and current estimates are identified below.

The NASA estimate comparable to the planning estimate is the total project estimate used by the NASA administrator or deputy administrator in deciding whether to move a project from the conceptual phase to a more advanced definition of the project. It is generally comprised of separable elements, each relating to a significant part of the project (launch vehicle, spacecraft, etc.). The subestimates facilitate examination of alternate approaches, adjustment of project objectives, and the making of important tradeoffs as the project progresses.

The NASA estimate comparable to the development estimate is the one prepared during the period in which the technical plan and the technology requirements are established and the project schedule and management system and controls are planned. It is the estimate used in deciding to proceed into full-scale development which consumes most of the total project funding.

The NASA estimate comparable to the current estimate is the up-to-date estimate of the cost of completing the total approved program.

NASA should classify its cost estimates, clearly define the estimates, including when and how the estimates are prepared, provide all parties concerned, including the Congress, with the official titles and definitions, and consistently refer to the estimates by title when discussing them, particularly in congressional testimony. NASA's consistent use of clearly defined terminology should help to reduce misunderstanding about cost estimates.

PROVISIONS FOR INFLATION AND PROJECT UNCERTAINTIES

Realistic cost estimating is indispensable to both the Congress and agency management for selecting and evaluating a new project and for cost control during the project's acquisition process. Valid estimates provide a reliable basis for deciding which projects are to be developed and whether a project should be continued, modified, or stopped. Program uncertainties and inflation are two factors which must be considered and provided for if valid estimates are to be prepared. Otherwise, significant cost growth will occur.

Inflation

Changes in the nation's economy over the span of a project's acquisition can significantly impact on the cost of developing and acquiring the project. Perhaps there is little NASA can do to control the effects of inflation. Nevertheless, inflation is a real factor that has contributed to cost growth in the past and it is important that it be recognized if valid cost estimates for a total project are to be prepared. Providing for inflation will result in more realistic estimates and, consequently, changes in estimates which may be attributed to inflation will be reduced.

When an agency requests the Congress to authorize and appropriate funds to proceed with a program, realistic cost estimates are needed to determine the total cost as accurately as possible. In this connection, the General Accounting Office recently suggested to the Congress and the Office of Management and Budget that cost estimates for long-term programs include an estimate for inflation which should be presented to the Congress as supplemental data. This suggestion was made in report B-176873 issued on December 14, 1972, and entitled "Estimates of the Impact of Inflation on the Costs of Proposed Programs Should be Available to Committees of the Congress."

NASA guidelines for preparing research and development program operating plan cost estimates do not contain guidance regarding the manner in which inflation should be treated. Consequently, inflation is not treated consistently. NASA should develop and issue appropriate guidelines regarding the treatment of inflation. Comparability of cost estimates would be facilitated by consistent treatment of inflation.

Program Uncertainties

One of the most important and difficult aspects of cost-estimating concerns identifying uncertainties and developing a realistic allowance for their cost impact. In estimating cost, work objectives should be divided into knowns and unknowns and provision should be made in the estimates for resolving the knowns and unknowns.

