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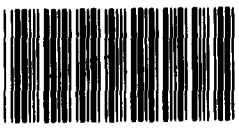
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STATEMENT OF
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MISSION ANALYSIS AND SYSTEMS ACQUISITION DIVISION

BEFORE THE
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I appreciate the opportunity to appear before the subcommittee today to discuss (1) factors affecting cost and schedule growth and (2) the work we have done on the executive agencies' implementing the Office of Management and Budget (OMB) Circular A-109. As requested by the subcommittee, we will provide a Government-wide perspective of these issues with emphasis on space programs, as appropriate.

As you are aware, our office has been concerned for many years over cost, schedule, and performance problems on a wide variety of Federal acquisition programs, including National Aeronautics and Space Administration's (NASA's) research and development (R&D) programs. The rapidly escalating costs of Government projects and budget restraints intensifies interest in the management of all acquisitions. We are pleased that, at the Congress' request, NASA has recently reexamined its management policies and practices to examine the factors aggrevating cost growth and schedule slippage on its R&D projects. That reexamination is commonly referred to as the Hearth study.

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We have examined the Hearth study findings and recommendations and, in our opinion, they address the major management principles generally associated with the acquisition of major systems. We look forward to the implementation of the recommendations which should improve the planning and managing of NASA's projects.

MAJOR FEDERAL ACQUISITIONS AND COST GROWTH

As part of our continuing effort to keep the Congress apprised of the progress on Federal acquisitions, we periodically report the latest available financial status of major projects. On September 30, 1980, there were 1,040 acquisitions reported, and these were estimated to cost $777 billion. The $777 billion cost estimate was $326 billion (or 72 percent) over baseline cost estimates. The "baseline" estimate could be either a planning, development, or current estimate. I will discuss the differences between these estimates shortly.

The Department of Defense (DOD) programs are estimated to cost $436 billion. Estimated costs for civil projects was $341 billion. On September 30, 1980, NASA reported 16 major projects estimated to cost $14 billion, and about $10 billion of the amount was for the Space Shuttle. The estimated cost growth on five of NASA's projects (i,e., Space Shuttle, Landsat-D, Space Telescope, Galileo, and International Solar Polar Mission) is over $2 billion. The Space Shuttle alone accounted for about $1.5 billion of the cost growth, excluding inflation.

While these estimates supplied by the agencies provide a general picture of the magnitude of major Federal acquisitions, it should be noted that comparing cost increases for civil and defense agencies could be misleading due to the varying nature of Federal acquisitions (dams, power plants, weapon systems, space projects, etc.,), complexities of the projects, length of the programs, different methods of establishing baselines, and so forth.

For situations where civil agencies reported a 100 percent or greater cost growth and for weapon systems included in Selected Acquisition Reports (SARs) we also compiled data on the types of change the agencies attribute project cost growth. The attachment on page 18 shows that as of September 30, 1980, 77 civil projects had 100 percent or greater cost growth. The estimated cost to complete the projects reflected cost growth of about $153 million. Of that amount, $83 billion was attributed to economic changes (inflation), $35 billion to engineering changes, $15 billion to quantity changes, $7 billion to estimating changes, $6 billion to schedule changes, and $7 billion to other changes.

There were 54 defense projects reported on SARs with cost growth of $132 billion. Of this, $45 billion was attributed to economic changes, $34 billion to quantity changes, $20 billion to schedule changes, $15 billion to estimating, $6 billion to engineering, $9 billion to support, and $3 billion to other changes.

FACTORS AFFECTING COST AND SCHEDULE GROWTH

The matter of cost growth on Federal acquisitions is a complex problem involving economics, budget priority decisions, political decisions, as well as program and project management policies and practices. In our opinion, it is important to recognize early on that factors accounting for cost growth are generally interrelated and will vary in importance depending on the type of acquisition being analyzed. NASA's space projects in particular involve procurement of a small number of R&D spacecraft, launch vehicles, and associated hardware. The technological complexity of these R&D projects can be great and involve risks to project schedule and cost estimates. This does not mean that agency management should be less concerned about cost growth but only that policies and practices in a high technology R&D area have to be tailored to exercise adequate project management, while not stifling the pursuit of worthwhile, albeit risky scientific projects.

With these thoughts in mind, I will discuss some of the principal factors which, in our opinion, contribute to cost and schedule growth on Federal acquisitions, including NASA's space projects.

Program technical and management problems

R&D projects by their nature involve various technical problems, modifications, and changes which have the potential for affecting cost and schedule. Some problems can realistically be anticipated and provisions made in the project cost and

schedule estimates. Others may not be. We recognize, therefore, that some cost growth may result even in the most conscientiously managed high technology program.

With respect to NASA space projects, we have noted that concurrent developments add to the risks. Problems experienced on one development can cause delays and cost growth on other projects. For example, because of delays and problems in the development of the Inertial Upper Stage, the launch of the Galileo mission had to be slipped. NASA has now decided to use a modified Centaur as the upper stage for the Galileo mission because of substantial cost growth on the three-stage Inertial Upper Stage and the delays in its development. Total estimated cost growth on the Galileo project is over $300 million.

There have been problems on the Landsat-D project in interfacing with the Tracking and Data Relay Satellite System and the Space Shuttle programs. Technical and management problems have also been evident in other aspects of that project. Cost growth on Landsat-D is over $185 million.

In our opinion, the high level of technology involved in both NASA and DOD programs emphasizes the need for careful project planning and definition work before contracting for implementation.

Inflation

Inflation affects every element of society and has caused cost growth on Federal acquisitions. Measuring the effect of inflation on acquisitions is difficult because

there is a lack of uniform and consistent treatment of inflation in the program cost estimates of the various Federal agencies. Some agencies include inflation in their program estimates and some do not. Because inflation is treated differently from program to program and agency to agency, it is virtually impossible to compare the costs of programs. Even where inflation is included, the rates used are often unrealistically low.

DOD's inflation rate projections on major weapons have traditionally been lower than actual inflation. The effect of using low inflation rates for DOD projects (in the budget and in the SARs) has been that appropriations have not funded everything in the budgets, and SARs cost estimates have been periodically increased to reflect the experienced inflation.

We noted that the Hearth study had found that inflation has contributed to cost growth on NASA projects although the effect was difficult to quantify. For major projects of long duration, the study proposes that the current NASA policy of estimating completion costs in budget-year dollars be continued, and the possibility of applying this approach to all future NASA projects be explored with OMB and the Congress. Our understanding of this proposal is that the project manager should not be held accountable for cost growth due to factors beyond his influence and control. We would agree that inflation per se is not a valid basis for judging performance on a project.

Estimating the rate of inflation is admittedly speculative and provides no guarantee of actual costs to be incurred, but the Congress should be aware that funds needed for dealing with future budgets and appropriations may be considerably more than the program estimates, as now drawn, would indicate.

Funding uncertainty

In some cases, cost growth can also be aggrevated because of the general uncertainty about funding. On weapon systems, the lack of sufficient production funding, for example, can inhibit the use of the most economical production rates. Planning optimism often meets the reality of limited funds available for a given number of projects. Program stretchouts or deferrals can likewise be a cause of cost growth.

Cost estimating

The final factor I would like to discuss regarding cost and schedule growth is cost estimating. Although I am discussing it last, cost estimating is probably the key ingredient in reducing cost growth and it entails each of the other factors that I have previously discussed. But, first let me briefly define the various estimates involved in the process.

Typically, cost estimates on R&D projects involve a planning estimate and a development estimate. For projects with a follow on production phase (e.g., weapons), there would also be a production estimate. The Congress usually gives its initial approval for R&D based on the planning estimate. This estimate

should be the best early projection that an agency can make after having considered all pertinent factors. Too often, however, it is nothing more than a rough feel for the potential cost of a project. The development estimate is a refinement of the planning estimate after some degree of project definition work and is usually made at about the time the development contract is awarded. A current estimate is the latest estimate for the project. For purposes of measuring cost growth, NASA and DOD have traditionally compared the development estimate to the current estimate.

As far back as the early 1970s, we have reported that both planning and development cost estimates on Federal acquisitions in many cases are quite optimistic on technical development problems, costs, and potential performance. Recognizing the technical complexity of R&D projects, we believe it is extremely important that adequate project definition be performed to provide as accurate and reliable an estimate of schedule milestones and total project cost as possible.

The desire of program advocates to sell the program to both agency management and the Congress with low-cost estimates and high expectations for solving technical problems is understandable. After all, the vitality of an agency depends to a large extent on new program starts. But this must be balanced against the need for as realistic appraisals

as possible of the potential resources needed. Recent testimony, by both NASA and DOD, recognizes that unrealistically low contractor and agency estimates on the front end aggrevates cost growth. What is needed is more candor up front in presenting programs to the Congress and not promising more than can be realistically delivered.

The Space Shuttle development program demonstrates how cost growth can arise by over optimism in cost estimating and in requesting funds for the program. The programs has experienced a cost growth of at least $1.5 billion (not considering inflation), and the launch of the first manned orbital flight was delayed 3 years. First of all, following on the heels of past successes in its manned space program, NASA established a shuttle development schedule that was success oriented--it could be met only if no major technical problems were encountered. Second, the shuttle was underfunded year after year. This was partially because of an agreement between NASA and OMB for funding limitations.

In this regard, the former NASA Administrator has testified that the underfunding was a result of trying to run as lean a program as possible and in effect requesting too little to do what had to be done. He said the budget requests were the problem and not the congressional response to those requests. Thus, managing to cost became a prime program driver as NASA management limited cost estimates to predetermined annual ceilings during the budgeting process.

Adjustments were made to delete, defer, or reprogram work to aline the development program within the cost ceilings. Thus, funding problems were moved into the future or into other budgets where potential cost growth would not be readily identifiable. The end result was inevitable--cost growth and schedule slippage.

Another element that must be considered when discussing cost estimates is project reserves. NASA includes a reserve amount in its project estimates to absorb any unforeseen cost increases. The amount of reserves that are included in a project's budget varies with the number and nature of uncertainties involved. NASA is not required to and normally does not separately identify the amount of reserve funds included in project cost estimates or how the funds are subsequently used. The result of this practice is that it is possible for one or more contractor to experience cost overruns. Unless those overruns deplete the built in reserves and cause the total project cost to be exceeded, the Congress is not necessarily made aware of the problems and cost increases.

In the past, we have recommended that the NASA Administrator direct that the Project Status Reports submitted to the Congress identify the reserve funds included in the initial estimates, the current amount of reserves, and an explanation of how the resources were used. However, we have not been successful in getting NASA to adopt our recommendations. Perhaps this subcommittee might encourage NASA to do so.

The final item relative to cost estimating that I would like to discuss is NASA's practice of not including civil service salaries costs in its cost estimates. This practice is consistent with NASA's longstanding policy of excluding these costs because, in its view, these costs are relatively fixed and are not sensitive to the effect that any one project will have on the NASA budget. We disagree. In our opinion, civil service salaries have a definite effect on the NASA budget and excluding them from the cost estimates is misleading as to the total cost of a project.

This has been a point of contention between GAO and NASA for many years. Several times we have recommended, that the NASA Administrator direct that these costs be included in the agency's cost estimates. Having had no success at getting our recommendations adopted by NASA, on November 26, 1980, we recommended that this subcommittee, in conjunction with the other congressional committees with responsibility for NASA programs, require NASA to include in its cost estimates the cost associated with the direct civil service requirements of a project. As far as we know, there has been no congressional action on our recommendation to date.

To briefly sum up this portion of my statement, we believe that agency management and the Congress must have reliable estimates to make informed decisions about initiating, continuing, modifying, or canceling projects. Management policies and practices are needed to establish

and confirm the need for a project and provides for adequate up front project planning and definition to facilitate reliable cost estimates. One such procurement policy is Circular A-109 which grew out of the desire to combat the factors that contribute to cost growth that I have just discussed. As requested by the subcommittee, I would like now to discuss our work relevant to Circular A-109.

OMB CIRCULAR A-109 MAJOR SYSTEMS ACQUISITIONS

As you know, Circular A-109 was issued on April 5, 1976, to establish management policy for acquisition of major systems by the executive branch agencies. The circular implements recommendations contained in the 1972 report of the congressionally appointed Commission on Government Procurement. The commission found that troubles usually began at the front end of the acquisition process. There, a series of cumulative decisions below top administrator levels would launch new programs without the benefit of objective mission need analysis, affordability study, and real design competition.

Our former Comptroller General was a member of the commission. GAO generally supported the concepts of Circular A-109 and, in fact, on March 3, 1981, the Comptroller General wrote to the Director, OMB, expressing GAO's concern about a momentum being built in some quarters of the executive branch to set aside the relatively new and important OMB Circular A-109. We are now concerned that this momentum is spreading to some in the Congress.

In August 1979, we reported on the progress made by NASA in implementing Circular A-109 into their operations (PSAD-79-89, Aug. 14, 1979). Earlier, in 1978 we reviewed DOD's acquisition process, paying particular attention to compliance with Circular A-109 (PSAD-79-9, Feb. 20, 1979.) Our objectives during these reviews were to examine the functioning of the acquisition process and, where possible, develop an understanding of the effects of Circular A-109.

Status of NASA's compliance with Circular A-109

Our work on Circular A-109 at NASA has been rather limited. However, we did make a study in the 1978-79 time frame, and in our 1979 report, we noted that NASA's progress in implementing Circular A-109 included issuing an implementing directive, approving Mission Element Need Statements (MENS), and extensive Circular A-109 training. NASA's implementing directive is consistent with Circular A-109's policy. But what NASA actually plans to do in implementing Circular A-109 could be in conflict with the Circular A-109 objectives and the recommendations of the Commission on Government Procurement in that it could possibly restrict innovation and competition.

As you know, NASA has many sources which generate mission needs. Besides the identification of needs in-house, projects can develop from the ideas generated by other Government agencies, industry, the scientific community, universities, and the Congress. After a need is identified, it will be

studied to determine potential costs, feasibility, and technical risks associated with programs satisfying the need. For example, NASA centers would conduct studies to determine the best approaches for satisfying a need. Approaches determined to be unattractive would not be pursued, while feasible approaches would then give rise to the preparation of a need statement.

Our concern is that the practice followed is for feasibility study data, developed before the mission-oriented request for proposal (RFP) for conceptual designs, to be communicated to contractors and may lead them to respond with similar concepts. This result could limit contractor innovativeness and design competition--primary objectives of Circular A-109.

Status of DOD's compliance with Circular A-109

We recently reviewed DOD's acquisition process, paying particular attention to compliance with Circular A-109. We found that DOD has increased its compliance with Circular A-109 since our previous review in 1978. It is our belief that, governmentwide, DOD is well in front of other agencies in implementing Circular A-109.

However, we also found some difficulties were being experienced in complying with Circular A-109. MENS document preparation and approval was taking excessive time at first because of confusion about desired content, format, and processing. This has since been resolved.

In other cases, service action to start some new programs was well underway before the MENS documents were formally approved by the Secretary of Defense. For example, the RFP for the CX aircraft program was released early, not only before MENS approval but also before complying with a congressional request to accomplish a strategic mobility study. DOD also poured considerable funding into the British development of the JP-233 Low Altitude Airfield Attack System without first having an approved MENS document.

In some instances, attempts to avoid preparing MENS occurred, for example, the Air Force LANTIRN program and the protracted Navy argument against MENS for ships which has since been decided as necessary.

Some problems has been experienced using competition. Although they were unwilling to provide specific data, most contractors claimed the services were underfunding competition in new programs.

Some contractors did not feel the services were implementing Circular A-109 very well and that program managers were "prone to take a cookbook" approach to complying with the directive. According to the contractors, service officials were reluctant to take the risk of a more flexible approach and usually placed excessive and untimely requests for data to have as much information as possible so as to avoid any possible criticism later. Service officials disagreed with this view.

Service program office officials were developing acquisition strategy for their program as advocated by Circular A-109. They complained, however, that such strategy does not hold up because of changes in program funding. Most believed not being able to fund programs as planned was the greatest obstacle to successful program completion.

Measuring the benefits of Circular A-109

The attention that Circular A-109 has received since its issuance in 1976 sometimes conveys the impression that it is viewed by some people as providing the solution to all of the problems of managing the acquisition of major weapon systems. Unfortunately, the problems are too complex for such assumption, if for no other reason than each weapon system development program (or major civil acquisition) has its own peculiarities. Thus, any attempt to measure between programs and compare savings in cost and schedule on better weapon performance would be difficult at best or impossible. Evaluation of Circular A-109's effect will probably be reduced to perceptions--does it appear that Circular A-109 has provided better management, and so forth? It is too early to reach firm judgments as yet because no weapon system has progressed through the entire process.

Despite the obvious benefits of using Circular A-109, it is not a panacea. As the Commission on Government Procurement stated of its recommendations on which Circular A-109 was based, "the recommended acquisition structure does not eliminate the need for competent personnel to exercise sound judgement."

SUMMATION

By their very nature, major acquisition programs, in defense or civil agencies, will always be subject to some controversy surrounding their high cost, long development period, or shortfall in performance. Much has been done to help explain the causes of cost growth. However, much more can be done. For example, DOD provides a cost/schedule/ performance track on many of its major systems through its SAR system. There are many additional systems which should, in our opinion, be in SARs.

Concerning Circular A-109, GAO continues to support the management principles set forth. If Circular A-109 did not exist, something like it would have to be invented.

Mr. Chairman, that concludes my prepared statement. We will try to answer any questions that you and your colleagues may have.

ATTACHMENT I

COST GROWTH ON SELECTED

CIVIL (NOTE a/) AND DEFENSE (NOTE b/) PROJECTS

	Type of change								No. of projects	
	Quantity	Engineering	Support	Schedule	Economic	Estimating	Sundry	Total	100% or more growth	Total
	(billions)									
Civil agencies										
Appalachian Regional Commission	$ 1.6	$ 1.9	$ -	$ -	$ 5.7	$ -	$ -	$ 9.2	1	1
Department of the Interior	0.5	0.5	-	-	6.2	0.9	0.2	8.3	29	90
Department of Transportation	9.8	29.7	0.2	0.2	56.8	1.7	4.4	102.8	12	93
Tennessee Valley Authority	1.3	2.2	-	3.9	12.2	3.3	2.6	25.5	10	14
Washington Metropolitan Area Transit Authority	1.1	0.5	0.1	2.0	1.2	0.7	0.1	5.7	1	2
Other	0.5	0.1	-	-	0.4	0.3	-	1.3	24	654
Total	$14.8	$34.9	$0.3	$6.1	$82.5	$ 6.9	$7.3	$152.8	77	854
Department of Defense										
Programs on selected acquisition reports:									On SAR	
Air Force	$ 5.7	$1.8	$2.7	$ 8.0	$11.3	$ .1	$1.1	$ 30.7	14	38
Army	3.9	0.9	1.7	3.6	11.7	6.6	0.2	28.6	17	50
Navy	24.8	3.6	4.5	8.8	22.1	7.9	1.2	72.9	23	96
Other	-	-	-	-	-	-	-	-	-	2
Total	$34.4	$6.3	$8.9	$20.4	$45.1	$14.6	$2.5	$132.2	54	186

a/Civil projects having a 100 percent or greater cost growth.

b/DOD projects reported on SARs.