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Data compiled by the National Aeronautics and Space Administration (NASA) on its resources and management techniques for supporting, planning, and controlling research and development programs omitted some resources, and did not identify others with the projects they benefited.

Findings/Conclusions: The data base of resources available in fiscal year 1976 for carrying out its research and development programs excluded about 36% of NASA's appropriated funds, 7% of its personnel, and 72% of its real and personal property. Subcommittee staff members and NASA agreed to exclude some resources, but others were excluded due to inadvertent omissions, NASA's belief that the subcommittee did not want certain resources included, the agency's definition of research and development costs, differing interpretations by NASA's centers of its headquarters' instructions for compiling the data, or the fact that NASA said it regularly reports certain resource data to the Congress. There were no major problems with NASA's internal guidelines for program planning and control of resources. Recommendations: The NASA Administrator should revise the data provided to the subcommittee to include all resources available to NASA in fiscal year 1976 to carry out its research and development programs, and identify, to the extent possible, all resources with the projects they benefit. The subcommittee should investigate NASA's management of underused, deactivated, or inoperable facilities and NASA's policy and procedures for identifying such facilities and reaching decisions concerning their use or disposal. (Author/SC)

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**REPORT OF THE
COMPTROLLER GENERAL
OF THE UNITED STATES**

**NASA's Resource Data Base And
Techniques For Supporting,
Planning, And Controlling
Programs Need Improvement**

Data the National Aeronautics and Space Administration compiled on its resources and management techniques for supporting, planning, and controlling research and development programs omitted some resources and did not identify others with the projects they benefited. GAO recommends ways of improving the NASA data and identifies a potential study area for the Subcommittee.



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-133340

The Honorable Don Fuqua
Chairman, Subcommittee on Space
Science and Applications
Committee on Science and
Technology
House of Representatives

Dear Mr. Chairman:

To assist the Subcommittee in its review of program planning and control at the National Aeronautics and Space Administration, we examined the validity and accuracy of data the agency compiled on its resources and management techniques for supporting, planning, and controlling research and development programs. This report presents the results of our examination which were discussed, in part, at Subcommittee hearings on March 18 and July 1, 1976. The report provides information for the Subcommittee to use in completing its review and preparing its final report on the agency's program planning and control.

This report contains recommendations to the Administrator of National Aeronautics and Space Administration. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report. We will be in touch with your office in the near future to arrange for release of the report so that the requirements of section 236 can be set in motion.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Luther B. Stucke".

Comptroller General
of the United States

D I G E S T

Is the National Aeronautics and Space Administration's (NASA's) data base of resources and management techniques for supporting, planning, and controlling its research and development programs accurate and complete? The report answers this question and identifies a potential study area for the Subcommittee on Space Science and Applications.

NASA's RESOURCE DATA INCOMPLETE

NASA did not compile data on all resources available in fiscal year 1976 for carrying out its research and development programs. About 36 percent of NASA's appropriated funds, 7 percent of its personnel, and 72 percent of its real and personal property were excluded.

NASA excluded

- \$345.4 million of unobligated research and development funds carried over from prior years (see p. 5);
- \$210.8 million of research and development funds for NASA headquarters and the National Space Technology Laboratories (see p. 5);
- \$795.5 million of research and program management funds (see p. 6);
- \$198.9 million of construction funds (see p. 7);
- the cost of time spent on NASA's programs by temporary employees, employees detailed from other agencies, and Federal employees working overtime (see p. 9); and
- \$5.1 billion in real and personal property (see p. 12).

Also, \$160 million of development, test, and mission operations funds and support contractor staff procured with these funds were not identified with the NASA projects they supported. (See pp. 5 and 11.)

Subcommittee staff members and NASA agreed to exclude some resources, but others were excluded due to

- inadvertent omissions,
- NASA's belief that the Subcommittee did not want certain resources included,
- the agency's definition of research and development costs,
- differing interpretations by NASA's centers of its headquarters' instructions for compiling the data, or
- the fact that NASA said it regularly reports certain resource data to the Congress.

PROBLEMS IN IMPLEMENTING
NASA'S PROGRAM PLANNING
AND CONTROL GUIDELINES

NASA's data described its internal guidelines for program planning and control of resources. GAO did not identify any major problems with the NASA guidelines. However, Johnson Space Center had problems applying the guidelines to NASA's Large Area Crop Inventory Experiment--one of two projects tested by GAO.

Problems were:

- Arbitrarily changing estimates of project resources.
- Establishing an unidentified reserve.
- Using inconsistent estimating methods.
- Failing to document estimates. NASA said it is following up on these problems. (See pp. 18 and 19.)

CONCLUSION AND RECOMMENDATIONS

NASA's data is inaccurate and incomplete. The Subcommittee should not rely on this data in carrying out its oversight duties and initiating future studies. The NASA Administrator should revise the data provided to the Subcommittee to (1) include all resources available to NASA in fiscal year 1976 to carry out its research and development programs and (2) identify, to the extent possible, all resources with the projects they benefit. (See p. 17.)

AGENCY COMMENTS

NASA said that its data would be more complete and valuable if revised. It said that much of this data is readily available and can be provided to the Subcommittee in a format conforming to the data it submitted. However, NASA's position is that, since GAO agreed to data requirements before its examination, it should not issue a report criticizing these requirements.

GAO did not agree to data requirements established and used by NASA in compiling its data. NASA did not furnish GAO with information on data requirements it planned to use in compiling its data nor did it attempt to agree with GAO on these, as requested by the Subcommittee staff. (See pp. 15 and 16.)

KEY ISSUES FOR SUBCOMMITTEE ATTENTION

The Subcommittee should ask about the results of NASA's followup on the problems at Johnson Space Center. (See p. 19.)

The Subcommittee should investigate NASA's management of underused, deactivated, or inoperable facilities and NASA's policy and procedures for identifying such facilities and reaching decisions concerning their use or disposal. (See pp. 20 and 21.)

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ABBREVIATIONS

COF	construction of facilities
DTMO	development test and mission operations
GAO	General Accounting Office
NASA	National Aeronautics and Space Administration
R&D	research and development
R&PM	research and program management

CHAPTER 1

INTRODUCTION

The Chairman, House Committee on Science and Technology (see app. I), asked us to assist the Subcommittee on Space Science and Applications in reviewing the National Aeronautics and Space Administration's (NASA's) program planning and control. The Subcommittee asked NASA to compile a data base of its resources and management techniques for supporting, planning, and controlling its research and development (R&D) programs. This data was requested to provide a tool for the Subcommittee's use in carrying out its oversight duties and to serve as a point of departure for future Subcommittee studies.

To assist the Subcommittee, we examined the validity and accuracy of the NASA data and identified a potential study area for the Subcommittee.

BACKGROUND

NASA initially developed data for two pilot centers--the Johnson Space Center and the Ames Research Center. While we were examining this data at the two pilot centers, NASA compiled data for its other centers, except its National Space Technology Laboratories and its headquarters.

NASA formally presented all its data to the Subcommittee at a hearing on March 18, 1976. At this hearing, we testified as to our initial observations on the NASA data for the two pilot centers.

On July 1, 1976, we testified before the Subcommittee on the results of our preliminary examination of the NASA data for all centers. NASA presented comments on our findings.

This report with NASA comments (see app. II) presents the final results of our examination of the NASA data and identifies a potential area for Subcommittee study. It provides additional details on matters on which we testified and includes comments on five additional items:

--Unobligated R&D funds carried over from prior years.

--R&D funds for NASA headquarters and the National Space Technology Laboratories.

- Funds for construction of facilities.
- Facility replacement values.
- The need to show all personnel in terms of equivalent staff-years.

DESCRIPTION OF THE NASA DATA

The NASA data provided a snapshot-in-time picture of the agency's fiscal year 1976 resources available to carry out its R&D programs. The data also provided a description of key management techniques NASA uses to plan and control its programs and resources.

NASA presented its data by center. Generally, the data included:

1. Narrative descriptions of R&D projects conducted during fiscal year 1976 and each project's relationship to a specific NASA mission, such as manned space flight, space science, space applications, energy, and aeronautics and space technology.
2. Estimates of fiscal year 1976 resource requirements for each project in terms of (a) new obligational authority for R&D funds, (b) the number of full-time NASA civil service employees, and (c) staff-years of support contractor effort.
3. Summary statistics on facilities, including their cost and replacement value, net square feet of enclosed space, and specific identification of selected major technical facilities as well as the percentage of time used for each project. For most centers the data also included detailed lists of R&D program work scheduled to be done in major technical facilities.
4. Narrative and graphic descriptions of planning and control techniques.

SCOPE OF EXAMINATION

Our comments primarily resulted from examining NASA's data at Ames and Johnson, including (1) identifying the sources and methods used to compile the data, (2) testing

the accuracy and completeness of the data, and (3) tracing selected R&D projects through the center's resource planning and control processes.

In addition, we made a limited review of data for nine other NASA centers. Our review included:

1. Obtaining certain data on the National Space Technology Laboratories.
2. Inquiring at NASA headquarters about certain data elements for five centers--Dryden Flight Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Lewis Research Center, and Wallops Flight Center.
3. Testing selected elements at three centers--Langley Research Center, Kennedy Space Center, and Marshall Space Flight Center.

CHAPTER 2

IMPROVING THE NASA RESOURCE DATA

The NASA data did not include all resources available in fiscal year 1976 to carry out its R&D programs. About 36 percent of NASA's appropriated funds, 7 percent of its personnel, and 72 percent of its real and personal property were excluded. We believe a more accurate and complete picture of NASA's resources would result if

- all resources available to NASA in fiscal year 1976 to carry out its R&D programs were included in the data and
- to the extent possible, all resources were identified with the projects they benefit.

NASA RESOURCES NOT INCLUDED IN DATA

The NASA data excluded resources available at its headquarters and its National Space Technology Laboratories, as well as the following resources from its other centers:

- Unobligated R&D funds remaining from prior years, research and program management funds, and construction of facilities funds.
- Temporary employees, employees of other Federal agencies detailed to NASA, certain full-time NASA civil service employees, and overtime worked by Federal employees.
- Some real property and nearly all personal property.

NASA did not include some resources by agreement with the Subcommittee staff members. However, other resources were not included due to inadvertent omissions, NASA's belief that the Subcommittee did not want certain resources included, the agency's definition of R&D costs, differing interpretations by NASA's centers of its headquarters' instructions for compiling the data, or because, according to NASA, it regularly reports certain resource data to the Congress.

NASA FUNDING

The NASA data includes fiscal year 1976 new R&D obligational authority for 10 NASA centers. This represents only about 64 percent of the funds available to NASA during fiscal year 1976 to conduct its R&D programs. Table 2-1 shows the types of funds appropriated, the amounts available, and the amounts included in the data.

Table 2-1
Funds Available For NASA Missions
Fiscal Year 1976

<u>Fund types</u>	Unobligated carryover from prior periods	Fiscal year 1976 appropriations	Total funds available	Funds included in data	Funds excluded from data
----- (millions) -----					
Research and development	\$345.4	\$2,941.5	\$3,286.9	\$2,730.7	\$ 556.2
Research and program management	0	795.5	795.5	0	795.5
Construction of facilities	<u>116.8</u>	<u>82.1</u>	<u>198.9</u>	<u>0</u>	<u>198.9</u>
	<u>\$462.2</u>	<u>\$3,819.1</u>	<u>\$4,281.3</u>	<u>\$2,730.7</u>	<u>\$1,550.6</u>
			100%	63.8%	36.2%

R&D funds

The \$556.2 million of R&D funds excluded from the data consisted of \$345.4 million of unobligated funds carried over from prior years and \$210.8 million of fiscal year 1976 funds for activities at NASA headquarters and the National Space Technology Laboratories. NASA did not provide us with data on the \$210.8 million for our analysis. Unobligated funds carried over from prior years were excluded by NASA because it believed the Subcommittee agreed these funds were not to be included.

The NASA data included over \$160 million of fiscal year 1976 R&D funds required for development, test, and mission operations (DTMO) but did not identify these funds with the R&D projects they support. DTMO funds are used primarily to procure the support contractor staff which provides special skills and expertise in support of manned

space flight missions assigned to Johnson, Kennedy, Marshall, and the National Space Technology Laboratories.

When funds carried over from prior years are included in the NASA data and DTMO funds are identified with the projects they support, the funding shown for certain projects changes considerably. For example, funding for the Space Shuttle Orbiter project at Johnson would increase by over \$90 million with the addition of these funds as shown below.

Space Shuttle Orbiter Project
Johnson Space Center

<u>Description</u>	<u>Amount</u>
	(millions)
R&D funds per NASA data	\$853.0
Add:	
Funds carried over (note a)	\$18.0
DTMO funds (note b)	<u>72.5</u>
	<u>90.5</u>
Total	<u>\$943.5</u>

a/Includes some obligated carryover that has not been liquidated.

b/DTMO funds were allocated to the Space Shuttle Orbiter project based on DTMO support contractor staffing estimated for the project by Johnson.

Research and program management funds

The NASA data excluded the \$795.5 million of research and program management (R&PM) funds budgeted for fiscal year 1976. These funds pay for civil service and some support contractor personnel services, which total about 60 percent of the staffing shown in the NASA data.

Historically, NASA has not included the cost of these personnel in its R&D project cost estimates presented to the Congress. The addition of the cost of these personnel to particular projects can be significant. Again using the Space Shuttle Orbiter project at Johnson as an example, the addition of R&PM funds would further increase the project's dollar resources by \$60.6 million.

Space Shuttle Or Project
Johnson Sp er

<u>Description</u>	<u>Amount</u>	<u>Percent</u>

	(millions)	
R&D funds per NASA data	\$ 853.0	85
R&D funds carried over	\$18.0	
DTMO funds	<u>72.5</u> 90.5	9
R&PM funds (note a)	<u>60.6</u>	<u>6</u>
Total	<u>\$1,004.1</u>	<u>100</u>

a/Johnson received \$128.2 million in fiscal year 1976 R&PM funds. We allocated a portion of these funds to the Space Shuttle Orbiter project based upon the number of Johnson's direct civil service personnel assigned to the project. Johnson officials considered this to be a reasonable method.

Construction of facilities funds

Construction of facilities (COF) funds totaling about \$198.9 million were excluded from the NASA data. These funds consist of \$116.8 million carried over from prior years and \$82.1 million of new obligational authority for fiscal year 1976. NASA did not include data on COF funds because it believed that it did not have to. COF funds are used for the construction of new facilities; the purchase of related equipment; the design, major rehabilitation, and modification of facilities; minor construction; and advanced design related to facilities planned for future authorization.

We believe that COF funds available for supporting fiscal year 1976 R&D projects should be included in the NASA data. We recognize that facilities and equipment acquired with these funds will be used, in many instances, to support other projects in subsequent years; however, we believe that, to the extent possible, these funds also should be related to the current R&D projects they benefit. For example, about \$47.2 million or 57.5 percent of fiscal year 1976 COF new obligational authority was budgeted for facilities directly related to the Space Shuttle program.

NASA PERSONNEL

We estimate that about 7 percent of NASA's personnel was not included in the data. Some personnel were inadvertently omitted, and some--detailed employees and temporary employees--were intentionally excluded because, as NASA stated, it regularly reports data on these employees to the Congress.

Also, DTMO-funded support contractor staff were not identified with the benefiting projects, and civil service and support contractor staff were reported on different bases--one being fiscal yearend ceiling positions and the other being equivalent staff-years. We believe that including all personnel in the data, showing the information on the same basis, and identifying it with the benefiting projects would provide a much clearer picture of NASA's human resources and their use.

Table 2-2 compares NASA's actual Federal employees with that shown in its data for the five centers visited.

Table 2-2

Federal Employees at Selected NASA Centers

<u>Description</u>	<u>Ames</u>	<u>Johnson</u>	<u>Kennedy</u>	<u>Langley</u>	<u>Marshall</u>	<u>Total</u>
Included manpower	<u>1,669</u>	<u>3,613</u>	<u>2,259</u>	<u>3,305</u>	<u>3,696</u>	<u>14,542</u>
Excluded manpower (note a):						
Full-time employees:						
Omissions	7	0	0	4	417	<u>b/428</u>
Actual ceiling (over or under(-))	-8	32	-2	-11	-42	-31
Detailed employees	<u>c/9</u>	39	5	0	3	56
Staff-years of over-time	13	31	20	18	32	114
Temporary employees	<u>101</u>	<u>170</u>	<u>97</u>	<u>136</u>	<u>200</u>	<u>734</u>
	<u>122</u>	<u>272</u>	<u>120</u>	<u>147</u>	<u>640</u>	<u>1,301</u>
Total	<u>1,791</u>	<u>3,885</u>	<u>2,379</u>	<u>3,452</u>	<u>4,336</u>	<u>15,843</u>
Percent of total excluded	7	8	5	4	17	9

a/Average actual data for the first 9 months of fiscal year 1976, except as noted.

b/Net number of employees inadvertently omitted due to mistakes in compiling data.

c/Employees detailed to Ames from other Federal agencies as of April 10, 1976.

Full-time civil service employees

Table 2-2 shows 428 full-time civil service employees were omitted from the NASA data for the five centers visited.

Individual project data sheets showing 439 employees for Marshall were inadvertently omitted, whereas 22 employees were added to the summary data on all projects. The result was a 417 employee understatement.

Ames' individual project data sheets showing 12 employees were omitted from the NASA data, whereas one project's data sheet showed 5 employees more than the summary data. The result was a net understatement of seven employees.

Langley data was prepared using the actual number of employees as of December 1975, rather than using an estimate, the procedure followed by the other NASA centers. Langley actually had four employees less than reported.

Detailed employees

NASA's fiscal year 1976 budget request estimated that about 86 employees would be detailed to NASA by other Federal agencies, at a cost of about \$2.2 million. Most were military personnel who were detailed because of (1) their experience in manned flight and (2) a need to keep the Department of Defense current on manned space flight technology. Fifteen of NASA's astronauts are military officers.

Federal employee overtime

NASA's fiscal year 1976 budget request estimated overtime for five centers visited at about \$3.1 million. As shown in table 2-2, overtime at these centers totaled about 114 staff-years for fiscal year 1976. Most overtime was authorized to meet operational requirements, such as maintaining launch schedules and meeting long duration test requirements.

Temporary employees

These employees include participants in the College Cooperative Training, Summer Employment, Youth Opportunity Campaign, and Temporary Clerical programs. NASA defines these programs as follows:

--The College Cooperative Training program alternates work at NASA centers and study

periods at colleges thereby providing students with both practical experience and academic training.

- The Summer Employment program employs high school and college students and faculty members, giving these participants an insight into Government operations while providing the agency with many benefits from their employment.
- The Youth Opportunity Campaign program enables disadvantaged youths to work at unskilled jobs both during the summer and throughout the regular school year.
- The Temporary Clerical program provides short-term support in positions occupied by permanent employees who are absent from work because of illness, vacation, maternity, or training.

NASA's fiscal year 1976 congressional budget request estimated that temporary employees would contribute the equivalent of about 1,166 staff-years of effort. The College Cooperative Training and Summer Employment programs account for about 54 percent of this effort, the Youth Opportunity Campaign program about 32 percent, and the Temporary Clerical program about 14 percent.

The following examples of participants in the College Cooperative Training program illustrate the contribution of nonpermanent employees.

1. Marshall Space Flight Center--A student developed a computer program to analyze the sensitivity of Space Shuttle launch rates to varying payload packaging densities and developed a theoretical approach to assembling an inspace power station.
2. Kennedy Space Center--A student collected, organized, and analyzed line printer data from the two Viking-Mars lander spacecraft and maintained a record of environmental data on the meteorology sensor assembly to support wind tunnel tests at Ames Research Center.

Identifying personnel
with benefiting projects

Except for DTMO support contractor employees, which the NASA data showed in total, all R&D-funded personnel in the NASA data were identified with benefiting R&D projects. NASA estimates DTMO support contractor staffing by benefiting project for internal reporting purposes.

Showing DTMO staffing by benefiting project would have made it consistent with other personnel data. The Space Shuttle Orbiter project at Johnson illustrates the impact of showing DTMO support contractor staffing by benefiting project.

Space Shuttle Orbiter Project
Johnson Space Center

<u>Description</u>	<u>Staff-years</u>	<u>Percent</u>
Support contractor staff in NASA data	528	17
Add: DTMO support contractor staff	<u>2,549</u>	<u>83</u>
Total	<u>3,077</u>	<u>100</u>

Showing all personnel
on the same basis

The NASA data showed civil service personnel in terms of the number of planned end of fiscal year 1976 ceiling positions. Support contractor staffing was stated in terms of equivalent staff-years. We believe that all personnel should be shown on the same basis and that equivalent staff-years is the more descriptive method since it shows total hours worked, including overtime and is used by NASA in preparing its project cost estimates.

NASA PROPERTY

NASA owns more than \$7 billion in real and personal property. The NASA data showed only about \$2 billion of this property. Some real property was excluded, according to NASA, based on its understanding of the Subcommittee's request. Most personal property was not included by agreement with Subcommittee staff members. Table 2-3 shows property included and excluded.

Table 2-3

NASA Property as of June 30, 1975

<u>Type</u>	<u>Cost</u>		<u>Total</u>
	<u>Included</u>	<u>Excluded</u>	
	----- (millions) -----		
Real property:			
Land	\$ 79.7	\$ 37.6	\$ 117.3
Buildings	1,188.5	302.4	1,490.9
Leasehold improve- ments	.2	.9	1.1
Fixed assets in progress (note a)	0.0	187.2	187.2
Other structures	<u>698.2</u>	<u>384.8</u>	<u>1,083.0</u>
	<u>b/1,966.6</u>	<u>912.9</u>	<u>2,879.5</u>
Personal property:			
Plant equipment	30.6	2,440.4	2,471.0
Special test equip- ment	0.0	569.4	569.4
Special tooling	0.0	67.8	67.8
Space hardware	<u>0.0</u>	<u>1,105.8</u>	<u>1,105.8</u>
	<u>30.6</u>	<u>4,183.4</u>	<u>4,214.0</u>
 Total	 <u>\$1,997.2</u>	 <u>\$5,096.3</u>	 <u>\$7,093.5</u>
	28%	72%	100%

a/NASA officials stated that fixed assets in progress primarily consist of real property.

b/Includes Johnson and Goddard property as of December 31, 1975.

The NASA property data could be improved if each NASA center used the same bases in its compilation. For example, Dryden included equipment although other NASA centers did not. Ames included only buildings; other NASA centers also included land and other structures and facilities. Also, the methods and bases used for computing property replacement values varied. Depending upon the Subcommittee's use of the property data, comparisons among centers could be difficult.

Real property

Some real property at NASA's centers and installations was excluded, as was most NASA real property held by contractors. Following are examples of real property excluded from the NASA data.

--Goddard did not include \$58.9 million in real property at its tracking stations.

--Lewis excluded \$107.5 million in real property at its Plum Brook Operations Division in Sandusky, Ohio.

--None of \$279.1 million in real property at the National Space Technology Laboratories was included.

--Ames' data included only buildings. It excluded \$9.1 million in land and other structures.

--With the exception of certain property at the Jet Propulsion Laboratory, contractor-held real property was excluded from the data by all centers. For example:

--\$33.5 million in NASA real property at Downey, California, where the Space Shuttle orbiters are being fabricated;

--\$15.4 million in NASA real property at the Space Radiation Effects Laboratory in Newport News, Virginia; and

--\$100.9 million in NASA manufacturing facilities at the Michoud Assembly Facility in New Orleans, Louisiana, where the external tanks for the Space Shuttle will be constructed.

Personal property

In addition to real property, NASA centers have so-called personal property, such as plant equipment and special test equipment. At the time NASA headquarters' instructions on compiling the data were issued, they did not require the centers to include this type of property. Only Dryden did so. This property is significant in dollar terms (\$4.1 billion) as well as in its contribution towards NASA's R&D mission and should be included in the data.

The following are examples of personal property excluded from the Johnson data.

	<u>Cost</u>
Plant equipment:	
Analog computer	\$ 450,000
Spectrometer	302,000
Special test equipment:	
Environmental chamber	177,505
Flight motion dynamic simulation table	260,157
Special tooling:	
Automatic welding jig	1,248,310
Mid-fuselage structure tool	336,020
Space hardware:	
One Boeing 747 airplane (note a)	15,600,000
Automatic circuit analyzer	2,151,000

a/This airplane is to be used to carry the shuttle orbiter piggy back during launch and landing tests as well as ferrying operations when necessary.

During the hearing on March 18, 1976, we pointed out that equipment had not been included in the data. On June 7, 1976, NASA provided us with a list of \$3 billion of equipment as an addendum to the data. The information contained in the list, in our opinion, is a valuable addition to the data.

Replacement value

NASA headquarters did not provide guidance to its centers on how to compute facility replacement values. Two centers visited used the same method for computing replacement value. The three other centers visited used different methods.

- Johnson selected a factor for computing replacement value which represents the difference between a wholesale price index for one period and a consumer price index for another period. The replacement value computed using this factor appears questionable because (1) the cost of land which is not subject to replacement was included in the computation, (2) neither index is an indicator of land values, (3) combining the two indexes to obtain a factor for computing replacement value does not appear proper, and (4) some facilities for which a replacement value was computed were constructed during periods other than the 1964-66 base period.
- Kennedy also used Johnson's method.
- Langley used building cost indexes from the Engineering News Record.
- Marshall used indexes from the Engineering News Record building cost index but adjusted these to local conditions.
- Ames used a method based upon a 1969 study by a contractor at the center.

Depending on the method used, widely different replacement values can result. For example, applying the Johnson method to its Space Environmental Simulation Laboratory constructed in 1964 at a cost of \$41.4 million results in a replacement value of \$67.9 million. If the method used by Langley had been used for this laboratory, its replacement value would have been estimated at \$94.8 million, or a difference of \$26.9 million.

We recognize that there may be a number of valid methods for computing replacement values, including some of those used by the NASA centers. We believe that, however, if the Subcommittee wishes to use replacement value data in future studies, such data would be more useful if it were computed by using a valid method consistently applied.

AGENCY COMMENTS AND OUR EVALUATION

NASA said our report appears to be in conflict with the request made to the Comptroller General by the Chairman of the Committee on Science and Technology and the program plan of the Subcommittee on Space Science and Applications. (See

app. I.) The Subcommittee program plan described the approach to be employed in executing the Chairman's assignment.

The Subcommittee plan specified that we assist in preparing its final report. This is the purpose of our report. As suggested by NASA, we appended the Subcommittee plan to our report to describe the participative and advisory role we were to play in the Subcommittee review.

NASA said that we participated fully in developing data base requirements and added that this places us in a position of issuing a report criticizing data requirements to which we had agreed prior to our examination.

We did not agree to data requirements established and used by NASA in compiling its data. NASA did not furnish us with information on data requirements it planned to use in compiling its data nor did it attempt to reach agreement with us on these requirements as requested by the Subcommittee staff.

Agreement of data base requirements was primarily between NASA and the Subcommittee staff. We maintained in our earlier meetings that the data base phase of the project could only be developed by NASA and that we would independently report on the results of our review. This we have done.

NASA believes the data it compiled was fully responsive to the Subcommittee's request and complies with its understanding of agreements reached with Subcommittee staff members. Notwithstanding any agreements NASA may have made, we were charged with reporting on the validity and accuracy of the data. This report provides the results of that effort.

NASA believes that revising and improving its resource data will not help the Subcommittee assess the effectiveness of its program planning and control. NASA states that the Subcommittee has not requested that it provide this data. We note, however, that NASA has provided a list of \$3 billion of equipment as an addendum to its property data and has informed the Subcommittee that it is correcting errors in the data it compiled.

NASA stated that the data we believe is needed to better present the agency's project resources would make its data more complete and thus could be of value to the data user. According to NASA, much of this information is readily available and can be provided to the Subcommittee in a format conforming to the data it submitted. We believe that before using the NASA data for future studies, the Subcommittee should obtain this additional information from NASA.

CONCLUSION AND RECOMMENDATIONS

The Subcommittee should have accurate and complete data for better visibility of NASA's resources if the data is to be of value in undertaking any future studies.

recommend, therefore, that the NASA Administrator revise the data provided to the Subcommittee to (1) include all resources available to NASA in fiscal year 1976 to carry out its research and development programs and (2) identify, to the extent possible, all resources with the projects they benefit.

CHAPTER 3

PROBLEMS IN IMPLEMENTING NASA'S

PROGRAM PLANNING AND CONTROL GUIDELINES

The NASA data contained descriptions of NASA's internal guidelines for program planning and control. We did not identify any major problems with the guidelines. However, during our examination of one of two projects chosen to test the guidelines--the Large Area Crop Inventory Experiment--we noted problems in their implementation. Problems identified were (1) arbitrarily changing estimates of project resources, (2) establishing an unidentified reserve, (3) using inconsistent estimating methods, and (4) failing to document estimates. These are discussed below.

ARBITRARY CHANGES IN ESTIMATES

When project cost estimates are refined during review, changes should be made to reflect the impact on project resource requirements and on accomplishment of project objectives. We found that the Earth Resources Program Office at Johnson directed the Data Systems and Analysis Division to reduce its estimated resource requirements to meet limits imposed by NASA headquarters' guidelines. While the Division had no intention of reducing its requirements for computer equipment purchased about 4 months previously, it arbitrarily reduced its estimated cost for the equipment by \$280,000 below the contracted price. Center officials stated that time constraints for preparing budget estimates necessitated the arbitrary reduction. We believe, such arbitrary actions by center officials could preclude effective planning and control of agency resources by higher management.

UNIDENTIFIED RESERVE

Each level of program review needs to know what resources will be required to conduct a program and how these resources will be used. However, our examination of Johnson cost estimates for the Large Area Crop Inventory Experiment disclosed a \$52,000 reserve that was not identified to NASA headquarters as a reserve.

Johnson requested and received from NASA headquarters \$9.2 million of resource authority for certain projects, including the crop inventory experiment; however, Johnson's

estimated resource requirements were \$52,000 less than the amount requested. Center officials stated that while reserves can provide planning and control flexibility, NASA headquarters would recall any funds identified as reserves.

We do not question the need for reserves, but we believe the existence of unidentified reserves, such as this, could impair the validity of the estimating process which agency management relies on as a basis for evaluating the merits of competing R&D projects.

INCONSISTENT ESTIMATING METHODS

To properly evaluate and select from among projects competing for limited resources, agency management also needs cost estimates prepared on consistent bases. Our examinations of estimating methods used to develop resource requirements for one contract showed an instance in which inconsistent estimating methods resulted in a \$25,000 overstatement. While the overstatement in this instance is not overly significant by itself, the cumulative result of the use of inconsistent estimating methods could affect project resource requirements and management's use of these project estimates in its planning and control functions.

DOCUMENTATION OF ESTIMATES

A primary requisite of any estimating process is that its results be logical and verifiable. For the Large Area Crop Inventory Experiment we did not find any documentation supporting how estimates for support contractor personnel requirements were derived initially and what changes, if any, occurred during the review by the various levels of management. Consequently, we were unable to evaluate the reasonableness of the estimates of support contractor personnel shown for this project in the NASA data.

ISSUE FOR SUBCOMMITTEE ATTENTION

At the Subcommittee's hearing on July 1, 1976, NASA stated that it was following up with Johnson on our findings regarding problems in planning and control of resources required for the Large Area Crop Inventory Experiment. The Subcommittee should inquire about the results of this followup and pursue with NASA whether these were only isolated instances in which resource planning and control problems have occurred.

CHAPTER 4

POTENTIAL STUDY AREA

Another purpose of our examination of the NASA data was to assess its potential use for identifying areas for future Subcommittee studies. One potential study area is the management of underused, deactivated, or inoperable facilities.

UNDERUSED, DEACTIVATED, OR INOPERABLE FACILITIES

We recently made a review for the House Science and Technology Committee concerning NASA's acquisition and utilization of wind tunnels. ^{1/} During that review, we identified 9 wind tunnels that were inactive and 36 that had been dismantled. Our analysis of the NASA data at Johnson and Ames and inquiries at other centers identified other underused, deactivated, or inoperable facilities.

For example:

- The man-rated centrifuge facility at Johnson had not been used for its design purpose for a number of years. During our examination (March 1976) Johnson requested and received permission from NASA headquarters to dispose of the centrifuge equipment. The building will be modified for other uses.
- Two test facilities at Ames--a shock tunnel and a small wind tunnel--are no longer being used because newer facilities incorporated similar test capabilities. There are no plans for using these facilities, according to Ames officials.
- An explosion in 1971 damaged a wind tunnel at Langley. The damage has not been repaired.
- White Sands Test Facility has been operating and is expected to continue operating at a capacity considerably less than that required for the Apollo Program. For example, a 23,000-square-foot building had been closed since March 1974 and was not expected to be reopened until the end of calendar year 1976.

^{1/}"Acquisition and Utilization of Wind Tunnels by the National Aeronautics and Space Administration" (PSAD-76-133, June 23, 1976).

ISSUE FOR SUBCOMMITTEE ATTENTION

Following our testimony at the hearing on July 1, 1976, NASA acknowledged concern about its underused, deactivated, and inoperable facilities. NASA informed the Subcommittee that it is developing and implementing a new management system in this area.

The Subcommittee should investigate NASA's management of underused, deactivated, or inoperable facilities and NASA's policy and procedures for identifying such facilities and reaching decisions concerning their use or disposal.

OLIN E. TEAGUE, TEX., CHAIRMAN

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COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
 SUITE 2321 RAYBURN HOUSE OFFICE BUILDING
 WASHINGTON, D.C. 20515

May 9, 1975

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Honorable Elmer B. Staats
 Comptroller General of the
 United States
 441 "G" Street, N.W.
 Washington, D. C. 20548

Dear Mr. Staats:

As part of the Committee on Science and Technology's oversight activity during the 94th Congress the Subcommittee on Space Science and Applications, Chaired by the Honorable Don Fuqua, will undertake a comprehensive review of the National Aeronautics and Space Administration's program planning and control. For the Subcommittee and staff to accomplish this task, they will require additional assistance. Therefore, I am requesting that you provide appropriate personnel in support of the Subcommittee's activity.

Attached is a Subcommittee program plan submitted to me by Mr. Fuqua. You will note that there are three phases in this plan:


- (A) the development of a data base,
- (B) a preliminary analysis, and
- (C) a final report by the Subcommittee.

At the completion of each phase a Subcommittee hearing would review the work accomplished and receive comments and recommendations from GAO and NASA. I would expect our staff to work with your staff on a week-by-week basis in support of your activity in phases (A) and (B) as outlined in Mr. Fuqua's plan.

I would assume that you would designate a person to lead your effort and provide guidance to GAO personnel involved.

Since we wish to initiate these efforts at an early date, please provide me with your comments and recommendations at your earliest convenience.

Sincerely,



OLIN E. TEAGUE
Chairman

cc: Honorable Don Fuqua
Honorable Larry Winn

COPY

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

May 8, 1975

Oversight Program Initial Plan, Item #2

Subject: NASA Program Planning and Control

Objective: To examine the effectiveness of institutional planning and control in the employment of NASA resources for research, development, manpower, and facilities through a center-by-center analysis of research programs, development programs, manpower and facilities employment and their interaction with NASA Headquarters management.

Approach: Undertake a three phase study:

Phase A - Develop a data base on a center-by-center basis, including:

- 1 - an inventory of research programs
- 2 - an inventory of development programs
- 3 - an inventory of personnel
- 4 - an inventory of facilities
- 5 - an inventory of planning and control techniques employed

- Subcommittee Hearing - to formally receive data base and GAO/NASA comments and recommendations on data base.

Phase B - Develop preliminary analysis based on Phase A data base outlining the strengths and weaknesses of:

Approach (continued)

Phase B (cont'd)

- 1 - research program allocation and control
- 2 - development program allocation and control
- 3 - facilities and manpower utilization
- Subcommittee hearing to formally receive preliminary report and comment of GAO and NASA on the preliminary report

Phase C - Develop final Subcommittee report based on Phase (A) and (B) effort providing conclusions and recommendations by the Subcommittee on NASA program planning and control.

Basic Work Plan:

General Accounting Office:

Phase A - Develop data base

Phase B - Develop preliminary report

Phase C - Assist Subcommittee Staff in preparation of Subcommittee draft final report

- Testify before Subcommittee at completion of Phase (A) and (B)

Subcommittee

Phase (A) - staff monitor and cooperate in development of criteria for data base development

- staff monitor, through regularly scheduled meetings, the progress of the data base development

Subcommittee Phase (A) cont'd

- Subcommittee-Hold hearing to review data base and determine adequacy to proceed with Phase (B)
- Publish hearings and data base

Phase (B) - staff monitor development of preliminary report through regularly scheduled meetings

- Subcommittee-Hold hearing to review preliminary report and determine adequacy to proceed to Phase (C)
- Publish hearings and preliminary report

Phase (C) - Staff prepare draft final report of Subcommittee based on Phase (A) and (B) hearings and data.

- Subcommittee consider draft final report and approve, as modified by Subcommittee deliberations
- Publish Subcommittee report

Assignments:

GAO-(Subject to Cooperatively developed program GAO/Subcommittee Staff)

GAO Program leader - to coordinate and control GAO activities in all phases

GAO Personnel - to develop data base in:

- 1 - research programs
- 2 - develop programs
- 3 - manpower allocation
- 4 - facilities allocation
- 5 - management systems inventory

GAO Personnel - as required to prepare preliminary analysis for Subcommittee

- as required to assist Subcommittee in final report preparation.

Subcommittee Staff-

Mr. Wilson - to coordinate and control all phases of the the study for the Subcommittee

Mr. Tate & Mr. Branscome - to monitor Phase (A) and (B) effort on development programs effort and prepare draft final report section on development in Phase (C)

Dr. Widnall & Mr. Branscome - to monitor Phase (A) and (B) effort on research programs effort and prepare final draft report in Phase (C)

Assignments: Subcommittee Staff (cont'd)

Col. Gould & Mr. Wilson - to monitor Phase (A) and (B)
effort on manpower and prepare draft final
report on manpower and facilities

Initial Schedule:

- a. Develop overall study schedule goals - complete by April 25
- b. Develop subgroup study schedule goals, Phase (a) -
complete by May 15

GAO note: Because of poor legibility the Subcommittee on Space
Science and Applications program plan was retyped
in its entirety.



National Aeronautics and
Space Administration

Washington, D.C.
20546

February 3, 1977

Reply to Attn of J

Mr. Richard W. Gutmann
Director, Procurement and
System Acquisition Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Gutmann:

Thank you for the opportunity afforded to NASA to review and comment on the draft report titled "Improvements Needed in NASA's Resource Data Base and Its Techniques for Supporting, Planning and Controlling Programs," which was forwarded with your letter, dated October 27, 1975.

The report appears to be in conflict with the request made to the Comptroller General by the Chairman of the Committee on Science and Technology in his letter of May 9, 1975, and the program plan attached to that letter, dated May 8, 1975, prepared by the Subcommittee on Space Science and Applications. This plan described the approach to be employed in executing the Chairman's assignment. The Subcommittee program plan was omitted from the GAO draft report. This is an essential part of the Chairman's request and should be disclosed in GAO's report because the plan describes, in considerable detail, the participative and advisory role (to the Subcommittee) GAO was to play in this review. Indeed, no mention was made in the GAO draft report of the role assigned to them to participate with NASA and the Subcommittee staff in determining the data required for the review.

The GAO report also conflicts with a letter received by the NASA Administrator from the Chairman of the Subcommittee on Space Science and Applications dated October 28, 1975, a copy of which was provided to your office. These and other references cited in this letter are indexed and provided in the Enclosure.

These two above-cited letters describe the three-way cooperative effort of NASA, GAO, and the Subcommittee staff aimed at defining data requirements and assembling sufficient data to

permit examination of the effectiveness of the NASA program planning and control process. The final report was to be prepared by the Subcommittee staff with assistance from GAO. The Subcommittee staff was to prepare the report following this three-way effort and after hearings eventually held on March 18 and July 1, 1976, to give both NASA and GAO an opportunity to report their comments and recommendations.

Throughout the Subcommittee's review, the data base provided by NASA was in direct response to specifications laid down by the Subcommittee staff ". . . based on joint discussions with NASA and GAO" as stated in Chairman Fuqua's letter to NASA, dated October 28, 1975.

This point regarding report preparation was again made quite clear by the Chairman of the Subcommittee on Space Science and Applications at the July 1, 1976, Hearing, attended by you when he said: "As we outlined in the original program plan, following the GAO critique and recommendation of this morning, the Subcommittee will undertake a further review of the program planning and control data calling on the staff of both GAO and NASA to assist as may be necessary. A Subcommittee report will be prepared on this subject at a later date."

This somewhat different role for GAO, that is, participating and working cooperatively with NASA and the Subcommittee staff toward a final report to be prepared by the Subcommittee staff, was also acknowledged by you. This occurred at the March 18, 1976, Hearing (page 23) when, after concluding your prepared statement to the Subcommittee, you said to Chairman Fuqua: "I would like to add a few observations at this time, first about the somewhat different, cooperative relationships and atmosphere that your committee and staff have created here, working together with GAO and NASA, all three... We recognize the size of the task involved in pulling this data together. We hope to continue with this relationship as we now travel further down the road into the actual planning and control system." The Subcommittee staff and NASA have followed this plan.

The draft report describes in considerable detail how the NASA data base should have been made more complete. This ignores the fact that GAO participated fully in the development of the data base requirements and places GAO in a position of issuing a report criticizing data requirements to which it had agreed prior to the study. In view of (a) the initial assignment to GAO, that is, to work with NASA and the Subcommittee staff to define requirements and assemble

sufficient resource data to permit assessment of the effectiveness of the NASA program planning and control process, (b) the subsequent GAO conclusion that no major problems were found with NASA's planning and control guidelines, and (c) the fact that NASA provided the Subcommittee with all the data it requested during the course of the review (a fact corroborated by an advance copy of the Summary of Hearings portion of the Subcommittee report, provided to NASA on January 12, 1977) - it is difficult to understand why 75 percent of the body of the GAO report describes ways that the data base should have been expanded.

As you know, the March 18, 1976, Hearing (page 27), was primarily aimed at permitting the Subcommittee to appraise the pilot information, and to firmly establish the data base requirements. In response to a direct question from Mr. Downing of the Subcommittee, "What are the major weaknesses of the data base as it has evolved so far?", you responded: "We really do not have what I would call a complete set of suggestions for improvement." Yet our records indicate that a complete set of data for Johnson Space Center and Ames Research Center (see Enclosure) was provided to GAO more than five months earlier, on October 3, 1975, with a specific request for suggestions as to how the data could be improved before information was gathered for the other NASA Centers. No suggestions were received. It was not until the March 18 Hearing that GAO expressed any dissatisfaction with the data. At that time, the assembly of NASA data was virtually completed and the time for a change in groundrules was long since past. Subsequent to this Hearing, I offered to amend the data base along the lines of the GAO suggestions but the Subcommittee staff indicated the additional data were not necessary for the purposes of the study.

Our concerns with the nature of the draft report were expressed to GAO at a meeting on December 16, 1976, at which we indicated that GAO appeared to be criticizing NASA for not providing data that it had not been asked to provide. GAO acknowledged the NASA concerns, agreed to revise the draft report, and returned it to NASA for review and comment on December 30, 1976. The revised report still presents a misleading picture of events as they actually transpired.

NASA's concern about the misleading nature of the GAO report was underscored upon receipt of the advance copy of the Summary of Hearings provided by the Subcommittee staff on January 12, 1976. This summary (enclosed in its entirety), which the Subcommittee has authorized NASA to use in this

response to GAO, makes several major points:

1. NASA was directed by the Subcommittee to provide a data base which would provide only a prospective look at the program planning and control process (not account for all its resources as implied in the draft report).
2. The Subcommittee felt that the comparative data displays developed by NASA presented a considerable insight into how NASA plans, controls, and deploys resources. No further resource data were required or requested by the Subcommittee.
3. In the implementation of NASA's planning and control techniques, GAO (in a limited test) did not identify any significant deviation from the guidelines described for NASA Centers. This is consistent with the GAO draft report which states that "GAO did not identify any major problems with the NASA guidelines" for program planning and control.
4. More attention should be given to the management of underused, deactivated, or inoperable facilities. NASA acknowledged this concern and is committed to developing and implementing a new management system in this area and reporting progress to the Subcommittee before July 1977.

Chairman Teague's May 9 letter to GAO (together with Chairman Fuqua's program plan), specifically requested that, in the course of the three-way (GAO, NASA, and Subcommittee staff) cooperative study, both GAO and NASA report their comments and recommendations at Subcommittee Hearings at the end of Phase A (March 18, 1976, on the development of a data base) and again at the end of Phase B (July 1, 1976, for a preliminary analysis). Phase C is specifically identified as "... a final report by the Subcommittee." Phases A and B have been completed. We have assisted the Subcommittee in the preparation of their final report. Our receipt of the advance copy of the Summary of Hearings (a part of the final Subcommittee report) indicates to NASA that the final report on the Subcommittee's review (Phase C) is nearly completed.

In addition, the draft report dwells on the incompleteness of the mutually-agreed-upon data and describes data categories and details that were not only not requested by the Subcommittee, but in some instances, guided out of the study. Moreover, at the hearing before the Subcommittee on July 1, 1976, (page 19) I specifically offered to make additional information available if so requested; no such request was made.

It should also be noted that the data base portion of the study was intended to be of a limited, selective nature. It was purposely designed to provide insight to the Subcommittee into, the techniques by which NASA plans and controls its programs, without reviewing great amounts of detailed information.

In view of the cooperative three-way nature (GAO, NASA, and Subcommittee staff) and the role GAO played in developing in data requirements, we suggest that GAO may wish to: (a) recast its report to state the conclusions and recommendations more in context with the original assignment; (b) describe its own role in determining initial data base criteria; (c) discuss the reasons why an all-inclusive data base was not considered necessary to assess NASA's institutional planning and control process; and (d) describe the changes it would recommend if a similar type of report were requested by the Subcommittee in the future. The proposed title of the report is misleading; a more appropriate title might be "Evaluation of the NASA Program Planning and Control Process."

In considering further expansion of the data base, we would urge GAO to note that the NASA information and data furnished for this Subcommittee study totalled 23 volumes. Further expansion to review even more details certainly would not facilitate the primary purpose of the study, that is, assess the effectiveness of NASA's program planning and control.

Detailed comments addressed specifically to the GAO draft report are provided in the Enclosure which contains all the references noted above, provides additional background information to support the NASA position, and suggests revised wording for selected portions of the report.

Your staff has assured me that the proposed report will be issued on a RESTRICTED basis to the Chairman of the Subcommittee on Space Science and Applications, House Committee on Science and Technology. The NASA comments were prepared with that in mind. We request that all of this material be made a part of the GAO report.



Ray Kline
Assistant Administrator for
Institutional Management

Enclosure (with Attachments) [See GAO note.]

GAO note: The NASA enclosure (with attachments) is not included in the report because it primarily provides only additional background information on the NASA positions set forth in this letter and suggests revised wording we did not agree to incorporate in the report. Page references in this appendix refer to the NASA enclosure.