



governmentattic.org

"Rummaging in the government's attic"

Description of document: **25 National Aeronautics and Space Administration (NASA) Office of Inspector General (OIG) Audit reports, 1985 - 1996**

Requested date: 10-July-2009

Released date: 25-March-2010

Posted date: 26-April-2010

Titles of documents: See release letter

Date/date range of document: 25-October-1985 – 22-February-1996

Source of document: Office of Inspector General
NASA Headquarters
Room 8V69
300 E Street, S.W.
Washington, D.C. 20546
E-mail: foiaoirg@hq.nasa.gov
Fax: (202) 358-2767
[Online FOIA request form](#)

The governmentattic.org web site ("the site") is noncommercial and free to the public. The site and materials made available on the site, such as this file, are for reference only. The governmentattic.org web site and its principals have made every effort to make this information as complete and as accurate as possible, however, there may be mistakes and omissions, both typographical and in content. The governmentattic.org web site and its principals shall have neither liability nor responsibility to any person or entity with respect to any loss or damage caused, or alleged to have been caused, directly or indirectly, by the information provided on the governmentattic.org web site or in this file. The public records published on the site were obtained from government agencies using proper legal channels. Each document is identified as to the source. Any concerns about the contents of the site should be directed to the agency originating the document in question. GovernmentAttic.org is not responsible for the contents of documents published on the website.



MAR 25 2010

SUBJECT: Freedom of Information Act (FOIA) Request

I am responding to your July 10, 2009, request for 27 audit reports released between October 1985 and February 1996, which reports are not available on our website.

My initial determination is to provide redacted copies of the audit reports. Individuals' signatures are being withheld under FOIA exemption (b)(6) to protect personal privacy. 5 U.S.C. § 552(b)(6). The released reports are:

A-AR-89-001, Reuse of Computer Tapes.

A-GO-87-004, Space Telescope Science Institute.

A-GO-91-007, Wallops Flight Facility Balloon Program.

A-JP-88-001, Extreme Ultraviolet Explorer Project.

JP-96-001, Cassini Program Management.

A-JS-87-003, Contingency Planning for the Shuttle Carrier Aircraft.

A-JS-87-005, Space Transportation System Operations Contract (STSOC) NAS9-18000.

A-JS-88-004, Alternative Sources of Electricity.

A-JS-88-008, Super Guppy Operations.

A-JS-89-012, Magnetic Data Tape Usage and Recertification.

A-JS-91-008, Orbiter Production Phasedown Activities.

JS-93-006, Space Shuttle Payload Operations.

JS-94-002, Extended Duration Orbiters.

A-KE-87-006, Contingency Planning for Orbiter Emergency Landings.

KE-93-005, Acquisition of Orbiter Spares.

KE-95-008, Selected Security Risks to the Space Shuttle and Crew.

A-LA-84-302, Management and Utilization of Wind Tunnels.

A-LA-85-004, Aircraft Landing Dynamics Facility.

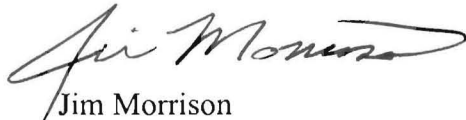
A-LE-88-002, Disposition of Atlas and Centaur Property.

LE-93-004, LeRC 50th Anniversary Expenditures.

A-MA-86-003, Audit of Selected Aspects of Hubble Space Telescope Award Fees
A-MA-87-007, Selected Aspects of the Space Transportation System National Resource Protection Program.
A-MA-89-002, Martin Anomaly Reporting System.
A-MA-90-005, Advanced Launch System Budget, Stennis Space Center.
A-MA-92-003, Advanced X-Ray Astrophysics Facility (AXAF).

Two reports, A-JS-87-007, Orbiter Maintenance and Repair, and A-JS-87-004, Management and Control of Lunar Matter, could not be located.

You have the right to appeal this initial determination to the Inspector General. Under 14 CFR § 1206.605(b), the appeal must: (1) be in writing; (2) be addressed to the Inspector General, NASA Headquarters, Washington, DC 20546; (3) be identified clearly on the envelope and in the letter as an "Appeal under the Freedom of Information Act"; (4) include a copy of the request for the Agency record and a copy of the contested initial determination; (5) to the extent possible, state the reasons why you believes the contested initial determination should be reversed; and (6) be sent to the Inspector General within 30 calendar days of the date of receipt of the initial determination.

A handwritten signature in black ink, appearing to read "Jim Morrison", is written over a horizontal line.

Jim Morrison
Assistant Inspector General for Auditing
OIG FOIA Officer -- Audits

Enclosures

AUDIT REPORT

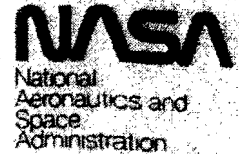
REUSE OF COMPUTER TAPES
AMES RESEARCH CENTER

NOVEMBER 7, 1989

NASA
National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General
Ames Research Center
Moffett Field, California 94035



Reply to Affn of: W/9959

November 7, 1989

TO: Director of Administration, Ames Research Center
FROM: OIG Center Director, Ames Research Center
SUBJECT: Survey Report on Reuse of Computer Tapes
Ames Research Center
A-AR-89-001

The Office of Inspector General has completed a survey of the reuse of computer tapes at Ames Research Center (ARC). The survey was conducted in accordance with the authority and responsibility contained in NASA Management Instruction 9910.1, dated January 28, 1980.

A discussion draft report was provided to ARC on August 30, 1989, and an exit conference was held on September 15, 1989. A draft report was submitted to the Center on October 17, 1989. ARC's formal response to the draft report, received November 3, 1989, outlined measures and actions which were responsive to the recommendations. These comments are presented after each recommendation, and are included in their entirety as Appendix A of the final report. The OIG does not plan to perform any further follow-up activities with regard to the implementation of the corrective actions, but requests notification when ARC management considers the recommendations closed.

OBJECTIVES AND SCOPE

The survey objectives were to evaluate the policies and procedures for disposition of used electronic data processing tapes at ARC. Specific areas of emphasis included possible savings available to ARC through the reuse of computer tapes, and the disposal of tapes containing classified information.

The survey scope included a review of the cost and quantity of computer tapes used at ARC, the costs of recertification, the NASA Physical Security Handbook (NHB 1620.3B), and ARC procedures for disposing of computer tapes containing classified information. The survey did not address the policies, procedures, practices, and internal controls applicable to purchasing new computer tapes or the adequacy of standards for recertified tapes.

The survey covered the period January 1, 1988, through December 31, 1988. During this period, ARC issued approximately 28,000 new computer tapes and cartridges to ARC users, at a total cost of approximately \$291,000.

The audit was performed in accordance with generally accepted Government auditing standards, and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances. Except for the conditions reported below under "Survey Results," the internal controls tested were considered satisfactory.

BACKGROUND

Used magnetic computer tapes can be erased, recertified, and reused. Tapes which contain classified information must be degaussed by a bulk degaussing unit approved by the Department of Defense before they can be returned to general use. Tapes which are no longer needed at the Center are turned over to the Defense Reutilization Materials Office (DRMO).

SURVEY RESULTS

Recertification of Tapes - The results of the survey disclosed that the recertification of magnetic computer tapes is not currently a practical alternative to the purchase of new magnetic computer tapes. Recertification could become a practical alternative if the cost of new tapes (primarily cartridge-type tapes) substantially increases, and/or the number of tapes used at ARC substantially increases.

Of the 28,000 new computer tapes and cartridges issued to ARC users during the 12 month period ended December 31, 1988, about 15,500 were recertifiable. The total purchase price of these tapes was about \$169,000; or an average of about \$10.90 each. The Goddard Space Flight Center (GSFC) maintains a recertification facility which could recertify such tapes at a cost of approximately \$8.00 per tape. (Historical data shows that approximately 35 to 40 percent of the tapes survive the recertification process and are recertified.) Considering that shipping costs to GSFC would approximate \$1.00 per tape each way, and the low tape survival rate, the recertification of computer tapes does not appear to offer significant savings at this time. Also, it was disclosed that many ARC users are already erasing and reusing their own tapes. The survey found no indications that classified tapes were being reused.

In addition to tapes, ARC uses about 5,500 recertifiable #3480 cartridges each year, at a new cost of about \$26,000. The average cost of a new cartridge is about \$4.70. Since ARC had no experience in recertifying cartridges, other centers were contacted to determine their experience with cartridges. GSFC was

found to be considering obtaining the necessary equipment, but at the time had no capability to recertify cartridges. GSFC's projected cost to recertify was estimated at \$2.00 per cartridge. JSC was found to be recertifying cartridges under a local contract, but had insufficient experience to determine the cartridge survival rate.

If ARC sent its recertifiable cartridges to GSFC and then enjoyed a 100 percent recertification rate, ARC would still save only about \$12,000 per year through the reuse of its cartridges ($\$4.70 - (\$2.00 \text{ recertification cost per tape} + \$4.44 \text{ roundtrip postage, ARC to GSFC}) \times 5500 \text{ cartridges per year}$). Due to the small amount of possible savings and the uncertain cartridge survival rate, we do not recommend changes in this area at this time. However, if the level of usage or the purchase price of these cartridges increases, we suggest that ARC determine whether the recertification of cartridge tapes is warranted.

Disposition of Used Tapes - The audit disclosed that some improvements are needed in the disposition of used tapes that contain classified data. The NASA Physical Security Handbook, NHB 1620.3B, requires that the method of destruction selected must ensure that recognition or reconstruction of the classified information or material, in whole or in part, is made impossible.

Results of the survey disclosed that four or five boxes of classified plastic materials (microfiche and computer tapes) were recently burned by the Center. It was later found that the furnace used to burn these items was not certified by the Environmental Protection Agency for the burning of plastics. Also, ARC does not have an approved tape degaussing unit. Without an approved furnace or tape degaussing unit, ARC cannot destroy classified computer tapes, at ARC, in accordance with applicable regulations. The survey also disclosed that the materials burned had accumulated over a period of several years. When classified tapes designated for destruction have been stored for extended periods of time, the possibility is increased that the information may be compromised.

RECOMMENDATION

We recommend that ARC:

1. Destroy all classified tapes designated for destruction, in a timely manner.

MANAGEMENT RESPONSE

Concur. In the absence of specific guidance on the definition of "timely," the Center will commit to destroy all classified tapes within three months of their designation for destruction.

The matter of timely designation for destruction by custodians of classified tapes presents a different problem. In the majority of instances, such designation is a purely subjective decision to be made by the custodian, or the originating program security officials. This fact should not relieve the Center from responsibility for fostering appropriate procedures and for encouraging periodic review of stored classified tapes.

Each periodic Center-wide inventory of classified materials will include actions to encourage the retirement of items no longer needed.

RECOMMENDATION

We recommend that ARC:

2. Burn or erase classified computer tapes only in accordance with applicable regulations.

MANAGEMENT RESPONSE

Concur with the recommendation. Suggest a restatement to broaden and strengthen its effect.

In lieu of "burn or erase" substitute "destroy or erase." The NASA Physical Security Handbook, NHB 1620.3B, does not require the burning of computer tapes. It requires that the method of destruction ensure that recognition or reconstruction of the information, in whole or in part, is precluded. This can be done in an approved furnace, but, it can also be done in any number of approved shredders or pulverizers.

The Center agrees to comply with applicable regulations by properly destroying classified tapes marked for destruction. This will be accomplished in the near term by the Security Operations Office using existing low capacity shredders. In Fiscal Year 1990, the Center plans to initiate procurement of a large, highly capable unit which shreds the tapes then crushes the resultant material. This will allow for on-site destruction of large volumes of this material in a timely way. It will be sized to handle the destruction requirements of both Ames sites now and in the future.

ADDITIONAL AUDIT COMMENTS

We agree that the Center's suggested restatement satisfies the intent of the recommendation.

No further review of the matters discussed in this memorandum appears warranted at this time.

David L. Gandrud

RECEIVED

NOV 3

NASA OFFICE OF
GENERAL

Reply to Attn of: A:200-23

November 3, 1989

TO: Director, Center OIG, Ames Research Center

FROM: Darrell E. Wilcox, Director of Administration

SUBJECT: OIG Survey Report, A-AR-89-001, Reuse of Computer Tapes

We have reviewed your recommendations and offer the following response:

Recommendation No. 1

Destroy all classified tapes designated for destruction, in a timely manner.

Center Response

Concur. In the absence of specific guidance on the definition of "timely", the Center will commit to destroy all classified tapes within three months of their designation for destruction.

The matter of timely designation for destruction by custodians of classified tapes presents a different problem. In the majority of instances, such designation is a purely subjective decision to be made by the custodian, or the originating program security officials. This fact should not relieve the Center from responsibility for fostering appropriate procedures and for encouraging periodic review of stored classified tapes.

Each periodic Center-wide inventory of classified materials will include actions to encourage the retirement of items no longer needed.

Recommendation No. 2

Burn or erase classified computer tapes only in accordance with applicable regulations.

Center Response

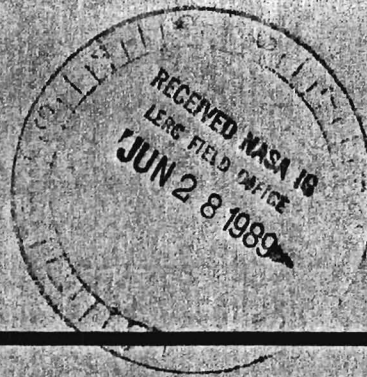
Concur with the recommendation. Suggest a restatement to broaden and strengthen its effect.

In lieu of "burn or erase" substitute "destroy or erase". The NASA Physical Security Handbook, NHB 1620.3B, does not require the burning of computer tapes. It requires that the method of destruction ensure that recognition or reconstruction of the information, in whole or in part, is precluded. This can be done in an approved furnace, but, it can also be done in any number of approved shredders or pulverizers.

The Center agrees to comply with applicable regulations by properly destroying classified tapes marked for destruction. This will be accomplished in the near term by the Security Operations Office using existing low capacity shredders. In Fiscal Year 1990, the Center plans to initiate procurement of a large, highly capable unit which shreds the tapes then crushes the resultant material. This will allow for on-site destruction of large volumes of this material in a timely way. It will be sized to handle the destruction requirements of both Ames sites now and in the future.

 Darren E. Wilcox

AUDIT REPORT



BP _____
BW _____
OT _____
MC LAR _____

SPACE TELESCOPE SCIENCE INSTITUTE
GODDARD SPACE FLIGHT CENTER

JUNE 19, 1989



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Reply to Attn of: 200.1

JUN 19 1989

TO: 100/Director, Goddard Space Flight Center
FROM: 200.1/OIG Center Director, GSFC
SUBJECT: Final Audit Report on Space Telescope Science
Institute, A-GO-87-004

We have completed an audit of the Space Telescope Science Institute. Six copies of the final audit report are attached for your attention and further distribution.

The audit was performed to determine the impact on the Institute's program due to the Space Shuttle Program delays, and to evaluate selected aspects of the administrative and technical contract requirements.

The audit indicated a need for more management oversight of the contractor's performance during the delay period. This included a need for written assessments of contractor performance and a need for improvements in the internal controls over property management, purchasing, and telephone usage. Recommendations were made to increase the level of GSFC oversight and to improve the contractor's internal controls. The Center concurred with the recommendations and corrective actions have been initiated. The specific actions taken by the Center and additional OIG comments are included after each recommendation. General comments provided by the Center are included in their entirety as Attachment A to the report.

In accordance with audit follow-up policy, we wish to be included in the concurrence cycle on recommendation #1 prior to Center management recording the actions completed.

Daniel J. Samoviski

Attachment

cc: W/R. Pelletier
201/J. Clark

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
DIGEST	i
INTRODUCTION	1
OBJECTIVE AND SCOPE	3
OBSERVATIONS AND RECOMMENDATIONS	5
1. Impact of Shuttle Delay on the Institute's Operation	7
2. Contractor Financial Management Report Reviews ...	15
3. Property Management	19
4. Material and Equipment Purchases	23
5. Long Distance Telephone Expenses	27
GENERAL COMMENTS	31
ATTACHMENT A - GSFC Comments	

June 19, 1989

SPACE TELESCOPE SCIENCE INSTITUTE
GODDARD SPACE FLIGHT CENTER

DIGEST

Introduction

The Office of Inspector General (OIG), Goddard Space Flight Center (GSFC), has completed an audit of the Space Telescope Science Institute (the Institute). The purpose was to evaluate the impact of the shuttle delay on the Institute's operation. The audit included an evaluation of: (1) contract administration, (2) in-house support, (3) contractor activities, (4) the reasons for cost growth under the contract, and (5) elements of incurred costs.

Observations and Recommendations

Our review showed that more effective GSFC management oversight of the contractor's performance is needed. A major portion of the work performed at the Institute during the delay period was associated with enhancements to existing systems or to the development of new research. This caused the contract to experience cost growth totalling over \$18 million within a one year period. Essentially the audit focused on an evaluation of the administrative and financial internal controls. The areas in need of improvement are discussed below:

1. Impact of Shuttle Delay on the Institute's Operation

Monitoring of the Institute's operations during the shuttle delay period, between January 1986 and December 1987, was not adequate to ensure that GSFC was obtaining only those services which were necessary for the success of the Institute's mission. As a result, there was not a baseline from which to measure scheduled performance or assess the reasonableness of increased cost. We recommended that GSFC require technical monitors to prepare written assessments of major Science Operating Ground Systems enhancements and capabilities demonstrated in major pre-launch ground systems testings. Additionally, we recommended that GSFC expedite negotiations of contract changes to include definition of enhancements, identification of costs, and schedule completion dates (page 7).

2. Contractor Financial Management Report Reviews

Contractor cost and performance reports provided to GSFC were not used for the purpose described in NASA Handbook (NHB) 9501.2B. As a result, inadequate cost data was used to evaluate contractor performance. We recommend that GSFC perform the Contract Financial Management Report analysis required by NHB 9501.2B and implemented by Goddard Management Instruction (GMI) 9501.1A (page 15).

3. Property Management

Government and contractor property is not adequately controlled by the Institute in accordance with the provisions of the Space Telescope contract. As a result, over \$200,000 in property is not controlled. We recommended that the GSFC Contracting Officer (CO) inform the Institute's management and Defense Contract Administration Service (DCAS) of the noted weakness in the Institute's property management system and enforce compliance with contract clauses regarding reporting of centrally reportable equipment. In addition, the CO should monitor corrective actions taken in response by the Institute (page 19).

4. Material and Equipment Purchases

Accounting and administrative controls over the Institute's material and equipment purchases are inadequate. Purchases were found to have no supporting vendor documentation, state sales taxes were paid unnecessarily, available discounts were lost, and required prior GSFC approvals for purchases were not obtained. As a result, the need for these items and their allowability as contractual cost are questionable. We recommended that the GSFC CO advise the Institute managers and cognizant DCAS office of internal control weaknesses identified in the purchasing and accounting systems and establish stronger internal controls for reducing and controlling contract costs. Also, we recommended that GSFC request Defense Contract Audit Agency (DCAA) to evaluate the propriety of the payments lacking adequate supporting documentation (page 23).

5. Long Distance Telephone Expenses

There is no contractual requirement that the Institute certify its long distance telephone expenses as being calls incurred for official business purposes. Additionally, the Association of Universities for Research in Astronomy (AURA), who has oversight over the Institute, does not have a policy requiring reviews of telephone utilization. As a result, we believe that billings to GSFC may include as much as \$108,000 in personal long distance telephone calls each year. We recommended that GSFC take action to ensure that the

Institute develop and implement an effective policy regarding use of telephone lines and equipment by the Institute (page 27).

INTRODUCTION

The Office of Inspector General (OIG), Goddard Space Flight Center (GSFC), has completed an audit of the Space Telescope Science Institute (the Institute). The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMI) 9910.1 and 1103.27A, dated January 28, 1980, and August 5, 1986, respectively.

The Institute, located on the campus of Johns Hopkins University, Baltimore, Maryland, was established as part of the support function provided by GSFC to the Hubble Space Telescope (HST) program. In general, the HST program is an effort by NASA to establish, operate, and maintain an automated space observatory, which will be placed into orbit by a shuttle. The HST will observe astronomical objects utilizing five scientific instruments and a Fine Guiding System. The data collected will then be transmitted to earth via the Tracking and Data Relay Satellite System for astronomers and scientists to analyze. The major purpose of the Institute is to enable NASA to conduct an astronomy science program resulting from the operation of the HST. More specifically, the Institute will manage the planning and coordination of proposed astronomy research projects, provide a facility for astronomers using the HST and collect, analyze, and disseminate the data observed by the HST.

Funding for this project is provided through a Cost-Plus-Negotiated-Management-Fee contract with the AURA. The period of performance is from April 1981 through two years after the launch of the HST, which was initially scheduled for January 1985. The contract also has provisions for three five-year options.

The launch date for the HST has been rescheduled many times since January 1985. As of December 1987, six cost growth modifications were issued against the basic contract, which have increased the initial estimate from \$40.5 million to \$64.9 million. Currently, GSFC is reviewing a follow-on proposal for a two-year extension to the basic contract, which will further increase the estimated contract cost by an additional \$70 million. Provisional funding is being provided to the contractor until this cost proposal is definitized. The actual cost expended on the contract from April 1981 through December 31, 1987, was \$78.7 million.

OBJECTIVE AND SCOPE

The overall objectives of the audit were to: (1) determine the impact on the Institute's program due to the Space Shuttle Program delays and (2) evaluate selected aspects of the administrative and technical contract requirements. Specifically, our review included an evaluation of: (1) contract administration, (2) in-house support, (3) contractor activities, (4) the reasons for cost growth under the contract, and (5) elements of incurred costs.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documents as were considered necessary in the circumstances. Essentially, most of the audit steps performed in the review related to both administrative and financial internal controls. Internal control weaknesses that were identified are described in the body of the report along with recommended remedial actions.

OBSERVATIONS AND RECOMMENDATIONS

More effective GSFC management oversight of the contractor's performance is needed. A major portion of the work performed at the Institute during the delay period was associated with technical enhancements to existing systems and research. This caused the contract to experience cost growth totalling over \$18 million within a one year period.

Essentially, most of the audit steps performed in the review related to administrative and financial internal controls. The areas in need of improvement are briefly described below:

1. GSFC did not provide sufficient oversight of the Institute's contract during the delay period.
2. Contractor Financial Management Reports (CFMR's) were not being analyzed by GSFC.
3. Government property maintained by the contractor was not adequately controlled in accordance with the provisions of the contract.
4. The accounting and administrative controls over certain Institute purchases were inadequate.
5. The Institute was not certifying that its incurred long distance telephone expenses were all for official business.

The specific conditions relating to these weaknesses, their causes, effects, and our recommended actions are described in the following sections of the report.

1. Impact of Shuttle Delay on the Institute's Operations

Monitoring of the Institute's operations during the shuttle delay period, between January 1986 and December 1987, was not adequate to ensure that GSFC was obtaining only those services which were necessary for the success of the Institute's mission. This condition developed because of a redirection of the Institute's operation prompted by the shuttle delay. The changes resulting from this redirection were never incorporated into the contract. As a result, there was not a baseline from which to measure scheduled performance or assess the reasonableness of increased cost.

The launch delay resulting from the shuttle accident and the subsequent short incremental reschedulings of the HST launch, prompted a new approach to program operations at the Institute. Interviews with Institute managers, scientists, technicians, and administrative personnel indicate that the following operating conditions existed during the delay period:

- The Institute was concerned with losing highly qualified employees with specialized technical and astronomical skills. As a result, the Institute maintained the same level of staffing throughout the delay period.

- New ideas and refinements to existing systems were being developed that led to the purchase of new and more advanced automatic data processing equipment. Specifically, major revisions were made to the Science Operation Ground Systems (SOGS).

- Personal research activities by astronomers increased. The related costs of these activities, such as labor, travel, equipment and supplies were charged to the Institute's contract. (It should be noted that the contract allows for up to 50 percent of the scientist's time to be used for independent research).

- More extensive testing and simulation of existing operating systems were performed. These activities resulted in additional cost for items such as labor and the repair and replacement of hardware and software.

Overall, the work performed during the delay period could be categorized into the following five ground systems task areas established by the Institute:

- a. Test and Repair of SOGS;
- b. Development Projects;

c. Science Instrument Command and Instruction Development and Testing;

d. Procedure and Documentation Development; and

e. Training and Simulations.

Major portions of the contract work associated with these activities were focused on new research ideas and on refining existing hardware and software systems. We determined that these enhancements, which were primarily technical in nature, were never incorporated into the contract statement of work, their costs were not identified, and their scheduled completion dates were not established in relation to the contract mission.

GSFC funded these technical enhancements through the issuances of cost growth increases to the contract. These enhancements increased the Institute's average monthly cost from \$.7 million to \$1.6 million between April 1981 and December 1987, respectively.

GSFC has taken from 7 to 11 months to definitize three of four major cost proposals issued by the Institute over the past 7 years, and as of June 1988 had exceeded 18 months for the other proposal. Such long delays place the contractor in a stronger negotiating position and inhibit the Government's ability to evaluate and control cost growth. Although some controls were in place to monitor and review the allowability of the Institute's incurred costs, GSFC's contract oversight was not sufficient to monitor the Institute's level of spending associated with changes during the delay period. For example, the cognizant DCAA office was performing proposal evaluations and incurred cost audits and the Defense Contract Administration Services (DCAS) was doing the property management reviews. However, GSFC's Technical Officer made only periodic trips to the Institute to review and discuss technical matters and no periodic written assessments of contract performance were being provided to the CO.

In our opinion, additional GSFC oversight of the Institute's contract is necessary during the delay period. The Institute has had a cost growth of over 40 percent, half of which occurred during the delay period. Additionally, it has been incurring costs at a rate of \$1.6 million a month since January 1986. Its operations went from a state of preparing for a 1986 launch of the HST, to a condition of performing work of an enhancement or refinement nature while awaiting launch. Currently, the HST is scheduled for deployment in December 1989, but additional launch delays could occur. As a result, NASA could continue spending a large amount of money for efforts

that may not be necessary to ensure successful contract performance. These conditions show the need to: (1) document and make available to the Contracting Officer assessments made by the Technical Officer in monitoring contractor performance in the area of major ground systems enhancements and (2) definitize contract changes in a timely manner to ensure that contract costs and performance are adequately reported and evaluated against established baselines.

RECOMMENDATION 1

GSFC require technical monitors to prepare written assessments of major Science Operating Ground Systems enhancements and capabilities demonstrated in major pre-launch ground systems testings and submit them to the CO.

MANAGEMENT RESPONSE

Concur. The recommendation to make additional written assessments following major prelaunch tests will be implemented.

Although we agree with the basic recommendation, we disagree with some of the OIG'S discussion and findings in this area. The OIG makes the observation that:

"Monitoring...was not adequate to ensure that GSFC was obtaining only those services which were necessary for the success of the Institute's mission." And, that: "GSFC's Technical Officer made only periodic trips to the Institute to review and discuss technical matters, and no written assessments of contractor performance were being provided to the Contracting Officer."

GSFC takes exception to those statements concerning inadequate technical monitoring of the Institute. Adequate technical reviews occur regularly, and reports are generated to effectively manage the Institute contract. In calendar year 1987, for example, the GSFC Technical Officer traveled to the Institute at least 38 times. Other HST Project members also made trips to the INstitute in the execution of their duties. The HST Project Officer maintains continual surveillance of the ST Institute activities via various primary mechanisms. These are listed as follows:

- o Biannual formal assessments of the technical direction of primary program objectives are performed by the Project Manager and transmitted to the Institute Director.

- o Assessments of Institute performance are provided to senior Project management through monthly status reviews.

- o Monthly progress reports are provided to GSFC as formal contractual documents.
- o Telecons routinely occur several times a week between the Contracting Officer's Technical Representative (COTR) and Institute management.
- o Onsite reviews and meetings are held between technical HSTP-G staff members and technical ST Sci members.
- o Administrative matters are regularly reviewed, such as foreign travel requests and all procurements greater than \$1,000.
- o In addition, ground-system-wide monthly reviews are held by HSTP-G, of which the Institute is a major element, for purposes of ensuring a coherent ground system development.

ADDITIONAL OIG COMMENTS

GSFC comments that adequate technical reviews occurred regularly and reports were generated to effectively manage the Institute contract. However, GSFC is overlooking the fact that our observation was concerned with not only the technical activities of SOGS but with all of the ST Sci's activities being performed during the delay period. The work being performed on this contract was divided among six different task groups within the Institute's organization; namely, (1) General Observer Support; (2) Research Support; (3) Academic Affairs; (4) Operations & Data Management; (5) Instrument Support; and (6) Business Management. In preparation for the scheduled launch in February 1986, all of these task groups were well staffed and pointed in one direction--launch of the HST. As a result of the shuttle accident, these groups took on numerous new activities. Most of these activities were not previously planned for, or scheduled to be performed within the time-frame of the initial contract period of performance as stated in the report. The monthly incurred costs for the contract performance of the Institute escalated from \$.7 million a month to \$1.6 million a month during the delay period. Our review showed that there were no changes made to the oversight procedures at the Institute to appropriately adjust for more controls over the increased spending or in reviewing the necessity of the enhancements taking place during the unique situation of the shuttle delay.

It should be further emphasized that our observations did recognize the items cited by GSFC, in their comments, as primary mechanisms to oversee the contract technical performance. However, some of these items, such as the monthly status reviews and the monthly progress reports, were just contractual requirements to report the status of ongoing activities to GSFC. Further, the bi-annual

assessments, quoted by GSFC, were performed primarily on activities related to achieving ground system readiness (SOGS) between the Institute and Goddard. Also, only two of these bi-annual assessments were performed and they were both done after our review. We believe this action, by GSFC, was a recognition on their part that additional activity was needed at the Institute. The other mechanisms, such as telecons, onsite meetings and administrative reviews, in our opinion, were routine activities mostly pertaining to the HST Project, and not increased monitoring necessary to assess the Institute activities during the unique situation of the shuttle delay. In concluding, we still strongly support our statements that more monitoring is needed during the delay period. It is our opinion that our recommendation to assess the major enhancements will greatly improve controls over spending, and allow the Contracting Officer to be more knowledgeable of the efficiency of contract performance.

RECOMMENDATION 2

GSFC expedite negotiation of contract changes to include definition of enhancements, identification of costs, and schedule completion dates.

MANAGEMENT RESPONSE

Concur. We agree that expediting all contract activities in order to have a current and accurate baseline is a top concern. Although we agree with the basic recommendation, we do take exception to some of the reported findings which led to that recommendation. Coupled with the OIG observation of inadequate monitoring is the observation that: "...a redirection of the Institute operation [was] prompted by the shuttle delay. The changes resulting from this redirection were never incorporated into the contract. As a result, there was not a baseline from which to measure scheduled performance or assess the reasonableness of increased cost."

The OIG statement that the contract lacks a baseline from which to measure performance is misleading. The contractor is responsible not only for the establishment of the ST ScI facility, but also for developing, maintaining, and refining the scientific capability of that facility. The contract contains a broad mission statement that defines performance objectives. As a result, the work effort necessary to fulfill that mission may not be reflected in specific contractual language which would require alteration of the statement of work by change order. Specifically, the statement of work (SOW), requires the Institute to maintain and improve its operational systems. Accordingly, no contract changes are necessary to authorize the work. The Institute's work plans are evaluated

continuously and reviewed formally on a bi-annual basis as a minimum. Work is prioritized and scheduled. Unnecessary or over-budget items are eliminated.

While we agree with the OIG recommendation that negotiation of changes be expedited, there are extenuating circumstances. The most notable situation is the resolution of a proposal cited in the OIG report as having been over 18 months in-house without definitization. This particular launch delay proposal, Science Institute Proposal #0046, dated October 6, 1986, became bogged down in a dispute over the application of cost accounting standards (CAS) to the contract. This is a difficult issue which could not be resolved without NASA Headquarters involvement. The CAS issue, although not directly related to the launch delay itself, prevented actual definitization of a modification. The proposal was, however, completely negotiated, if not executed.

An observation made by the OIG in connection with both of the above cited recommendations is that launch delays have resulted in a new approach to the Institute contract. The concern here is that this redirection was not monitored or approved appropriately by the HSTP-G nor was the baseline for this redirection negotiated into the contract in a timely manner. The two concerns have been addressed above. However, the OIG makes observations regarding the work performed by the Institute during the delay period and comments on several areas which they have taken issue with. Before commenting on the specific findings, it should be pointed out that launch delays have been announced in short increments. This has resulted in several launch delay proposal iterations which were characterized by the OIG as "cost growth." About half of the 40 percent growth figure quoted by the OIG is a result of launch delay extensions.

ADDITIONAL OIG COMMENTS

GSFC believes that some of our statements concerning the Institute's redirection of work and the absence of an established baseline to measure scheduled performance are misleading. In our opinion, all the statements made in our observation regarding a baseline clearly show the conditions we found during the delay period. In many instances throughout the comments made by GSFC, it can be noted where GSFC recognized that these conditions exist, but yet, felt it was necessary to explain them in more detail. For example, our observation took note of the long delays in definitizing contract modifications. This is an action that is necessary in order to update other related financial reports and show the current status of contract costs and other changes. GSFC acknowledged these

conditions, but felt compelled to explain that there were extenuating circumstances that caused them.

Secondly, our review disclosed that there were increased costs to the contract due to the redirection of work during the delay period, and activities being performed which were not planned or included in the contract. Again, GSFC agreed by stating in their comments that the cost growth to the contract was the result of launch delay extensions which provided the opportunity to accomplish a large portion of enhancements to the SOGS system before HST becomes operational. They also explained that the contract contains a broad mission statement that allows them to maintain and enhance the various systems during the performance of the contract. However, it is our opinion that these conditions had to be applicable to the operational phases of the HST project especially since a delay period was not foreseen. Restated, a great deal of the work which was performed during the delay period should have been completed prior to the launch date.

We recognized that GSFC may have a justifiable reason for some of the conditions. However, considering the increased level of spending for enhancements to a project that is not yet operational, it is necessary that controls be in place to ensure that all efforts are required for a successful contract performance. Our observation, along with our supporting recommendation, clearly states these conditions and provides the most appropriate corrective action.

2. Contractor Financial Management Report Reviews

Contractor cost and performance reports provided to GSFC were not used for the purposes described in NASA Handbook (NHB) 9501.2B. This condition occurred because the CO and project management were satisfied with only a limited amount of information on contractor performance and because of alleged staffing shortages. As a result, inadequate cost data was used to evaluate contractor performance.

In accordance with GMI 9501.1A, which implements NHB 9501.2B, a formal analysis of the CFMRs is required on any contracts where the estimated cost is over \$500,000 and the period of performance is one year or more. The GMI requires that CFMRs be analyzed and evaluated regularly, and the results recorded in a definitive format. Further, it states that at a minimum, a quarterly written analysis will be performed on CFMRs and should consist of at least the following:

- a. A comparison of the current CFMR with previous ones;
- b. An explanation for any changes in the report's projection;
- c. An explanation for anticipated changes in resource requirements from those outlined in the current contract;
- d. An assessment of completeness, timeliness, and accuracy of the CFMR; and
- e. A description of the analyst's approach and observations, if any, toward analysis of technical (work) progress to date versus cost to date, projections and assessments, including earned value versus costs (if appropriate), and recommended actions. An attempt should be made to assess technical progress as compared to cost in all CFMR analyses.

The purposes of this analysis as described in NHB 9501.2B are to:

- a. Project both costs and hours to ensure that dollar and labor resources realistically support the schedule;
- b. Evaluate contractor cost performance;
- c. Plan, monitor and control resources; and
- d. Establish the basis for the agency's accrued revenue and expenditure accounting system.

The Institute contract is a multi-year contract valued at over \$170 million and requires a formal analysis. Our review disclosed that since April 6, 1984, the date of the last noted review, no formal written analyses of the CFMRs were prepared. According to the contract's financial analyst, the CFMRs were used to calculate an overall labor rate and the number of full time equivalents. These two calculations were used to determine whether the contractor was operating within the estimates submitted on the quarterly CFMRs (533Q). In addition to this review, the Technical Officer performed a limited review of the reports. Specifically, the Technical Officer reviewed the contract's monthly cost over the past year to assist in the establishment of incremental funding estimates for the upcoming fiscal year. Reports on the results of the CFMRs' analyses are to be made available to key management officials such as the CO and Project Manager to provide them with the information needed to properly administer the contract.

In our opinion, these limited reviews do not provide sufficient information to ensure the accuracy of the reported figures, nor are they adequate to provide management with needed data to meet the purposes as described in NHB 9501.2B. For example, the Institute changed the February 1984 CFMR (533M) to show subcontractor's costs as \$6 million less than they should have been. This unauthorized change was not detected until 18 months later when a GSFC internal review of the CFMRs was requested during the negotiation of contract Modification 41. OIG review disclosed no written explanation for the change. Although the bottom line figure totalled the same, this action created an appearance of a significant cost overrun in the subcontractor's cost category. Subsequently, it was used as a basis to seek additional funding for the contract. If this error had gone unnoticed during negotiation, a cost growth proposal for an additional \$5 million to this cost category may have been approved for an amendment to the contract estimate. It is our opinion that the absence of periodic formal written analyses of the CFMRs contributed significantly to this error entering the system and remaining undetected for 18 months.

During our review of fiscal year 1986 CFMRs, we identified another example of inaccurate reporting that would have been detected and explained if periodic analyses were being performed. Modification number 49 was negotiated for \$4.9 million to cover potential overruns. The monthly CFMR dated June 1986 showed that, instead of updating all the estimates of the various cost categories as negotiated (see below), the total amount of the Modification was posted by the Institute to the estimate designated for subcontract costs on the CFMR.

	<u>Negotiated</u>	<u>Posted</u>
<u>Labor</u>	\$ 2,514,000	-0-
Employees Benefits	416,000	-0-
Materials & Equipment	1,603,000	-0-
Travel	640,000	-0-
Subcontract	<1,088,000>	\$ 4,923,000
Other Direct Costs	838,000	-0-
TOTAL	\$ 4,923,000	\$ 4,923,000

Both examples display a need for improvements in the financial analysis of CFMRs. Inaccurate information not only misrepresents the contract's financial status and contractor's performance, but also could mislead management in negotiations of cost increases.

In our opinion, this part of contract administration is a significant management tool and to be meaningful, GSFC must ensure that the analyses as described in NHB 9501.2B and GMI 9501.1A are performed.

RECOMMENDATION 3

GSFC should perform the CFMR's analyses as required by NHB 9501.2B as implemented by GMI 9501.1A.

MANAGEMENT RESPONSE

Concur. The project will perform the CFMR analyses required by NHB 9501.2b and work with the Institute to improve the quality of its submissions.

While GSFC concurs with the recommendation, we take issue with the OIG findings that inadequate cost analysis was done on the monthly financial management reports. The analysis was performed both by the cost analyst and the Technical Officer for purposes beyond establishing incremental funding dates. The issue should be one of proper and adequate documentation of the ad hoc analysis performed. The Project has provided cost management of the Institute through: utilization of 533 reports for internal costing and budgeting activities; oversight of Institute expenditures via monthly review at the contractor's facility; review of Institute monthly progress reports and comparison with previously submitted 533 quarterly reports; and evaluation of the Institute program operating plan prior to establishment of the yearly budget.

The statement made on the OIG draft report that: "Inaccurate information not only misrepresents the contract's financial status and contractor's performance, but also could mislead management in negotiations of cost increases." It should be noted that 533's are not used as

a basis for evaluating or negotiating cost growth for the purposes of revising the negotiated cost of the contract. Separate and complete proposals are submitted for evaluation. These proposals undergo detailed audit by the Defense Contract Audit Agency (DCAA); formal technical evaluation by the Technical Officer; analysis of the cost proposal by the financial analyst, using the inputs from the audit report and technical evaluation; and, finally, review of all inputs by the negotiator for appropriate use in the formulation of a fully-documented and approved prenegotiation plan. While complete and accurate 533 reporting can provide a vehicle for monthly assessment of cost performance against the baseline plan, 533's are not used as the basis for adjusting the contract value. We would expect any errors made in 533 reporting to be uncovered during negotiations, as the OIG found was the case during the negotiation of Modification 41.

ADDITIONAL OIG COMMENTS

GSFC has taken issue with our observation that inadequate cost analyses were being performed on the financial management reports. However, their comments do not provide any information to show that our observation was incorrect. GSFC explained in their comments that cost management information on the Institute was being provided through a number of reports and reviews required by the contract. Although we do not disagree with this position taken by GSFC, it must be mentioned that none of these items provides the same information that would be obtained through proper and accurate monthly analyses of the Contractor Financial Management Reports. Further, the performance of these analyses is required by NHB 9501.2b.

GSFC also took issue with our statement that inaccurate information on the 533 reports could mislead management in negotiations of cost increases. From their comments, it seems they understood our statement to mean that 533 reports are used for negotiations. In our opinion, our observation did not disclose that this situation was occurring nor was it meant to be implied. The monthly analyses of 533 reports are required reviews for the purpose of providing management with the financial status of a contract. As explained in our observation, if these analyses are not properly prepared they can mislead management in their evaluation of costs increases proposed by contractors. In view of the concurrence with our recommendation, we believe that GSFC shares these same thoughts.

3. Property Management

Government and contractor property is not adequately controlled by the Institute in accordance with the provisions of the contract. This condition is due to internal control weaknesses in the Institute's property management system that allows equipment to go unaccounted for while in the custody of employees. As a result, over \$200,000 in property is not controlled.

Article XLIV of the Institute's contract (NAS5-26555) addresses the acquisition, fabrication, and reporting of centrally reportable equipment. Pursuant to the clauses, appendices, and NASA Procurement Regulations incorporated by reference in the Article, the Institute's property control system

"... shall provide financial accounts for Government owned property in the contractor's possession or control. The system shall be subject to internal control standards and be supported by property records" Furthermore, "... summary stock records may be maintained for plant equipment costing less than \$1,000 per unit. The contractor's property control system shall be such as to provide the following minimum information: (1) contract number, (2) noun name, (3) manufacturer, (4) quantity received, (5) balance on hand, (6) posting reference and date of transaction, (7) unit price, (8) location, (9) disposition."

The Institute's Equipment Visibility System (EVS) identified \$4,317,051 in controlled equipment with a unit price over \$1,000 and \$414,998 in equipment with a unit price between \$500 and \$1,000. We tested 37 items of reportable equipment using a two-way test approach to trace purchases to work areas and equipment located in various work areas to the property records. We located all items of equipment traced from the inventory listing to the accountable office; however, several items of equipment located in various offices were not recorded in the property listing. Specifically, the following items of equipment were in the Institute's offices but were not on its property list nor were they tagged:

Equipment Valued over \$1,000

<u>Location</u>	<u>Equipment Description</u>	<u>Serial #</u>	<u>\$ Value</u>
RM 111	Digital Computer-Microvax	WF-60605394	24,240
RM 128	Digital Letterwriter Model 100	AD-797	2,300
RM 128	Digital Correspondent	PN-537-34	1,800

RM 128	Digital VT 100 Terminal	WF-747708	1,425
RM 128	Digital RA81 Disk Drives	CX-03102	18,640
RM 128	Digital RA81 Disk Drives	CS-03102	18,640
RM 128	Digital RA81 Disk Drives	CXA-023804	18,640
RM 128	Digital RA81 Disk Drives	CXA-018871	18,640
RM 128	Digital RA81 Disk Drives	CXA-024206	18,640
RM 128	Digital RA81 Disk Drives	CSA-023249	18,640
RM 203	IBM Personal Computer	5170-732809	1,570
RM 411	Talaris Model 800 Laser Printer and Controller	1096733	25,240
RM 656	Texas Inst. Explorer Computer	434235002	40,000
RM 660	Digital Computer-Microvax	WF-61005613	<u>24,240</u>
TOTAL			\$214,015

Equipment valued between \$500 and less than \$1,000

<u>Location</u>	<u>Equipment Description</u>	<u>Serial #</u>	<u>\$ Value</u>
RM 644	IBM Selectric II	26-4776051	<u>\$ 885</u>
TOTAL			\$ 885

The Institute's facilities manager could not explain how or why the equipment was in the custody of an employee but not recorded in the Institute's EVS. Further inquiry disclosed some equipment that was originally loaned from the manufacturer was not included in the inventory when subsequently purchased because the accounting department failed to notify the facilities manager. Also, some equipment was delivered directly to the user location by the shipping and receiving department without initial tagging. As a result, a significant number of items are not accounted for in the Institute's property management system and are vulnerable to loss or theft.

The GSFC CO should inform the Institute's management and the cognizant DCAS office of the noted weaknesses with its property management system and request that they be remedied. The Institute's policies and procedures should be examined regarding shipping instructions issued by the purchasing department and equipment handling functions performed by the shipping and receiving department.

RECOMMENDATION 4

The GSFC CO should inform the Institute's management and DCAS of the noted weakness in the Institute's property management system and enforce compliance with contract clauses regarding reporting of centrally reportable equipment. In addition, the CO should monitor corrective actions taken in response by the Institute.

MANAGEMENT RESPONSE

The Contracting Officer informed the Institute of the weaknesses found in its property management system on December 1, 1988. At the same time, the Contracting Officer requested that the cognizant DCAS office perform a full review of the Institute's property management system and make appropriate recommendations for correction of all weaknesses and deficiencies found. The Contracting Officer shall review the findings, monitor implementation of corrective actions, and perform appropriate follow-up activities. The Institute provided a response on January 12, 1989. The response noted that the DCAS office has recently rated the Institute's property management system "satisfactory." The equipment listed in the OIG report has been located, tagged and entered on the ST Sci property inventory listing.

4. Material and Equipment Purchases

Accounting and administrative controls over the Institute's material and equipment purchases are inadequate. Purchases were found to have no supporting vendor documentation, state sales taxes were paid unnecessarily, available discounts were lost, and required prior GSFC approvals for purchases were not obtained. These conditions occurred due to employee errors, internal processing delays, and a lack of management oversight. As a result, the need for these items and their allowability as contractual costs are questionable.

The contract requires the Institute to obtain prior CO approval before purchasing material and equipment costing over \$1,000. In addition, the Institute, as an educational institution, is exempt from Maryland state sales tax. Good business practice dictates that the Institute claim the exemption on Maryland sales tax on its material and equipment purchases to reduce Government contract costs. We reviewed the Institute's material and equipment expenses billed under the contract for fiscal years 1985 and 1986 and the first eight months of 1987. Our sample consisted of 93 expense items charged to the materials and equipment account. In reviewing the 93 expense items for reasonableness, allowability, and allocability, the following deficiencies were observed:

a. Purchase order files for nine payments made during fiscal years 1985 and 1986 did not contain receipts or invoices describing the items purchased. These payments were as follows:

<u>Period</u>	<u>Payee</u>	<u>Amount</u>
85-02	John L. Tonry	\$ 300
85-04	Dr. E. Slagt	300
86-04	Lambda Electronics	222
86-04	Luskins	99
86-07	Epsteins	154
86-10	Excelan	3,950
86-10	Balto. County Public Library	630
86-12	Think Technologies	125
86-12	Institute employee	300
TOTAL		\$6,080

Each payment, except the last, was traced to a cancelled check to verify that the expense was incurred. However, without a vendor invoice or a detailed receipt, we could not determine the allowability or reasonableness of the expenditure. The last payment on the list was to an Institute employee and was not supported by any documentation.

b. Material and equipment were purchased without prior GSFC approval. While the contract requires that the CO approve in advance all purchases over \$1,000, we found that the following purchases were made without such approval:

Purchases without required GSFC approval

<u>Period</u>	<u>Payee</u>	<u>Expense</u>
86-03	Gould, Inc.	\$1,089
86-03	Mills Communications, Inc.	3,379
86-04	Neslab Instruments, Inc.	1,940
87-06	Computer Remarketing Corp.	1,275
TOTAL		\$7,683

In discussing these purchases with the Institute's Controller, he noted that employee error or oversight was the predominate reason for the deficiencies.

c. The Institute erroneously paid Maryland state sales tax and also lost available discounts on its purchases. In this regard we noted:

Sales tax paid

<u>Period</u>	<u>Payee</u>	<u>Expense</u>	<u>Sales Tax</u>
86-02	Continental Resources, Inc.	\$3,133.00	\$91.25
TOTAL			\$91.25

Lost available discounts

<u>Period</u>	<u>Payee</u>	<u>Expense</u>	<u>Lost Available Discounts</u>
86-12	U.S. Design Corp.	\$5,000	\$102
86-12	Sexauer	351	17
TOTAL			\$119

In summary, 17 percent (16 of 93) of the items reviewed disclosed accounting or administrative control weaknesses. The absence of adequate documentation supporting transactions creates questions as to the allowability and reasonableness of the expense. Also, payment of state sales tax when exempt and the loss of available discounts on purchases results in increased costs to the Government. Finally, the failure to obtain prior approval for purchasing materials and equipment over \$1,000

violates the terms and conditions of the contract. The occurrence of each of these conditions demonstrates a need for improved controls in the accounting and procurement systems.

We believe GSFC needs to emphasize to the Institute the importance of controlling costs and instituting efficient operating practices while complying with the terms and conditions of the contract. To this end, we believe the Institute should be advised of these observations and corrective actions monitored.

RECOMMENDATION 5

The GSFC CO should advise the Institute and cognizant DCAS office in writing of internal control weaknesses identified in the Institute's purchasing and accounting systems and require stronger internal controls for reducing and controlling contract costs.

MANAGEMENT RESPONSE

Concur.

RECOMMENDATION 6

GSFC request DCAA to evaluate the propriety of the payments lacking adequate supporting documentation.

MANAGEMENT RESPONSE

Concur. The GSFC Contracting Officer forwarded a copy of the OIG findings in the areas of material and equipment purchases to DCAS for response on December 1, 1988. The Contracting Officer will request that the DCAA review all previously-submitted vouchers to determine whether or not they were appropriate for payment. The Institute will be required to correct all weaknesses and deficiencies uncovered by the DCAS. GSFC will monitor those corrective actions. Any vouchers previously paid that are lacking in supporting documentation will be adequately documented, and credit to the contract received for any vouchers which cannot be fully supported.

The Institute noted in its response to GSFC that while the accounting files may not have contained all the support that the OIG desired, the procurement files supporting the actions questioned contained a description of all purchases.

5. Long Distance Telephone Expenses

There is no contractual requirement that the Institute certify its long distance telephone expenses as being calls incurred for official business purposes. Additionally, AURA, with management oversight over the Institute, does not have a policy requiring reviews of telephone utilization. As a result, we believe that billings to GSFC may include as much as \$108,000 in personal long distance telephone calls each year.

AURA employees may be using the Institute's telephone lines and equipment to conduct personal business. While GSFC and on-site contractor employees are directed by management instruction regarding the use of long distance telephone calls, no similar controls are in place at the Institute. NMI 2540.1B (Placing of Official Telephone Calls), states that "The FTS Network on commercial telephone facilities shall not be used for personal business." GMI 2540.2D, under Long Distance Telephone Calls, states "The FTS is for official Government business only and the use of Government facilities for personal business or pleasure is prohibited." Additionally, this GMI requires that annual certification be made by contractors that all telephone usage is for official business. The Institute's managers stated no certification requirement exists in its contract with GSFC, nor by AURA policy.

GSFC has instituted these management instructions to control long distance telephone usage. To demonstrate the value of these internal control measures, we noted that the Institute expends approximately \$240,000 each year for long distance telephone calls made by its employees. This equates to about \$800 for each employee. In contrast, GSFC, which has certification policies, expends approximately \$150 for each employee. While the Institute has self-imposed a limited review of calls "out of the ordinary," the review addresses only those calls greater than 100 minutes in duration.

A recent OIG review of the FTS utilization at GSFC and long distance telephone calls placed by Government and contractor employees has determined that as much as 45 percent of the calls placed were for employee personal business. Audit resources did not permit duplicating this review at the Institute; however, should similar conditions exist at the Institute, then as much as \$108,000 each year may be included in billings to GSFC for personal long distance telephone calls.

We believe internal controls over employee long distance telephone usage need to be strengthened. Such action will provide increased assurances that telephone

expenses billed to GSFC are allowable and allocable under the contract. In our opinion, the GSFC CO should emphasize increased monitoring of long distance telephone calls.

Accordingly, GSFC should take action to ensure the Institute develops and implements an effective policy regarding the authorized use of the Institute's telephone lines. Such a policy should establish sufficient internal control over the Institute and contractor employees' phone use to permit reasonable assurance that telephone expenses billed to the contract are for official purposes.

RECOMMENDATION 7

GSFC take action to ensure the Institute develops and implements an effective policy regarding the authorized use of all phone lines and equipment by the Institute.

MANAGEMENT RESPONSE

Concur. The Contracting Officer has been working with AURA on this action. On December 6, 1988, the Institute published a policy governing long distance telephone usage for all Institute staff members, contractors, and visitors, and distributed this policy on December 12, 1988.

The OIG states "...we believe that billings to GSFC may include as much as \$108,000 in personal long distance telephone calls each year." This statement is based on an extrapolation of a GSFC actual audit of employee telephone usage which found that 45 percent of the FTS calls placed at GSFC were for employee personal business. There is no basis for applying the GSFC audited "abuse" figure to the Institute. While there may be use of the Institute phone system for personal calls, such an extrapolation is conjecture.

The OIG observes that the average telephone bill per employee at GSFC is \$150 while it is \$800 at the Institute. GSFC does not believe that this is a meaningful comparison. The demographics of the Center do not resemble those of a small group of scientists whose mission is to establish and maintain contact with an international scientific community. The amount of international activity sponsored by the Institute does not resemble either Goddard or even its scientific organization, the Code 600 Space and Earth Sciences Directorate.

ADDITIONAL OIG COMMENTS:

GSFC seems to be displeased with our audit approach of applying prior telephone use conditions at GSFC to the Institute. Our decision to make such a comparison between

both entities was based on our observations of the following conditions at the Institute:

(a) Like other GSFC contractors, the Institute was being monitored by Goddard. Accordingly, it is subject to the same administrative controls of all the other contracts.

(b) The telephone usage at the Institute was not just by a small group of scientists, but by all the employees at the Institute, including administrative staff, subcontractors and other related HST Project people who were located there.

(c) The Institute did not have a policy requiring reviews of telephone utilization.

(d) The period of our review and of the contract performance was not during the operational phase of the HST when more frequent use of long distance calls would be expected.

Our observations show similarities as well as additional inefficiencies beyond the conditions noted at Goddard. It was emphasized several times throughout our writeup that the telephone use comparison approach was only to show the conditions and the associated costs that may be occurring without the knowledge of the Institute or GSFC personnel. It was also used to demonstrate the need for stronger internal controls regarding the use of long distance telephone calls.

GENERAL COMMENTS

The Office of Inspector General staff members associated with this review express their appreciation to the GSFC and ST ScI personnel contacted for their courtesy, assistance, and cooperation.

GODDARD SPACE FLIGHT CENTER

RESPONSE TO

OFFICE OF INSPECTOR GENERAL (OIG)

FINAL DRAFT REPORT:

AUDIT OF SPACE TELESCOPE SCIENCE INSTITUTE (ST Sci)

OIG REPORT NUMBER A-GO-87-004

DRAFT REPORT DATED DECEMBER 29, 1988

FEB 23 1989
FEB 23 1989

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771



FEB 23 1989

Reply to Attn of: 201

TO: 200.1/Director, Center Office of Inspector
General (OIG), GSFC

FROM: Director

SUBJECT: GSFC Response to OIG Draft Report on Review
of Space Telescope Science Institute (ST ScI),
A-GO-87-004

Enclosed is our response to your draft audit report dated
December 29, 1988, on ST ScI.

Please call Ms. JoAnn Clark at 6-7977 if you have any
questions or need further coordination or assistance on
this.

John W. Townsend, Jr.

Enclosure

cc: Mr. Dunfee/200
Ms. Clark/201
Mr. Ladomirak/280
Ms. Fortunat/280
Mr. Kirk/284.1
Mr. Moak/284.1
Mr. Longanecker/400
Mr. Moore/440
Mr. Mason/440

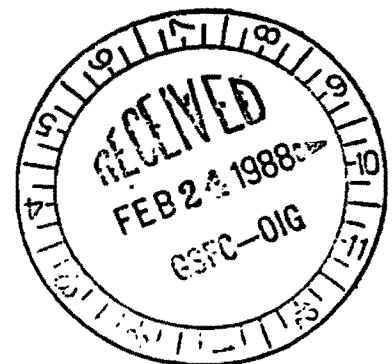


TABLE OF CONTENTS

OBSERVATIONS AND RECOMMENDATIONS (INTRODUCTION).....	1
1. IMPACT OF SHUTTLE DELAY ON THE INSTITUTE'S OPERATIONS...	2
OIG RECOMMENDATION 1.....	2
GSFC RESPONSE:.....	2
GSFC COMMENTS.....	2
OIG RECOMMENDATION 2.....	3
GSFC RESPONSE:.....	3
GSFC COMMENTS.....	3
2. CONTRACTOR FINANCIAL MANAGEMENT REPORT (CFMR) REVIEWS...	7
OIG RECOMMENDATION 3.....	7
GSFC RESPONSE:.....	7
GSFC COMMENTS:.....	7
3. PROPERTY MANAGEMENT.....	8
OIG RECOMMENDATION 4.....	8
GSFC RESPONSE:.....	8
4. MATERIAL AND EQUIPMENT PURCHASES.....	8
OIG RECOMMENDATION 5.....	8
GSFC RESPONSE:.....	9
OIG RECOMMENDATION 6.....	9
GSFC RESPONSE:.....	9

GSFC Response to OIG
12/29/88 Draft Report,
ST Sci, A-GO-87-004

TABLE OF CONTENTS

5. LONG DISTANCE TELEPHONE EXPENSES.....	9
OIG RECOMMENDATION 7.....	9
GSFC RESPONSE:.....	9
GSFC COMMENTS:.....	10

This response is organized following the "section" and recommendations" format of the OIG's draft report.

OBSERVATIONS AND RECOMMENDATIONS (INTRODUCTION)

The OIG makes the observation on page 8 of the draft report that: "A major portion of the work performed during the delay period was associated with enhancements to existing systems or to the development of new research."

With the Challenger accident, several of NASA's programs and projects faced unforeseen delays. Over time, the launch of the Hubble Space Telescope (HST) slipped from January 1985 until December 1989, the current projected launch date. As a result, the HST Project-Goddard (HSTP-G) was forced to regroup. The delays experienced have been used by the Institute, with the concurrence of the Project, to perform testing and other shakedown activities which otherwise would have occurred over the first 6 months of on-orbit performance. These activities will greatly reduce the postlaunch checkout of the complete observatory, the spacecraft, science instruments, and ground systems. The delays have also resulted in an opportunity to update software and equipment to ensure the greatest potential for efficiency and effectiveness of the HST when it is finally launched. These enhancements would have occurred as postlaunch activities in this timeframe in any event had the telescope been launched in 1985 as originally scheduled. The activities that have occurred during the launch delay period are consistent with that mission plan. Since the HST is a 17-year science mission, enhancements will continue to be made over the life of the contract.

Although the OIG may be accustomed to seeing tighter control over onsite contractor employees performing operational functions for the Government, the situation with the Institute is not analogous. At the inception of the procurement for the ST Institute, much discussion between NASA Headquarters, this Center, and the scientific community took place regarding exactly what "type" of facility the Institute would be. Locating the Institute onsite to allow for tighter Government control was, in fact, one of the options under discussion. The decision to locate the Institute away from the Center was made consciously in an attempt to demonstrate that the Institute was viewed by NASA as an independent scientific facility sponsored and funded by NASA, rather than a Government-controlled institution. This distinction is critical to the scientific community and directly affects GSFC's approach to providing oversight versus daily direction to the Institute. Therefore, GSFC maintains that the amount of monitoring provided Institute activities is appropriate.

1. IMPACT OF SHUTTLE DELAY ON THE INSTITUTE'S OPERATIONS

OIG RECOMMENDATION 1

GSFC require technical monitors to prepare written assessments of major Science Operating Ground Systems (SOGS) enhancements and capabilities demonstrated in major prelaunch ground systems testings and submit them to the Contracting Officer (CO).

GSFC RESPONSE: Concur

The recommendation to make additional written assessments following major prelaunch tests will be implemented.

Although we agree with the basic recommendation, we disagree with some of the OIG's discussion and findings in this area.

GSFC COMMENTS

The OIG makes the observation on page 10 of the draft report that: "Monitoring... was not adequate to ensure that GSFC was obtaining only those services which were necessary for the success of the Institute's mission." And, on page 13 of the draft, that: "GSFC's Technical Officer made only periodic trips to the Institute to review and discuss technical matters, and no written assessments of contractor performance were being provided to the Contracting Officer."

GSFC takes exception to those statements concerning inadequate technical monitoring of the Institute. Adequate technical reviews occur regularly, and reports are generated to effectively manage the Institute contract. In calendar year 1987, for example, the GSFC Technical Officer traveled to the Institute at least 38 times. Other HST Project members also made trips to the Institute in the execution of their duties. The HST Project Officer maintains continual surveillance of the ST Institute activities via various primary mechanisms. These are listed as follows:

- o Biannual formal assessments of the technical direction of primary program objectives are performed by the Project Manager and transmitted to the Institute Director. (See Attachment 1.)
- o Assessments of Institute performance are provided to senior Project management through monthly status reviews.

-3-

- o Monthly progress reports are provided to GSFC as formal contractual documents.
- o Telecons routinely occur several times a week between the Contracting Officer's Technical Representative (COTR) and Institute management.
- o Onsite reviews and meetings are held between technical HSTP-G staff members and technical ST Sci members.
- o Administrative matters are regularly reviewed, such as foreign travel requests (See Attachment 2) and all procurements greater than \$1000.
- o In addition, ground-system-wide monthly reviews are held by HSTP-G, of which the Institute is a major element, for purposes of ensuring a coherent ground system development.

OIG RECOMMENDATION 2

GSFC expedite negotiation of contract changes to include definition of enhancements, identification of costs, and schedule completion dates.

GSFC RESPONSE: Concur

We agree that expediting all contract activities in order to have a current, and accurate baseline is a top concern.

Although we agree with the basic recommendation, we do take exception to some of the reported findings which led to that recommendation.

GSFC COMMENTS

Coupled with the OIG observation of inadequate monitoring is the observation on page 10 of the draft report that: "...a redirection of the Institute operation [was] prompted by the shuttle delay. The changes resulting from this redirection were never incorporated into the contract. As a result, there was not a baseline from which to measure scheduled performance or assess the reasonableness of increased cost."

The OIG statement that the contract lacks a baseline from which to measure performance is misleading. The contractor is responsible not only for the establishment of the ST Sci facility, but also for developing, maintaining, and refining the scientific

-4-

capability of that facility. The contract contains a broad mission statement that defines performance objectives. As a result, the work effort necessary to fulfill that mission may not be reflected in specific contractual language which would require alteration of the statement of work by change order. Specifically, the statement of work (SOW), Paragraph 7.4, "Hardware Change and Augmentation," requires the Institute to maintain and improve its operational systems. (See Attachment #3.) Accordingly, no contract changes are necessary to authorize the work. The Institute's work plans are evaluated continuously and reviewed formally on a biannual basis as a minimum. Work is prioritized and scheduled. Unnecessary or over-budget items are eliminated.

While we agree with the OIG recommendation that negotiation of changes be expedited, there are extenuating circumstances. The most notable situation is the resolution of a proposal cited in the OIG report as having been over 18 months inhouse without definitization. This particular launch delay proposal, Science Institute Proposal #0046, dated October 6, 1986, became bogged down in a dispute over the application of cost accounting standards (CAS) to the contract. This is a difficult issue which could not be resolved without NASA Headquarters involvement. The CAS issue, although not directly related to the launch delay itself, prevented actual definitization of a modification. The proposal was, however, completely negotiated, if not executed.

An observation made by the OIG in connection with both of the above cited recommendations is that launch delays have resulted in a new approach to the Institute contract. The concern here is that this redirection was not monitored or approved appropriately by the HSTP-G nor was the baseline for this redirection negotiated into the contract in a timely manner. The two concerns have been addressed above. However, the OIG makes observations regarding the work performed by the Institute during the delay period and comments on several areas which they have taken issue with. Before commenting on the specific findings, it should be pointed out that launch delays have been announced in short increments. (See Attachment #4.) This has resulted in several launch delay proposal iterations which were characterized by the OIG as "cost growth." About half of the 40 percent growth figure quoted by the OIG is a result of launch delay extensions.

The OIG categorized the work performed during the delay period into the following five task areas established by the Institute. Our response is provided as follows:

a. Test and Repair Of SOGS

In GSFC's experience, this type of work is typical of systems enhancements that need to be made when large systems are delivered, tested in the operational environment, and then placed into operation. The delay period provided the opportunity to accomplish a large portion of this effort before HST becomes operational. A realistic load evaluation of the SOGS system cannot be made prior to SOGS delivery and placement in a full-up environment, loaded with a large number of proposals and operating procedures.

The Project made the decision to freeze the SOGS design at TRW, the SOGS contractor, and to allow the ultimate user, i.e., the Institute, to develop any refinements required. Contrary to the OIG's inferences, the HST Project reviewed detailed descriptions of the systems enhancements and established priorities prior to work being undertaken. The Project has monitored and continues to monitor Institute progress toward the accomplishment of these enhancements.

b. Development Projects

This task appears to be related to the OIG's observation on page 10 of the draft report that the Institute "...was concerned about losing highly-qualified employees with specialized technical and astronomical skills. As a result, the Institute maintained the same level of staffing throughout the delay period."

It is disappointing to see that the OIG did not expand its remarks to include an explanation concerning the activities which were carried out by the Institute during this delay period. As we pointed out in our response to the initial OIG draft, the OIG's discussion of the delay period activities would suggest that the efforts were "make work" to fill the void caused by the delay. Such a suggestion is false. The delay time was used productively to accomplish tasks which needed to be done at some point in time. In fact, the delay afforded the project some relief, since performing these shakedown activities postlaunch, as the original schedule necessitated, would have been more difficult.

The Institute's concern over maintaining staff is valid. The ST Sci is a new organization established to conduct HST science operations. This requires unique skills and specialized training. Such a staff cannot be acquired in a short period of time. The Association of Universities for Research in Astronomy (AURA), the party to the contract, has no other contracts to which it could off-load current ST Sci staff. Since maintaining expertise is

critical to the ultimate success of the Institute, it is appropriate that the Institute retain its staff and involve those individuals in useful, related areas of development. The expected return on this investment is increased proficiency of staff and greater productive use of the on-orbit HST. The SOW provides for Institute staff to be involved in research using systems other than the HST in order to develop their capabilities and maximize the HST observational programs. (See Attachment #5.) This delay period furthers these important ends.

Another area of concern is the OIG's reference to "personal research activities." Page 11 of the OIG report states: "Personal research activities by astronomers and their support groups increased." Left as is, the statement is misleading; and for this reason, we take exception to the OIG's treatment of the subject. As we pointed out before, the "personal" (or independent) research being performed during the delay period is not a redirection of planned contract effort but is a requirement under the existing contract. The objective is to maintain strong research skills and capabilities among the 40 or so scientists comprising the core staff of the Institute. This amounts to about 6 percent of the total effort of the Institute. The visiting committee, who also evaluates ST Sci performance, has been very critical of the Institute for not achieving the 50 percent independent research level. The OIG, by not amending its report to explain the fact that provisions are in place under the contract to require personal, or independent, research, implies that such activities were improper. Consequently, the OIG findings are damaging, taken at face value. In the interests of clarity and balance, we request clarification on this issue in the OIG final report. AUDIT NOTE: ADDITIONAL CLARIFICATION MADE TO BULLET REGARDING PERSONAL RESEARCH.

- c. Science Instrument Command and Instruction Development and Testing
- d. Procedure and Documentation Development
- e. Training and Simulations

The benefit of early shakedown is discussed above. As noted, the launch delay provided an opportunity for additional testing to identify and resolve interface and performance problems prior to on-orbit performance, greatly enhancing operational capability once HST is launched. The HST Project is fully involved in these testing, development and training activities.

2. CONTRACTOR FINANCIAL MANAGEMENT REPORT (CFMR) REVIEWS

OIG RECOMMENDATION 3

GSFC should perform the CFMR's analyses as required by NHB 9501.2b as implemented by GMI 9501.1a.

GSFC RESPONSE: Concur

The project will perform the CFMR analyses required by NHB 9501.2b and work with the Institute to improve the quality of its submissions.

GSFC COMMENTS:

While GSFC concurs with the recommendation, we take issue with the OIG findings that inadequate cost analysis was done on the monthly financial management reports. The analysis was performed both by the cost analyst and the Technical Officer for purposes beyond establishing incremental funding dates. The issue should be one of proper and adequate documentation of the ad hoc analysis performed. The Project has provided cost management of the Institute through: Utilization of 533 reports for internal costing and budgeting activities; oversight of Institute expenditures via monthly review at the contractor's facility; review of Institute monthly progress reports and comparison with previously submitted 533 quarterly reports; and evaluation of the Institute program operating plan prior to establishment of the yearly budget.

The statement is made on page 19 of the OIG draft report that: "Inaccurate information not only misrepresents the contract's financial status and contractor's performance, but also could mislead management in negotiations of cost increases." It should be noted that 533's are not used as a basis for evaluating or negotiating cost growth for the purposes of revising the negotiated cost of the contract. Separate and complete proposals are submitted for evaluation. These proposals undergo detailed audit by the Defense Contract Audit Agency (DCAA); formal technical evaluation by the Technical Officer; analysis of the cost proposal by the financial analyst, using the inputs from the audit report and technical evaluation; and, finally, review of all inputs by the negotiator for appropriate use in the formulation of a fully-documented and approved prenegotiation plan. While complete and accurate 533 reporting can provide a vehicle for monthly assessment of cost performance against the baseline plan, 533's are not used as the basis for adjusting the contract value. We would expect any errors made in 533 reporting to be uncovered

during negotiations, as the OIG found was the case during the negotiation of Modification 41.

Note: Correction required to OIG draft report, page 17: The sentence beginning on line 8 "Specifically the Technical Officer evaluated the contract's monthly cost over the past year to establish incremental funding estimates for the upcoming fiscal year" is incorrect. The Technical Officer does not determine incremental funding amounts. AUDIT NOTE: A CHANGE WAS MADE TO THE REPORT TO CLARIFY THE TECHNICAL OFFICER'S ORIGINAL STATEMENT TO US.

3. PROPERTY MANAGEMENT

OIG RECOMMENDATION 4

The GSFC Contracting Officer should inform the Institute's management and Defense Contract Administration Services (DCAS) of the noted weakness in the Institute's property management system and enforce compliance with contract clauses regarding reporting of centrally-reportable equipment. In addition, the Contracting Officer should monitor corrective actions taken in response by the Institute.

GSFC RESPONSE: Concur

The Contracting Officer informed the Institute of the weaknesses found in its property management system on December 1, 1988. (See Attachment #6.) At the same time, the Contracting Officer requested that the cognizant DCAS office perform a full review of the Institute's property management system and make appropriate recommendations for correction of all weaknesses and deficiencies found. (See Attachment #7.) The Contracting Officer shall review the findings, monitor implementation of corrective actions, and perform appropriate follow-up activities. The Institute provided a response on January 12, 1989. (See Attachment #8.) The response noted that the DCAS office has recently rated the Institute's property management system "satisfactory." The equipment listed in the OIG report has been located, tagged and entered on the ST Sci property inventory listing.

4. MATERIAL AND EQUIPMENT PURCHASES

OIG RECOMMENDATION 5

The GSFC Contracting Officer should advise the Institute and cognizant DCAS office in writing of internal control weaknesses identified in the Institute's purchasing and accounting systems

and require stronger internal controls for reducing and controlling contract costs.

GSFC RESPONSE: Concur

OIG RECOMMENDATION 6

GSFC request DCAA to evaluate the propriety of the payments lacking adequate supporting documentation.

GSFC RESPONSE: Concur

The GSFC Contracting Officer forwarded a copy of the OIG findings in the areas of material and equipment purchases to DCAS for response on December 1, 1988 (reference Attachment 6). The Contracting Officer will request that the DCAA review all previously-submitted vouchers to determine whether or not they were appropriate for payment. The Institute will be required to correct all weaknesses and deficiencies uncovered by the DCAS. GSFC will monitor those corrective actions. Any vouchers previously paid that are lacking in supporting documentation will be adequately documented, and credit to the contract received for any vouchers which cannot be fully supported.

The Institute noted in its response to GSFC (reference Attachment 8) that while the accounting files may not have contained all the support that the OIG desired, the procurement files supporting the actions questioned contained a description of all purchases.

5. LONG DISTANCE TELEPHONE EXPENSES

OIG RECOMMENDATION 7

GSFC take action to ensure the Institute develops and implements an effective policy regarding the authorized use of all phone lines and equipment by the Institute.

GSFC RESPONSE: Concur

The Contracting Officer has been working with AURA on this action (reference Attachments 6, 7, and 8). On December 6, 1988, the Institute published a policy governing long distance telephone usage for all Institute staff members, contractors, and visitors, and distributed this policy on December 12, 1988. (See Attachment #9)

GSFC COMMENTS:

The OIG states on page 29 of the draft report: "...we believe that billings to GSFC may include as much as \$108,000 in personal long distance telephone calls each year." This statement is based on (reference page 30 of the OIG draft report) an extrapolation of a GSFC actual audit of employee telephone usage which found that 45 percent of the FTS calls placed at GSFC were for employee personal business. There is no basis for applying the GSFC audited "abuse" figure to the Institute. While there may be use of the Institute phone system for personal calls, such an extrapolation is conjecture.

The OIG observes that the average telephone bill per employee at GSFC is \$150 while it is \$800 at the Institute. GSFC does not believe that this is a meaningful comparison. The demographics of the Center do not resemble those of a small group of scientists whose mission is to establish and maintain contact with an international scientific community. The amount of international activity sponsored by the Institute does not resemble either Goddard or even its scientific organization, the Code 600 Space and Earth Sciences Directorate.

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771



Reply to Attn of: 440

June 25, 1988

Dr. Riccardo Giacconi
Space Telescope Science Institute
Homewood Campus
Baltimore, MD 21218

Dear Riccardo:

Enclosed are the Primary Objectives for the ST Sci for the performance period of April 1, 1988, through September 30, 1988. These Primary Objectives have been established in discussions between Bob Milkey and Ivan Mason.

A comment, for the record, is necessary on the date of these objectives. The first draft of these objectives was issued in late-March 1988 and covered most of the content. The press of high priority work and the establishment of final wording has caused significant delay in issuing them. The staff has been working toward the achievement of these objectives.

Sincerely, ,

 James V. Moore
HSTP-G Project Manager

Enclosure

cc: A. Boggess/GSFC/440
R. Felice/GSFC/440
C. Fuechsel/GSFC/440
K. Kalinowski/GSFC/440
I. Mason/GSFC/440
R. Moore/GSFC/440
G. Repass/GSFC/440
E. Ruitberg/GSFC/440
C. Stephanides/GSFC/440
B. Milkey/ST Sci

**GSFC Response to
OIG 12/29/88 Draft Report,
ST SCI, A-GO-87-004**

ATTACHMENT #1

**Primary Program Objectives
Progress Reviews**

**PRIMARY OBJECTIVES FOR ST SCI
APRIL 1, 1988 THROUGH SEPTEMBER 30, 1988**

The following provides the primary objectives for the ST Sci from April 1, 1988, through September 30, 1988. These primary objectives are focused toward the functional work and key events required to establish the direct science operations capabilities necessary to support the post launch science operations of the HST. It is recognized that there are many other tasks under way at the ST Sci that are very important to having a full science operations support capability in place by launch. These other tasks are expected to be continued.

The current HST launch preparations direction from the NASA Headquarters HST Program Office is to schedule the project work to support an August 31, 1989 launch; however, work is to be planned such that a June 1, 1989 launch could be supported with less capabilities developed and tested to support HST operations. This direction forms the basis for the work during this period.

1. The ST Sci will conduct the science operations portions of GST-4, which is scheduled to be conducted in June 1988. The top level goals for GST-4 remain as follows: command all SI's in a full range of typical observation scenarios, perform astrometric observations in fixed target and transfer function modes (see item 1.6 below), use the PCS in the two-step mode, and process the science data received during the test. GST-4 will be used as a performance and throughput assessment of the operational ground systems; the ground systems performance during GST-4 will also be used to refine the objectives for GST-5 and establish the objectives for GST-6. Satisfactory performance of GST-4 will include the following key events and tasks:

1.1 Generate the GST-4 SMS from the proposal data base established for GST-4. The complete and executable SMS will be generated and delivered to GSFC for PASS processing by May 2; as SMS problems are discovered during PASS processing and HSIF test execution of the GST-4 loads the ST Sci will participate in the resolution of the SMS problems and regenerate the SMS as needed to support the ongoing tests.

1.2 During GST-4 conduct some realtime commanding from the OSS.

1.3 Use the GSSS/SOGS, SOGS/PASS, SOGS/PORTS, and SOGS/DCF electronic interfaces in an operational configuration and manner while preparing for and conducting GST-4.

1.4 Complete the validation of all command blocks to be used in GST-4 and obtain SI team engineer concurrence. Only validated commanding may be used during GST-4.

1.5. Collect the information that will be required to prepare and submit a report within two months after the GST-4 is completed (similar to the GST-3 report).

1.6 The astrometry objective of GST-4 will be satisfied by conducting it as a part of a MST-1 reexecution. The ST Sci will provide the necessary planning and SMS generation support to complete this Astrometry operation by early June, before GST-4 execution. The project will arrange the necessary MOC, STOMS, and other project element support needed to achieve this objective.

2. Prepare for the science operation portion of GST-5, which will be conducted in December 1988. GST-5 will be primarily a demonstration of the ground systems (PEP/SOGS/GSSS/PASS) capabilities to generate approximately 30 days of typical operating plans and continuous HST spacecraft command loads, generated from actual OV, SV and GTO proposals; proposals that have been processed by PEP and entered into the SOGS PMDB. GST-5 will provide a performance evaluation of the ground systems throughput capabilities needed to support OV, SV, and science operations planning and scheduling.

2.1 The ST Sci will prepare the detailed science operations plan for GST-5 and submit it to the STP-G by mid-August for incorporation into the overall GST-5 plan.

2.2 GST-5 will include about 7 days of operations derived from selected OV Part-1 proposals; the primary objective will be to include all of OV Phase-2 and some scheduling units from OV Phase-3. R. Moore (HSTP-G) will recommend the OV Part-1 proposals to be included in GST-5 by the week of May 30. The ST Sci will review these GST-5 OV proposals to determine if the commanding preparations can support their inclusion in GST-5, where necessary recommendations for change in GST-5 content will be made to the project. Where the proposal review shows that using the actual OV proposal would create a significant labor impact or be too difficult to use in the GST-5 application a subset of the proposal or an alternate proposal may be used.

In support of this GST-5 objective the ST Sci will participate in the OV proposal workshops which are being held to resolve proposal questions, process the OV Part-1 GST-5 proposals in PEP, enter them into the SOGS PMDB ready for SPSS scheduling, develop the necessary command instructions, and support the OV unique command preparations and validation needed to execute GST-5. (See paragraph 5.1 and 5.4 for OV commanding objectives.)

2.3 GST-5 will include about 10 days of operations derived from OV Part-2 and SV proposals which will be scheduled in accordance with a HSTP-G provided SV-like high-level timeline. K. Kalinowski (HSTP-G) will recommend the OV Part-2 and SV

proposals to be included in GST-5. (A list has been provided to the ST Sci and final resolution of remaining questions is underway.) The ST Sci will review these GST-5 OV and SV proposals to determine if the commanding preparations can support their inclusion in GST-5, where necessary recommendations for change in the GST-5 content will be made to the project. Where the proposal review shows that using the actual OV or SV proposal would create a significant labor impact or be too difficult to use in the GST-5 application a subset of the proposal or an alternate proposal may be used.

In support of this GST-5 objective the ST Sci will process the OV Part-2 and SV GST-5 proposals in PEP, enter the proposals into the SOGS PMDB ready for SPSS scheduling, and determine that the commanding capabilities will be adequate for execution of these proposals. (See paragraph 5.1 and 5.4 for OV commanding objectives.)

2.4 GST-5 will include about 14 days of operations scheduled from GTO proposals. This 2 weeks of operations will be used to evaluate SPSS Auto scheduling capabilities and verify the ground systems capabilities to perform routine science operations. The ST Sci will determine the GTO proposals to be included in GST-5.

In support of this GST-5 objective the ST Sci will select proposals, from the PEP data base of GTO proposals for execution in GST-5 and transform them from PEP into the SOGS PMDB ready for SPSS scheduling.

3. The ST Sci will complete the top level commanding instructions ("TOPS") required for generating the GST-5 SMS.

4. The ST Sci will schedule and implement the SOGS, GSSS, and PEP SPR-fixes and s/w projects that are essential for support of GST-5. The implementation will be carried out jointly between ST Sci staff and SOGS sustaining engineering support (the currently planned level) provided by the STP-G.

5. The instruction development and command validation will be continued as follows: (Priorities: 5.1 should receive top priority; the goal for 5.2, 5.3 & 5.4 is to have basic capabilities available at launch, in each area.)

5.1 The ST Sci will maintain (modify and retest as necessary) the flow instructions and command blocks that have been implemented for GHRs (level 1), WF/PC, FOC, HSP, AND FOS operations; complete and validate the remaining commanding flow instructions for normal science operations and then maintain them; and complete any OV unique commanding instruction development, flow instructions, and command blocks that are identified by June 1, 1988.

5.2. Schedule the remaining commanding development for MT, Astrometry, interleaved, and parallel science operations. Proceed with the initial implementation of these capabilities.

5.3 Schedule and initiate the implementation of GHRS Level-2 and Level-3 commanding, following the requirements review which will be held by the STP-G.

5.4 Incorporate any modifications to Astrometry commanding that are required following the June 88 MST/Astrometry operation test and prepare for a reverification test, if required. The highest priority for further command development in Astrometry is the capability to carry out the OV requirements and support the Astrometry Task Team in establishing the remaining definitive requirements. To achieve the OV Astrometry capabilities within this objective period the requirements must be established by 15 July. Then initiate the implementation of the remaining six high priority Astrometry command types (i.e. rate-feed-forward moving target mode, ambush mode, single scan transfer function mode, rapid acquisition mode, resume search mode, and LOS scan mode). The priority for implementing these modes is defined in the January 1988 Astrometry Task Team meeting minutes. This Astrometry operations development includes the command group design and implementation, flow level instruction implementation, and the generation of a set of calendars and SMSs to support the HSIF testing.

6. The ST SCI will provide the initial demonstration of planning, scheduling, and SMS generation to support Moving Target (MT) science operations (using #48 commands) by December 31, 1988. During this period the necessary development work will be scheduled and initiated to permit the MT operation demonstration by the end of December. The ST SCI will participate with other HST project personnel in defining a MT operations simulation using the HSIF (or simulator).

7. The following additional specific objectives are established for this performance period:

7.1 Complete the draft operating procedures for the GSSS, SPSS, OSS and PODPS operational areas needed for execution of GST-5.

7.2 Complete the draft training plans for the PEP, GSSS, SPSS, OSS, PODPS, and SSC operational areas.

7.3 Demonstrate the CDBS functionality for each of the SIs by taking typical SI data (e.g. GST-4 data) and use CDBS to generate revised calibration parameters, insert the new calibration in the data base for use by the PODPS/RSDP, and then reprocess SI data.

and verify the expected calibration results. The completion of this objective may extend into the next six-month period. Provide a written evaluation of the functionality tests for each of the SIs.

7.4 Release the STSDAS (combined SDAS and CDBS), this system provides required science data analysis capabilities.

7.5 Submit a revised draft of the ST SCI Configuration Management Plan (MA-04). (This is a carryover from the last period.)

8. Hire an astrometry scientist, a carryover from the prior period.

National Aeronautics and
Space Administration



Goddard Space Flight Center
Greenbelt, Maryland
20771

Reply to Attn of 440

June 13, 1988

Dr. Riccardo Giacconi
Space Telescope Science Institute
Homewood Campus
Baltimore, MD 21218

Dear Riccardo:

Enclosed is our assessment of the ST Sci progress toward meeting the Primary Objectives that were set for the period of October 1, 1987, through March 31, 1988. Comments are made on each specific objective. Significant progress has been made toward meeting these objectives and where the objectives were not being met we feel satisfactory arrangements were made to minimize the impact.

I want to highlight and express appreciation for the outstanding support being provided to the HST Project by the newly established ST Sci Project Management Office. The ST Sci is providing very good support to the HST Project, this continued support is essential to having adequate science operational capabilities tested and online at launch. Please express my appreciation to the ST Sci staff.

Sincerely,

 James V. Moore
HSTP-G Project Manager

Enclosure

cc: A. Boggess/GSFC/440
C. Fuechsel/GSFC/440
R. Felice/GSFC/440
C. Stephanides/GSFC/440
I. Mason/GSFC/440
G. Repass/GSFC/440
E. Ruitberg/GSFC/440

**ASSESSMENT OF PRIMARY OBJECTIVES FOR ST SCI
OCTOBER 1, 1987 THROUGH MARCH 31, 1988**

OBJECTIVE a:

Prepare for the conduct of the science operations portions of GST-4. The overall goal for GST-4 is as follows; command all SI's in a full range of typical observation scenarios, perform astrometric observations in fixed target and transfer function modes, and use the PCS in the two-step mode.

(1) Make final selection of proposals for GST-4 and plan for and conduct some realtime commanding from the OSS during GST-4.

ACCOMPLISHMENT: The operations proposals were selected, modified as necessary and prepared for use in a timely manner. GST-4 has not yet been conducted; however, the plans and preparation for realtime commanding have been made.

(2) Use the GSSS/SOGS and SOGS/PASS electronic interfaces in an operational configuration and manner while preparing for and conducting GST-4.

ACCOMPLISHMENT: The electronic interfaces are being routinely used.

(3) Produce the FINAL SMS by March 20, 1988.

ACCOMPLISHMENT: The final SMS was not generated by the planned date, primarily due to the lateness of software fixes (see Objective b, below). It was submitted on May 2.

(4) Validate all command blocks to be used in GST-4 and obtain SI team engineer concurrence, only validated commanding may be used during GST-4.

ACCOMPLISHMENT: This objective was satisfactorily achieved.

(5) Prepare preliminary operating procedures for use during the GST-4 operations.

ACCOMPLISHMENT: The discussions with the ST Sci indicates that this objective has been impacted somewhat to recover from the impact of the software lateness and other higher priority tasks.

(6) Collect the information that will be required to prepare and submit a report after GST-4 is completed (similar to the GST-3 report).

ACCOMPLISHMENT: Assurance has been provided that the required information is being compiled and retained.

ASSESSMENT: This objective has been completed in a highly successful manner. The problem with the lateness of some critical software fixes impacted this objective. Extra effort was applied where feasible to recover the schedule impacts. The shortfall in operating procedures is being carried forward into the next period, these procedures should be drafted at an early date so they can be used and improved during the major ground systems tests and be ready for operator training.

OBJECTIVE b:

Implement and have online for operational use the SOGS and GSSS SPR-fixes and s/w projects that have been identified as essential for support of GST-4.

ACCOMPLISHMENT: This objective was not accomplished as initially scheduled. When it became apparent that the work could not be completed as scheduled the ST Sci rescheduled the work and the related GST-4 activities. The work then progressed on the revised schedules.

ASSESSMENT: The delay in achieving this objective was one of the primary factors in a two month delay in GST-4. The ST Sci scheduled the software work in an effective manner; the effort required to achieve this objective was significantly more than anticipated. When rescheduled the work was then completed in accordance with the schedules. The achievement of this objective was not completely within the control of the ST Sci.

OBJECTIVE c:

Provide the preliminary science operations objectives and plans for GST-5 to STP-G. Also include an identification of the SOGS and GSSS SPR-fixes and s/w projects that are essential for the support of GST-5.

ACCOMPLISHMENT: The preliminary plan for GST-5 has not been submitted; however, we have been assured that it is well along. The SOGS and GSSS fixes for GST-5 have been identified, scheduled and assigned.

ASSESSMENT: The fact that the plan has not been submitted is not an impacting event. The fact that the software work has been identified, scheduled and resources assigned is a real plus.

OBJECTIVE d:

Instruction development and command validation shall be completed during this performance period in time for GST-4 support, as follows:

(1) the command blocks required for WF/PC, FOC, HSP, and FOS to conduct the currently planned operations. The unique commanding requirements that are identified during the OV proposal review and the on-going refinements of the command blocks, being implemented by the SI teams, will be validated after the completion of GST-4.

ACCOMPLISHMENT: This work was completed in a timely manner. The OV proposal review for unique commanding requirements is still underway (GST-4 has not yet been completed).

(2) the command blocks required for GHRS commanding at Level-1 for GST-4, except for OV unique operations and commanding refinements as in (d,(1)) above. Initiate the implementation of Level-2 and Level-3 GHRS commanding.

ACCOMPLISHMENT: The GHRS command validation for GST-4 has been completed in a timely manner. The STP-G was requested to provide a GHRS Level-2 and Level-3 operations requirements document to the ST Sci.

(3) the commanding required for fixed target and at least one mode of transfer function astrometry. It is recognized that the achievement of the astrometry objective requires some active support and information from other parts of the HST project team; STP-G has established an astrometry implementation working group to identify and provide the required information.

ACCOMPLISHMENT: The execution of this astrometry test has been moved from GST-4 to MST-1, the ST Sci believes the astrometry commanding was ready.

ASSESSMENT: These objectives have been satisfactorily completed, subject to the satisfactory completion of GST-4 and the MST-1 astrometry test. The delays in the astrometry test have been due to circumstances beyond the ST Sci's control.

OBJECTIVE e:

Hire an astrometry scientist, a carryover from the prior period.

ACCOMPLISHMENT: This objective has not been achieved.

ASSESSMENT: This staff person is needed to become knowledgeable about the conduct of astrometry science with HST, learn the applicable spacecraft and ground systems, and support the ST SCI preparations for conducting astrometry science operations. This objective will be carried forward.

OBJECTIVE f:

Submit a revised draft of the ST SCI Configuration Management Plan (MA-04).

ACCOMPLISHMENT: This objective was not achieved.

ASSESSMENT: While the DCR cancellation removed the immediate urgency for the revision (update) of this document, the current version is seriously out of date. Implementing procedures have been established and are satisfactorily being followed. This objective is being carried forward.

OBJECTIVE g:

A preliminary Training Plan will be required for submission as DCR backup documentation. The DCR backup documentation must be available two months before the DCR. The Training Plan preparation should be initiated during this period so it will be available by May 1, 1988.

ACCOMPLISHMENT: This objective was not achieved.

ASSESSMENT: While the DCR cancellation removed the immediate urgency for these training plans it is important that the plans be developed so STP-G can review them before they are needed for staff training. This objective is being carried forward.

**GSFC Response to
OIG 12/29/88 Draft Report,
ST SCI, A-GO-87-004**

ATTACHMENT #2

A-27

Travel Requests/Approvals

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, Maryland
20771

NASA

JUN 24 1988

Reply to Attn of:

284.1

Space Telescope Science Institute
Attention: Mr. H. Feinstein
3700 San Martin Drive
Baltimore, MD 21218

Subject: NAS5-26555, Travel Approval

As requested by your letters of June 7, 1988, and in compliance with the terms of the subject contract, travel is authorized as follows:

<u>Personnel</u>	<u>Destination</u>	<u>Date</u>	<u>Purpose of Trip</u>
Mr. R. Giacconi (Log #469)	Balt., MD/Munich, W. Germany/Return	07/10/88 - 07/13/88	Category
Mr. R. Giacconi (Log #470)	Balt., MD/Como, Italy/ Return	09/19/88 - 09/24/88	Category
Mr. R. Griffiths (Log #471)	Balt., MD/Durham and Leicester, England/ Return	07/16/88 07/27/88	Category

At the conclusion of each trip a report is to be submitted as required by the contract.

The cost associated with this travel is an allowable item of cost under the contract. The present estimated cost of the contract is not increased by this authorization.

0
Elizabeth Austin
Contracting Officer
cc: 440/I. Mason
284.1/Contract File

284.1/EA/gs:06/24/88



3700 San Martin Drive
Baltimore, MD 21218
(301) 338-4700
Telex 684910

7 June 1988

Ms. Elizabeth Austin
Contracting Officer
Code 284.1
National Aeronautics and
Space Administration (NASA)
Goddard Space Flight Center
Greenbelt, Maryland 20771

Subject: NAS5-26555 - FOREIGN TRAVEL LOG # 469

Dear Ms. Austin:

This letter is to request approval for the following
foreign travel:

Traveler: Riccardo Giacconi

Dates: July 10 - 13, 1988

Main Points of Travel: Baltimore, MD/Munich, W. Germany/
Return.

Purpose: Category (2)

Your formal approval of this travel is requested.

Thank you.

Very truly yours,
[Signature]

Harry W. Feinstein
Business Manager

HWF/fs

Enclosure: Foreign Travel Request & Approval Form

pc: P. Stockman
L. Greenwell
Traveler

[Signature]

6/16



FOREIGN TRAVEL REQUEST & APPROVAL

NAME OF TRAVELER: Riccardo Giacconi

LOG NO. 469
(TO BE ASSIGNED BY SNO)

DATES	TRAVEL POINTS FROM	TO	ORGANIZATION INSTITUTE OR EVENT	PEOPLE MET WITH	PURPOSE
7/10/88	Balto.	Munich	Fachbeirat Meeting and 25th anniversary	Max-Planck Institute	ENTER SPECIFIC PURPOSE/EVENT (REASON FOR FOREIGN TRAVEL) — STATE APPROVAL CATEGORY — NOTE (1) BELOW (2) to attend the MPE Fachbeirat meeting and participate in 25th anniversary of the Max-Planck Institute Foundation
7/13/88	Munich	Balto.			

TO TRAVELER: List any exceptions to above upon return so that an accurate trip report may be filed.

SUPERVISOR'S APPROVAL: _____ DATE: _____

DEPUTY DIRECTOR'S APPROVAL: _____ DATE: June 2, 1988

SIGNATURE OF TRAVELER: _____ DATE: June 2, 1988

NOTE (1) CONTRACT NAS5-26555 DOES NOT PROVIDE OTHER APPROVAL CATEGORIES THAN THOSE LISTED BELOW:

- (1) Presentation of papers at meetings, conferences, or symposia;
- (2) Participation in meetings, conferences or symposia as session chairmen, discussion leaders, special invitees, or official staff members of the sponsoring group;
- (3) "On-site" field work under a NASA grant or contract; and
- (4) In exceptionally meritorious cases, visits to scientific or technical organizations and attendance at international conferences.

To > Ivan Mason

6-2-88

Request is hereby made for authorization for Riccardo Giacconi to travel to Munich, Germany from July 10-13, 1988 to attend the meeting of the Fachbeirat and the 25th anniversary of Max-Planck Institute

Ivan

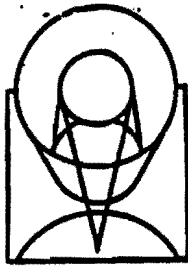
I don't know what the "Fachbeirat" is but why are we paying for travel to the 25th anniversary of Max-Planck Inst.? Maybe I'm being overly picky but it looks strange

Hey,

(science meeting)

The Fachbeirat and 25th Anniv. is all wrapped up in one event. The ST S&I must serve the international science ~~community~~ community and we feel that top ST S&I representation at events is appropriate.

When I checked I found out that Riccardo is on the Max-Planck Inst Visiting Committee (top level review board). The Max-Planck Inst. is covering Riccardo's cost for this trip.



SPACE
TELESCOPE
SCIENCE
INSTITUTE

3700 San Martin Drive
Baltimore, MD 21218
(301) 338-4700
Telex 684910

7 June 1988

Ms. Elizabeth Austin
Contracting Officer
Code 284.1
National Aeronautics and
Space Administration (NASA)
Goddard Space Flight Center
Greenbelt, Maryland 20771

Subject: NAS5-26555 - FOREIGN TRAVEL LOG # 470

Dear Ms. Austin:

This letter is to request approval for the following
foreign travel:

Traveler: Riccardo Giacconi

Dates: September 19, - 24, 1988

Main Points of Travel: Baltimore, MD/Como, Italy/
Return.

Purpose: Category (2)

Your formal approval of this travel is requested.

Thank you.

Very truly yours,

Harry W. Feinstein
Business Manager

HWF/fs

Enclosure: Foreign Travel Request & Approval Form

cc: P. Stockman
L. Greenwell
Traveler

Concur

6/14



SPACE
TELESCOPE
SCIENCE
INSTITUTE

FOREIGN TRAVEL REQUEST & APPROVAL

NAME OF TRAVELER: Riccardo Giacconi

LOG NO. 470
(TO BE ASSIGNED BY BMD)

DATES	TRAVEL FROM	POINTS TO	ORGANIZATION, INSTITUTE OR EVENT	PEOPLE MET WITH	PURPOSE
9/19/88	Balto.	Como, Italy	BL LAC Objects: 10 Years Later	Consiglio Nazionale delle Ricerche, Physics Dept. of Univ. of Milano, Regione Lombardia	ENTER SPECIFIC PURPOSE/EVENT (REASON FOR FOREIGN TRAVEL) — STATE APPROVAL CATEGORY — NOTE (1) BELOW (2) Participation in Centro di Cultura Scientifica "A. Volta"
9/24/88	Como	Balto.			

TO TRAVELER: List any exceptions to above upon return so that an accurate trip report may be filed.

SUPERVISOR'S APPROVAL: _____ DATE: _____

DEPUTY DIRECTOR'S APPROVAL: _____ DATE: 6/2/88

SIGNATURE OF TRAVELER: _____ DATE: 6/1/88

NOTE (1) CONTRACT NAS5-26555 DOES NOT PROVIDE OTHER APPROVAL CATEGORIES THAN THOSE LISTED BELOW:

- (1) Presentation of papers at meetings, conferences, or symposia;
- (2) Participation in meetings, conferences or symposia as session chairmen, discussion leaders, special invitees, or official staff members of the sponsoring group;
- (3) "On-site" field work under a NASA grant or contract; and
- (4) In exceptionally meritorious cases, visits to scientific or technical organizations and attendance at international conferences.

RECEIVED
JUN 6 1988
PURCHASING

Authorization is hereby requested for Riccardo Giacconi to attend the Centro di Cultura Scientifica "Alessandro Volta", BL LAC Objects: 10 Years After in Como, Italy from September 20-23, 1988.



3700 San Martin Driv
Baltimore, MD 2121
(301) 338-470
Telex 684910

9 June 1988

Ms. Elizabeth Austin
Contracting Officer
Code 284.1
National Aeronautics and
Space Administration (NASA)
Goddard Space Flight Center
Greenbelt, Maryland 20771

Subject: NAS5-26555 - FOREIGN TRAVEL LOG # 471

Dear Ms. Austin:

This letter is to request approval for the following
foreign travel:

Traveler: Richard Griffiths

Dates: July 16 - 27, 1988

Main Points of Travel: Baltimore, MD/Durham and Leicester,
England/Return.

Purpose: Category (1)

Your formal approval of this travel is requested.

Thank you.

Very truly yours,

Harry W. Feinstein
Business Manager

HWF/fs

Enclosure: Foreign Travel Request & Approval Form

pc: P. Stockman
L. Greenwell
Traveler

Canine
6/26



FOREIGN TRAVEL REQUEST & APPROVAL

NAME OF TRAVELER:

RICHARD GRIFFITHS

LOG NO. 471

(TO BE ASSIGNED BY DND)

DATES	TRAVEL FROM	POINTS TO	ORGANIZATION INSTITUTE OR EVENT	PEOPLE MET WITH	PURPOSE
JULY 16	BALTO.	DURHAM, ENGLAND	NATO ADVANCED RESEARCH WORKSHOP 'THE EPOCH OF GALAXY FORMATION'	ELLIS, ETC.	ENTER SPECIFIC PURPOSE/EVENT (REASON FOR FOREIGN TRAVEL) — STATE APPROVAL CATEGORY — NOTE (1) BELOW PRESENTATION OF PAPER CATY ①.
JULY 25		LEICESTER	SCIENTIFIC DISCUSSIONS	POUNDS	
JULY 27	LEICESTER	BALTO.			

TRAVELER: List any exceptions to above upon return so that an accurate trip report may be filed.

SUPERVISOR'S APPROVAL: _____

DATE: June 3

DEPUTY DIRECTOR'S APPROVAL: _____

DATE: June 6 1988

SIGNATURE OF TRAVELER: _____

DATE: June 2 1988

NOTE (1) CONTRACT NAS5-26555 DOES NOT PROVIDE OTHER APPROVAL CATEGORIES THAN THOSE LISTED BELOW:

- (1) Presentation of papers at meetings, conferences, or symposia;
- (2) Participation in meetings, conferences or symposia as session chairmen, discussion leaders, special invitees, or official staff members of the sponsoring group;
- (3) "On-site" field work under a NASA grant or contract; and
- (4) In exceptionally meritorious cases, visits to scientific or technical organizations and attendance at international conferences.

RECEIVED
JUN 7 1988
PURCHASING

The purpose of this trip to Durham, England is the presentation of a paper. I will be leaving from Baltimore on July 16 and will return on July 27. Will be attending the NATO Advanced Research Workshop "The Epoch of Galaxy Formation", and Leicester for a Scientific Discussions.

GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004

ATTACHMENT #3

Statement of Work
Paragraph 7.4
"Hardware Change and
Augmentation"

7.3 HARDWARE REPAIR, CALIBRATION, AND WEAROUT

The contractor shall provide for the repair and calibration of all ST ScIF and SSC equipment. This is to include replacing equipment when the existing equipment cannot be kept operational at a reasonable cost.

7.4 HARDWARE CHANGE AND AUGMENTATION

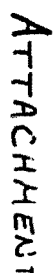
The contractor shall provide, as required, for the procurement, installation, and checkout of (a) additional equipment, and (b) improvements (e.g., new models) to existing equipment. The contractor shall not initiate any hardware changes and/or augmentations until approval from the Contracting Officer is obtained.

GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004

ATTACHMENT #4

HST Launch Date Trend

LAUNCH DATE TREND



**GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004**

ATTACHMENT #5

**Statement of Work
A-42 "Staff Unique Support"**

3.3 STAFF UNIQUE SUPPORT

The contractor shall provide and implement a plan for enabling and effecting research by members of the ST Sci scientific staff who, by direct competition, have been selected to use the ST or its archival data. The plan shall take into consideration NASA's estimation that it is reasonable to allow the scientific staff, on the average, approximately fifty percent of its time for ST related research. However, observing time and archival research programs shall be allocated to ST Sci staff on the same basis as for other GOs and other archival researchers.

This plan shall also provide for support to ST-related research by ST Sci staff members utilizing other space systems and ground observatories as needed to gain maximum benefit from their ST staff observation programs. The ST Sci may also conduct limited ST-germane theoretical research in support of the ST science program.

The contractor shall provide for the establishment and maintenance of liaison roles for the ST Sci staff with the general science community. This shall include liaison with national and international scientific bodies, university and educational institutions, the major national observatories and related space science programs. This specifically includes travel to professional meetings sponsored by these organizations.

GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004

ATTACHMENT #6

**GSFC Letter to ST Sci for Corrective
Actions in Property Management,
Material & Equipment Purchase, and
Long Distance Telephone Expenses**

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

File
NASA

DEC 01 1988

Reply to Airm of 284.1

• Chrono
• IG Report

Space Telescope Science Institute
Attention: Mr. Harry W. Feinstein
3700 San Marco Drive
Baltimore, Maryland 21218

Subject: Contract NAS5-26555 and Audit by the NASA
Inspector General

The purpose of this letter is to request certain actions on the part of the Space Telescope(ST) Science Institute(ST Sci) in resolving the findings of the Inspector General(IG) concurrent with the final review of the IG's draft report. Since the audit has not been released only the pertinent sections of the report will be used for this request. This request will be subdivided into topic areas in order to facilitate the subsequent follow-up and closure of each action.

1. Property Management

It is requested that the ST Sci review its property management procedures and ensure that Government and contractor property is properly controlled. The audit found pieces of property that were not contained on the ST Sci property listing. It is requested that the items listed on Attachment 1 be tagged and entered on the ST Sci property listing. The ST Sci policies and procedures, regarding shipping instructions issued by the purchasing department and equipment handling functions performed by the shipping and receiving department, should be examined and steps taken to ensure that these problems do not occur in the future.

2. Material and Equipment Purchases

The audit revealed some apparent accounting and administrative weaknesses. In the review of purchase order files for nine payments made during fiscal years 1985 and 1986, the files did not contain receipts or invoices describing the items purchased. It is requested that the files be corrected for the items listed in section a of Attachment 2.

The review also revealed that some purchases were made without the Contracting Officer's approval. The ST Sci should compile packages for the items listed in section b of Attachment 2 for ratification by the Contracting Officer.

Finally, the audit also found some apparent missed discounts and the improper payment of state taxes. The items which generated this finding are listed in section c of Attachment 2. It is requested that the ST Sci review the items discussed and establish stronger internal controls for reducing and controlling contract costs.

3. Long Distance Telephone Expenses

AURA/ST Sci is requested to establish a policy to ensure that telephone expenses reimbursed under the ST Sci contract are for official purposes only. A copy of this policy should be provided to the undersigned.

Summary

The ST Sci is requested to establish a plan to complete the above-actions and to notify the undersigned as to when they will be completed.

If you have any questions regarding this matter, you may contact me on (301)286-5761.

~~Gifford~~ P. Moak
Contracting Officer

Attachments

cc: 440/R. Flick
440/I. Mason
440/L. Warren
284.1/Contract File

Attachment 1

Property Management Discrepancies

The following items of equipment were in the Institute's offices but were not on its property list nor were they tagged.

Equipment Valued over \$1,000

<u>Location</u>	<u>Equipment Description</u>	<u>Serial #</u>	<u>\$ Value</u>
RM 111	Digital Computer-Microvax	WF-60605394	\$24,240
RM 128	Digital Letterwriter Model 100	AD-797	2,300
RM 128	Digital Correspondent	PN-537-34	1,800
RM 128	Digital VT 100 Terminal	WF-747708	1,425
RM 128	Digital RA81 Disk Drives	CX-03102	18,640
RM 128	Digital RA81 Disk Drives	CXA-023804	18,640
RM 128	Digital RA81 Disk Drives	CXA-018871	18,640
RM 128	Digital RA81 Disk Drives	CXA-024206	18,640
RM 128	Digital RA81 Disk Drives	CXA-023249	18,640
RM 203	IBM Personal Computer	5170-732809	1,570
RM 411	Talaris Model 800 Laser Printer and Controller	1096733	25,240
RM 656	Texas Inst. Explorer Computer	434235002	40,000
RM 660	Digital Computer-Microvax	WF 61005613	<u>24,240</u>
A-47	TOTAL		\$214,015

Attachment 1

Property Management Discrepancies (Cont'd)

Equipment valued between \$500 and less than \$1,000

<u>Location</u>	<u>Equipment Description</u>	<u>Serial #</u>	<u>\$ Value</u>
RM 644	IBM Selectric II	26-4776051	\$ 885
RM 644	Okidata Microline 192 Printer	-	<u>475</u>
		TOTAL	\$1,360

Attachment 2

Material and Equipment Purchase Discrepancies

The following items represent discrepancies found in the material and equipment purchasing area.

a. Purchase order files for nine payments made during fiscal years 1985 and 1986 did not contain receipts or invoices describing the items purchased. These payments were as follows:

<u>Period</u>	<u>Payee</u>	<u>Amount</u>
85-02	John L. Tonry	\$ 300
85-04	Dr. E. Slagt	300
86-04	Lambda Electronics	222
86-04	Luskins	99
86-07	Epsteins	154
86-10	Excelan	3,950
86-10	Baltimore County Public Library	630
86-12	Think Technologies	125
86-12	Institute employee	<u>300</u>
	TOTAL	\$6,080

Attachment 2

Material and Equipment Purchase Discrepancies (Cont'd)

b. Material and equipment were purchased without prior GSFC approval. While the contract requires that the Contracting Officer approve in advance all purchases over \$1,000, we found that the following purchases were made without such approval:

Purchases without required GSFC approval

<u>Period</u>	<u>Payee</u>	<u>Expense</u>
86-03	Gould, Inc.	\$1,089
86-03	Mills Communications, Inc.	3,379
86-04	Neslab Instruments, Inc.	1,940
87-06	Computer Remarketing Corp.	<u>1,275</u>
	TOTAL	\$7,683

Attachment 2

Material and Equipment Purchase Discrepancies (Cont'd)

c. The Institute erroneously paid Maryland state sales tax and also lost available discounts on its purchases. In this regard we noted:

Sales tax paid

<u>Period</u>	<u>Payee</u>	<u>Expense</u>	<u>Sales Tax</u>
86-02	Continental Resources, Inc.	\$3,133.00	<u>\$91.25</u>
		TOTAL	\$91.25

Lost available discounts

<u>Period</u>	<u>Payee</u>	<u>Expense</u>	<u>Lost Available Discounts</u>
86-12	U.S. Design Corp.	\$5,000	\$102
86-12	Sexauer	351	<u>17</u>
		TOTAL	\$119.

GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004

ATTACHMENT #7

A-52

GSFC Letter to DCAS
for Assistance on
Corrective Actions

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

NAS

DEC 01 1988

Reply to Attn of 284.1

Mr. Michael J. Sullivan
Administrative Contracting Officer
Defense Logistics Agency Baltimore DCAS Management Area
200 Towsontown Boulevard, West
Towson, Maryland 21204-5299

Subject: NAS5-26555 and DCAS Support

Reference: NASA Inspector General's Discussion Draft
Report on the Review of Space Telescope Science
Institute, Report Number A-GO-87-004

The purpose of this letter is to request assistance in the follow-up and resolution of the actions arising out of the above referenced IG report. The discussion draft was utilized in the IG's exit conference with GSFC management and is enclosed for your information.

DCAS assistance is specifically required in resolving recommendations 4 through 7. The resolution of recommendation 4 concerning property management should be accommodated by the contractor's compliance with other property management initiatives arising out of independent assessments by DCAS. I will be working with Ida Davidson of GSFC and Miriam L. Trotter of your office on these and other property issues on the contract. The follow-up of recommendation 4 will be an on-going effort. DCAS is requested to provide a specific response to recommendation 6. It should be noted that the contractor has been requested to correct the noted file deficiencies. No follow-up for recommendation 7 is expected at this time since the contractor has not generated the policy required for oversight.

If you have any questions regarding this matter, please contact me on (301)286-2271.

Gifford P. Moak
Contracting Officer

cc: 440/R. Flick
284.1/Contract File

440/I. Mason
A-53

440/L. Warren

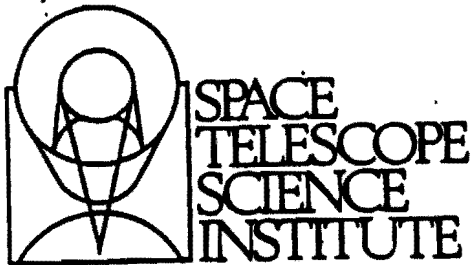
ATTACHMENT A

TAG NO	I. G. EQUIPMENT DISCREPANCIES DESCRIPTION	LOC	SERIAL NO	AMOUNT
3813	DISK DRIVE CABINET-4 HIGH	128	CX-03102	\$68,754.00
3814	DISK DRIVE, DIGITAL RA81	128	CXA-023804	
3815	DISK DRIVE, DIGITAL RA81	128	CXA-018871	
3816	DISK DRIVE, DIGITAL RA81	128	CXA-024206	
3817	DISK DRIVE, DIGITAL RA81	128	CXA-023249	
4240	CPU, TEXAS INSTRUMENTS EXPLORER	656	4342150054/4342 150055	\$53,000.00
4241	MONITOR, DIGITAL VR260-AA	660	AB60900X6//B06 122057Y4(KEYBRD)	\$1,800.00
4242	CPU, DIGITAL MICROVAX II	660	WF61005613	\$24,000.00
4245	MONITOR, DIGITAL VR260-AA	111A	AB61100XM9//B06 1301N52(KEYBRD)	\$1,800.00
4246	CPU, DIGITAL MICROVAX II	111A	WF60605394	\$24,000.00
4635	PRINTER/TERMINAL, DIGITAL LETTERWRITER	128	AD-797	\$2,300.00
4636	PRINTER/TERMINAL, DIGITAL CORRESPONDENT	128	PN-537-34	\$1,800.00
4637	LASER PRINTER, TALARIS 800	411	1096733	\$25,240.00
ST01060	MONOCHROME MONITOR	203	0262710	\$149.00
ST01061	PERSONAL SYSTEM UNIT/CPU	203	0222700	\$932.00
				<hr/> \$203,775.00

15 records listed.

ATTACHMENT #8

**ST Sci Response
Re. Corrective Actions**



3700 San Martin Drive
Baltimore, MD 21218
(301) 338-4700
Telex 6849101

12 January 1989

Mr. Gifford P. Moak
Contracting Officer
Code 284.1
Goddard Space Flight Center
Greenbelt, Maryland 20771

Subject: Contract NAS5-26555
Audit by the NASA Inspector General

Dear Gifford:

We are responding to your 1 December 1988 letter, requesting a description of the actions taken in order to resolve the audit findings of the Inspector General, for those items relevant to the ST Sci operation.

1. Property Management: We have reviewed and upgraded the Institute's Property Management Procedure in an effort to assure appropriate control over the Government's interests. The Contracting Officer is aware that we have had a long-term and continuing scrutiny by the cognizant property administrative office of DCASR, and they have recently rated our organization as "satisfactory." We also are in the process of establishing a full-time, in-house staff Property Administrator, who will devote the attention necessary to maintain that satisfactory condition.

All the equipment listed on Attachment 1 has been located, tagged, and entered on the ST Sci property inventory listing. A copy of our inventory sheet denoting this action is enclosed as Attachment A. The shipping instructions issued by the Purchasing Department and equipment handling functions performed by the Shipping and Receiving Department have been examined, reviewed with the staff, and, as necessary, modified to ensure a closure of identifiable potential problems.

Attachment 1 indicated that the property was on the premises, but had not been listed in the inventory nor tagged. A short explanation for the occurrence of these discrepancies is in order:

- a. Five (5) items identified as RA81 Disc Drives, totaling 44% of the total value listed, were really contained in one cabinet.

Distribution
• R. Flieck
• L. L. L. L.
• I. Mason
• D. FORTUNAT
• I. DAVIDSON, J35
• IG file (ORIGINAL)
• Chrono

This DEC equipment is required to be opened by a DEC representative upon receipt, in order to avoid negating warranty conditions. In the absence of DEC's representative, it was necessary to store the cabinet awaiting his action. Since we have a serious lack of storage space at the Institute, the cabinet was placed at its final destination, i.e., Room 128. The failure in the system was that when the DEC representative returned and checked out the equipment, the Shipping and Receiving Department was not notified of the final installation. As a result, the equipment was not tagged in a timely fashion. To avoid this recurrence, all Technicians responsible for receipt of computer equipment in the operational area have been instructed as to proper reporting requirements.

- b. All the remaining equipment on Attachment 1 was located on the Institute's premises on a trial basis, having been brought here directly by the Vendor, thereby circumventing the Shipping and Receiving Department. When the trial basis turns into a procurement, our system apparently fails to accommodate the physical transfer. We have remedied this loophole by utilization of a "zero balance" purchase order, to forewarn the Shipping and Receiving Department that a purchase will subsequently occur. Also, all staff members have been notified that equipment brought in on a trial basis must be reported to the Property Administrator prior to placement on site. [Note: When equipment is obtained on a trial basis, title is not passed to the Government.]

2. **Material and Equipment Purchases:** Attachment 2A identifies nine (9) items totaling \$6,000 for which the files fail to contain receipts or invoices describing the items purchased. All such future purchases, if any, will contain receipts or invoices in accordance with instructions presented to the appropriate staff. These items were purchased under terms of cash or C.O.D. basis. Although it is not the standard policy of the Institute to procure items on cash terms, the procurements in question were necessary and consummated under one or more of the following conditions: lower costs, items unavailable from other vendors, use of local retail establishments, small business considerations, cash transaction necessary to establish credit for future procurements, and software license agreements which require advance payment. Unfortunately, in most instances, cash register receipts and packing slips are the only return items that are available to provide backup for the procurement file. We have taken the necessary action to assure that all the supporting paper work, in the future, will be obtained and stored in the file. We do not intend to review here the nine (9) specific instances and why the discrepancies occurred -- for example, \$99.00 for Luskins, or \$125.00 for Think

Mr. Gifford P. Moak
12 January 1989
Page - 3 -

Technologies. It is sufficient to state that over a period of twenty-four (24) months, as audited, these occurrences, in the totality of the procurement activity, are minimal. Our corrective action will resolve this issue.

Attachment 2B highlighted procurements made without prior Contracting Officer consent, as required under the contract terms, and covered the period 1985-87. This finding reflects four (4) orders averaging \$2,000 each. We concur — this simply was an oversight. Requests for ratification for approval will be submitted to your office. As you are aware, the requirements for Contracting Officer approval in our Contract are rigid. We seem to be averaging between \$3 million-to-\$5 million of annual procurement volume, of which many specific items are submitted for requisite approval. Our goal has been, and will always be, to have zero discrepancies in this area. As a side note, relief in this area is appropriate for future discussion.

Attachment 2C represented miscellaneous items of discrepancies, i.e., \$91.00 for having paid sales tax which should not have been paid, and \$119.00 of a lost available discount. Unfortunately, the one sales tax item of \$91.00 was erroneously paid, possibly by a new employee's failure to understand our procedures. It was a one-time error, to the best of our knowledge, which occurred in 1985. It certainly should not happen again. The lost available discount was due to a delay in obtaining quick turnaround for Contracting Officer approval. A request was made for the placement of the purchase on September 26, 1986, and the approval was not obtained until October 22, 1986. The offered Vendor discount, unfortunately, had expired on October 11, 1986. We have always paid our bills as they mature, and take advantage of all available discounts, subject of course to the availability of funds that are allotted to us under the Contract.

3. *Long-Distance Telephone Expenses:* For quite some time, we too have been concerned about our long distance telephone expenses, and, in accordance with your request, a policy has been generated and implemented for Institute use. A copy of the policy and the accompanying distribution memorandum are attached hereto (Attachment B). It should also be noted for the record, that the telephone usage concern has been addressed at various management meetings at the Institute for communication to the staff. My staff will, from time to time, monitor the costs incurred in telephone usage. Appropriate action will be taken if such costs are found to be abusive.

As previously noted, the Inspector General reviewed our operation spanning the fiscal years 1985 through 1987, and some portion of fiscal year 1988. This was an indepth review and, to the best of our estimate, the IG was in residence for approximately four (4) man-months. This type of audit can be an illuminating tool which is useful to identify areas of weakness that are not always recognizable to those parties who work with the operation day-to-day. For that, we are appreciative and use the information of the audit to better our operations. In a sense, I also am gratified that the administration of approximately \$60 million during the period audited resulted only in these nominal discrepancies.

Mr. Gifford P. Moak
12 January 1989
Page - 4 -

We believe that all the actions required have been completed with the exception of the request for ratification of Contracting Officer approval for purchase orders. This item will be completed within the next thirty (30) days.

Very truly yours,

Harry W. Feinstein
Head of Administration

HWF:dka

Enclosures

cc: R. Giacconi
G. Oertel, AURA

GSFC Response to
OIG 12/29/88 Draft Report,
ST Sci, A-GO-87-004

ATTACHMENT #9

ST Sci Long Distance
Telephone Policy

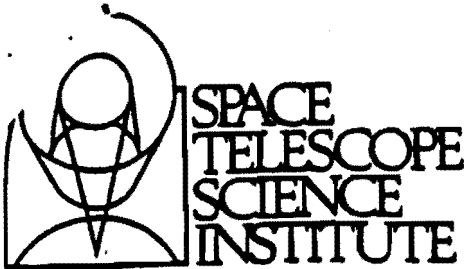
ST SCI LONG DISTANCE TELEPHONE USAGE POLICY

The Space Telescope Science Institute is a multi-national organization that requires a significant amount of both inter-state as well as international long distance voice communication. In order to provide a measure of control over the rising costs of long distance communication, a uniform policy of long-line usage is established for all staff members, contractors, and visitors at the Institute.

All long distance calls should be limited to Institute business-related matters. It is incumbent upon each staff member to realize the cost of long distance calling, especially calls over a prolonged period of time to remote areas. Also, there is a finite number of accessible trunks for outgoing calls which should not be tied up for unnecessary calls. Voice communication over a long distance is the most expensive means of conveying information. Other options available include either the telex machine located in Room 411, or the facsimile equipment in the Mail Room.

In order to maintain effective and timely voice communications at the institute, we must, in good faith, monitor ourselves. Abuse of this asset may incur serious restrictions on call access at the Institute. The demands for long line communication will continue to increase as the mission of ST Sci evolves and expands. The management urges thoughtful and efficient use of long distance calling which, in turn, will contribute to the success of our endeavor.

12.06.88



3700 San Martin Dr
Baltimore, MD 21
(301) 338-4
Telex 6849

12 December 1988

MEMORANDUM

TO: Distribution

FROM: Harry W. Feinstein

SUBJECT: Standard Practices and Procedures for Administration

Enclosed you will find additions to the recently distributed Standard Practices for Administration manual. These policies set the procedures for (a) parking at ST ScI, and (b) ST ScI long distance telephone usage.

As you will recall these matters have been discussed at various management meetings, and item (b) also has been noted by the Government as well. The Administration Division will, from time-to-time, review long distance calls to assure the reasonable use of the telephone system in compliance with this general policy.

Please include these in the Facilities section of your manual. Also, please discuss and distribute as you deem necessary.

HWF:dk

Enclosures

AUDIT REPORT

AUDIT OF WALLOPS FLIGHT FACILITY BALLON PROGRAM

GODDARD SPACE FLIGHT CENTER

SEPTEMBER 25, 1992

NASA
National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL



National Aeronautics and
Space Administration

Washington, D.C.
20546

Copy to Alan of W

September 25, 1992

TO: S/Associate Administrator for Office of Space
Science and Applications

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report on Audit of Wallops
Flight Facility Balloon Program,
A-GO-91-007

We have completed an audit of the Wallops Flight Facility (WFF) Balloon Program. The objective of the audit was to determine the overall economy and efficiency associated with managing the NASA Scientific Balloon Program. This included evaluating the rationale for managing the Program from WFF, while the National Scientific Balloon Facility (NSBF) and the majority of balloon launches are located in the western United States.

The audit showed that the Balloon Program was generally being operated in an economic and efficient manner. Between FY 1986 and 1990, 172 balloons carrying scientific payloads were launched with a success rate of approximately 92 percent. Further, we found adequate rationale for managing the program from WFF while launching balloons from other geographic locations. Despite the overall success of the program, the audit identified several items requiring management's attention. These include (1) the selection of the new permanent balloon launch site; (2) maintaining defective balloons in inventory; (3) NSBF physical security; and (4) scientific reporting.

An exit conference was held with your designees on April 8, 1992. A draft report was issued on June 26, 1992, requesting written comments from your office on Observation 4, entitled "Improvements Needed in Scientific Reporting". Your official response was received on August 20, 1992. The response is included after Recommendation 7 and is presented in its entirety as Attachment II to this report.

Seven recommendations were made to improve management oversight of the balloon program, strengthen internal controls and potentially provide cost benefits of \$1,250,000. Recommendations 1 through 6 were addressed to GSFC and required no written response from your Office.

If you have any questions, please call me or Robert Raspen,
Deputy Assistant Inspector General for Auditing at 453-1232.

for Richard J. Pelletier
Enclosure

cc:
W/OIG Center Director, GSFC

National Aeronautics and
Space Administration



Office of Inspector General
Code 200.1
Goddard Space Flight Center
Greenbelt, MD 20771

Reply to Attn of: W

September 25, 1992

TO: 100/Center Director

FROM: 200.1/OIG Center Director, GSFC

SUBJECT: Final Report on Audit of Wallops
Flight Facility Balloon Program,
A-GO-91-007

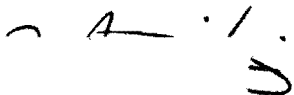
We have completed an audit of the Wallops Flight Facility (WFF) Balloon Program. The objective of the audit was to determine the overall economy and efficiency associated with managing the NASA Scientific Balloon Program. This included evaluating the rationale for managing the Program from WFF, while the National Scientific Balloon Facility (NSBF) and the majority of balloon launches are located in the western United States.

The audit showed that the Balloon Program was generally being operated in an economic and efficient manner. Between FY 1986 and 1990, a total of 172 balloons carrying scientific payloads were launched with a success rate of approximately 92 percent. Further, we found adequate rationale for managing the program from WFF while launching balloons from other geographic locations. Despite the overall success of the program, the audit identified several items requiring management attention. These include (1) the selection of the new permanent balloon launch site; (2) maintaining defective balloons in inventory; (3) NSBF physical security; and (4) scientific reporting.

An exit conference was held with your designees on April 14, 1992. A draft report was issued on June 26, 1992 requesting written comments from the center. The center's official response was received on August 12, 1992. The center's response is included after each recommendation and is presented in its entirety as Attachment I to this report.

A total of seven recommendations were made to improve management oversight of the balloon program, strengthen internal controls and potentially provide cost benefits of \$1,250,000. Recommendations 1 through 6 were addressed to GSFC. Recommendation 7 was addressed to the Associate Administrator for the Office of Space Science and Applications.

In accordance with NMI 9910.1A, we request to be included in the center's concurrence cycle for closure of recommendations 1 and 2. With respect to recommendations 3 through 6, please notify our office when they are considered closed. If you have any questions, please call me or Kevin Carson at 286-5561.


Daniel J. Samoviski

Enclosure

cc:
W/R. Pelletier
201/J. Clark

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
DIGEST	i
INTRODUCTION	1
OBJECTIVES AND SCOPE	3
OBSERVATIONS AND RECOMMENDATIONS	5
1. Existing Government Facilities Not Considered When Selecting A New Permanent Balloon Launch Site	5
2. National Scientific Balloon Facility Maintains Potentially Defective Balloons In Inventory	13
3. National Scientific Balloon Facility Physical Security Needs Improvement	17
4. Improvements Needed in Scientific Reporting	19
5. Other Matters	21
6. General Comments	23

ATTACHMENT I - GSFC RESPONSE DATED AUGUST 12, 1992

ATTACHMENT II - CODE S RESPONSE DATED AUGUST 20, 1992

AUDIT OF WALLOPS FLIGHT FACILITY BALLOON PROGRAM

GODDARD SPACE FLIGHT CENTER

DIGESTIntroduction

The NASA Office of Inspector General (OIG) has completed an audit of the Wallops Flight Facility (WFF) Balloon Program. The objective of the audit was to determine the overall economy and efficiency associated with managing the NASA Scientific Balloon Program. This included evaluating the rationale for managing the program from WFF, while the National Scientific Balloon Facility (NSBF) and the majority of balloon launches are located in the western United States.

The WFF Balloon Program launches scientific payloads using balloons with volumes up to approximately 40 million cubic feet. Balloon launches are currently conducted under contract between NASA and the New Mexico State University, Physical Science Laboratory (PSL). In addition to launching balloons, PSL is required by the contract to operate and maintain the NSBF. Launches are conducted from various sites throughout the world with most flights taking place domestically from Palestine, Texas and Fort Sumner, New Mexico. Total funding for the balloon program during Fiscal Years (FY) 1990 and 1991 was approximately \$15 million per year, including WFF Management and contractor costs.

Results of Audit

The WFF Balloon Program was generally being operated in an economic and efficient manner. Between FY 1986 and FY 1990, a total of 172 balloons carrying scientific payloads were launched with a success rate of approximately 92 percent. Further, we found adequate rationale for managing the program from WFF while launching balloons from other geographic locations. Despite the overall success of the program, the audit identified several issues requiring management attention. These include (1) the new permanent balloon launch site selection; (2) maintaining defective balloons in inventory; (3) NSBF physical security; and (4) scientific reporting.

A total of seven recommendations were made to improve management oversight of the balloon program, strengthen internal controls, and potentially provide cost benefits of \$1,250,000. Management generally concurred with the

recommendations but nonconcurred with the potential cost benefits.

1. Existing Government Facilities Not Considered When
Selecting A New Permanent Balloon Launch Site

The Wallops Flight Facility, Balloon Project Office is acquiring land and constructing facilities for a permanent balloon launch site, when existing Government launch facilities could be used. This situation exists because the balloon project office directed the contractor, conducting the surveys for a potential permanent launch site, not to consider an underutilized Department of Defense balloon facility as a viable location. As a result, the project office has expended approximately \$586,000 to lease land, renovate an existing facility, and acquire a new facility. They further plan to acquire additional buildings and land for about \$1,250,000, when existing similar facilities could be used. We recommended that WFF Management refrain from procuring additional buildings and land until all other alternatives of existing Government facilities have been considered. Further, WFF Management should conduct discussions with appropriate Air Force officials to determine the potential of using the Holloman AFB balloon launch facility for NASA's permanent western balloon launch site. Management generally concurred with the recommendations but nonconcurred with the potential cost benefits (page 5).

2. National Scientific Balloon Facility Maintains
Potentially Defective Balloons In Inventory

The National Scientific Balloon Facility (1) maintains a \$1.1 million inventory of potentially defective balloons and (2) does not inspect balloons for potential defects until immediately preceding launch. These conditions exist because (1) previous ascent failures occurred using balloons manufactured from similar material, and (2) WFF has not directed the NSBF to require inspection upon receipt or implement a warranty clause in the contract. As a result, NSBF is storing balloons unusable for science flights, and could potentially acquire additional defective balloons. We recommended that WFF Management (1) in conjunction with NSBF formulate a plan for either the use or disposition of the 36 potentially defective balloons, and (2) modify the contract with NSBF to include additional quality assurance procedures or a warranty clause if any significant changes in balloon materials are made by the balloon manufacturer. Management concurred with the recommendations and have either planned or initiated corrective actions (page 13).

3. National Scientific Balloon Facility Physical
Security Needs Improvement

Physical security at the NSBF needs improvement. During a site visit, several potential security risks were identified such

as: (1) the main gate was unoccupied during non-duty hours; (2) buildings, particularly warehouses, were unlocked with no security personnel nearby; and (3) employees were not openly displaying required identification badges. These conditions exist because (1) GSFC security has not performed routine surveys at NSBF and (2) the contractor was not performing in compliance with contract terms and conditions and the NASA Balloon Program Management Plan. As a result, the protection and safeguarding of Government property and assets are at risk. We recommended that GSFC security perform periodic, unannounced reviews at NSBF to ensure that potential security risks are identified and necessary changes implemented. Further, WFF Management should consider requiring NSBF employees to wear identification badges at all times. Management concurred with the recommendations and have either planned or initiated corrective actions (page 17).

4. Improvements Needed In Scientific Reporting

Results of scientific research performed by grantees are not being properly disseminated to the scientific community. This is occurring because technical officers are not ensuring that grantees submitted required semiannual status or interim reports detailing the results of research accomplishments. As a result, NASA cannot ensure that (1) grantees are performing in accordance with proposals or with grant provisions; (2) research previously performed is not being duplicated; and (3) research accomplishments are properly disseminated. We recommended that the Associate Administrator for the Office of Space Science and Applications remind technical officers of the requirement to receive semiannual and interim reports from grantees and that appropriate copies should be provided to the Center for Aerospace Information (CASI) for dissemination to the scientific community. Management concurred with the recommendation and have initiated corrective actions (page 19).

5. Other Matters

The National Scientific Balloon Facility maintains in inventory, 700 rolls of balloon film with a value of approximately \$221,000. The audit showed that no specific uses for the film have been identified. This film occupies approximately 20 percent of the space in a warehouse at NSBF, specifically constructed to store scientific equipment other than payloads. The material remains idle with no specified determination as to its future use. Some effort should be made to use this film rather than to permit the material to remain idle (page 21).

INTRODUCTION

The NASA Office of Inspector General (OIG) has completed an Audit of the Wallops Flight Facility (WFF) Balloon Program. The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMI) 9910.1A and 1103.27B; dated June 16, 1989; and January 31, 1990; respectively.

The WFF Balloon Program launches scientific payloads using balloons with volumes up to approximately 40 million cubic feet. Between Fiscal Years (FY) 1986 and 1990, 172 balloon launches occurred with a success rate of approximately 92 percent. Balloon success is measured by a balloon's operation during flight. Mission success is determined by whether the payload launched acquires the scientific data that it was designed to collect.

Payloads for balloon launches are selected through a process whereby a NASA Research Announcement is issued for scientific proposals. Once principal investigators provide proposals to NASA Headquarters (NHQ), they are independently evaluated and prioritized by leading authorities from outside the agency. Specific proposals to receive funding are then selected by discipline chiefs (program scientists) from the Office of Space Science and Applications (Code S).

Funding for selected proposals is divided between the scientific experiment/payload and launch support. Research and Development (R&D) funds are used for launch support, while the principal investigator receives payload funding either through a grant or a Research and Technical Operations Program (RTOP).

Using either grant or RTOP funding, the principal investigator develops the scientific payload. During the development phase, the WFF Balloon Project Branch, along with National Scientific Balloon Facility (NSBF) personnel, coordinates with the principal investigator issues such as: (1) establishing launch timeframes, (2) determining the specific telemetry, and (3) other support necessary to be integrated with the payload. Once the payload experiment is complete, it is launched to a specific altitude by the balloon to collect data. Following the analysis of the data collected, the principal investigator issues a report describing the experiment's findings and conclusions.

Prior to 1976, NHQ managed the Balloon Program with launches performed on a reimbursable basis through the National Science Foundation (NSF). At that time, the University Center for Atmospheric Research (UCAR), a NSF Contractor, managed and operated the NSBF, a government-owned, contractor-operated facility in Palestine, Texas. Although NHQ transferred management of the program to WFF in 1976, the reimbursable agreement with NSF continued. In 1982, NSF transferred

responsibility for management and operation of the NSBF to NASA. At that time, a NASA Resident Manager was physically located at NSBF, but this position was disestablished several years later.

Balloon launches are currently conducted under contract between NASA and the New Mexico State University Physical Science Laboratory (PSL). In addition to launching balloons, PSL is contractually required to operate and maintain the NSBF. Launches are conducted from various sites throughout the world with most flights taking place domestically from Palestine, Texas and Fort Sumner, New Mexico. Total funding for the Balloon Program during FY 1990 and FY 1991 was approximately \$15 million per year, including WFF Management and contractor costs.

OBJECTIVES AND SCOPE

The objective of the audit was to determine the overall economy and efficiency associated with managing the NASA Scientific Balloon Program. This included evaluating the rationale for managing the program from WFF, while the NSBF and the majority of balloon launches are located in the western United States. Audit field work was completed between May 1991 and May 1992.

The audit was performed in accordance with Generally Accepted Government Auditing Standards and included such examinations and tests of applicable records, documents, and internal controls as were considered necessary in the circumstances. Specifically, we reviewed various laws and regulations, contract records, and documents pertaining to the Balloon Program. Interviews with responsible NHQ, Goddard Space Flight Center (GSFC), and WFF Balloon Project Management personnel were conducted. We also contacted various contractor, Air Force, and Environmental Protection Agency (EPA) representatives, as well as environmental personnel from the states of New Mexico and Texas.

The significant internal controls related to the Balloon Program are contained in:

- the National Aeronautics and Space Act of 1958, as amended January 1990;
- Federal Acquisition Regulations (FAR);
- Resource, Conservation and Recovery Act (RCRA);
- NASA Provisions for Research Grants and Cooperative Agreements; and
- Statement of Work in contract NAS5-29800 with New Mexico State University Physical Science Laboratory.

We evaluated and tested internal controls on a limited basis, to determine their adequacy and compliance. For example, we reviewed the process by which NHQ directs the WFF Balloon project office. Further, we evaluated the project office's oversight of the contractor in adhering to the contract statement of work. We also reviewed the procurement of property and construction of facilities to determine if they were in conformance with provisions of the National Aeronautics and Space Act. In addition, we assessed quality assurance policies in balloon manufacturing as compared to those outlined in the FAR and reviewed provisions of RCRA pertaining to Government recycling of materials. Finally, we reviewed the dissemination of scientific results and Governmental reviews to determine their compliance with the NASA Provisions for Research Grants and Cooperative Agreements.

Based upon our tests, we found weaknesses in compliance with established internal controls. These weaknesses are described in detail in the "Observations and Recommendations" section of this Report.

OBSERVATIONS AND RECOMMENDATIONS

The WFF Balloon Program was generally being operated in an economic and efficient manner. Between FY 1986 and 1990, a total of 172 balloons carrying scientific payloads were launched with a success rate of approximately 92 percent. Further, we found adequate rationale for managing the program from WFF while launching balloons from other geographic locations. Despite the overall success of the program, the audit identified several issues requiring management attention. These include (1) the new permanent balloon launch site selection; (2) maintaining defective balloons in inventory; (3) NSBF physical security; and (4) scientific reporting. Management actions to address these issues could potentially provide cost benefits of \$1,250,000 and also strengthen internal controls. These items are discussed in the following paragraphs:

1. Existing Government Facilities Not Considered When Selecting A New Permanent Balloon Launch Site

The Wallops Flight Facility, Balloon Project Office is acquiring land and constructing facilities for a permanent balloon launch site, when existing Government launch facilities could be used. This situation exists because the balloon project office directed the contractor, conducting the surveys for a potential permanent launch site, not to consider an underutilized Department of Defense balloon facility as a viable location. As a result, the project office has expended approximately \$586,000 to lease land, renovate an existing facility, and acquire a new facility. They further plan to acquire additional buildings and land for about \$1,250,000, when existing similar facilities could be used.

~~THE NATIONAL AERONAUTICAL AND SPACE ACT OF 1958, AS AMENDED~~
January 1990, Section 102 (d), prescribes:

The aeronautical and space activities of the United States shall be conducted so as to contribute materially to the most effective utilization of scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.

Further, in Section 203 (c)(6), the Act states that:

Each department and agency of the Federal Government shall cooperate fully with the Administration in making its services, equipment, personnel, and facilities available to the Administration,...

In 1985, NASA/WFF developed a Safety Analysis Report, assessing the risks associated with launching balloons in the geographic

area surrounding Palestine, Texas. The report concluded that population areas east of Palestine were increasing and that balloons flown in that direction should be reduced to avoid the probability of injury to personnel and damage to property. The report recommended that NASA assess and evaluate balloon launch sites in less congested population areas such as the western United States.

Based on the results of the safety analysis report, the WFF project office, in 1986, directed NSBF to conduct surveys for a semi-permanent balloon launch site located in the western United States. NSBF produced a comprehensive survey report of six site areas located in Arizona, New Mexico, Nevada, and Utah. In this survey report, NSBF recommended the Fort Sumner, New Mexico site as offering the best considerations for the semi-permanent balloon launch facility. The WFF balloon project office concurred with the report's recommendation and selected Fort Sumner. Between FY 1987 and 1991, the project office expended approximately \$91,000 renovating existing facilities and leasing land and facilities at the Fort Sumner site. The table below shows the facilities that were renovated, and land and facilities leased for operational use at the semi-permanent site.

<u>Project</u>	<u>FY</u>	<u>Cost</u>
Aircraft Hanger Renovation	88	\$61,000
Aircraft Hanger/Office Building Lease	87-91	24,000
Land Lease	87-91	<u>6,000</u>
Total		\$91,000 =====

In 1988, the WFF balloon project office directed NSBF to conduct site surveys for a permanent (vs. semi-permanent) balloon launch site located in the western U.S. The project office established that a western permanent balloon launch site was required to satisfy the potential influx of balloons that would have been launched from Palestine. NSBF produced a comprehensive survey report of site areas located in Arizona, New Mexico, and Nevada. The report indicated that 40 site areas were considered. NSBF communicated the 40 site areas to WFF Management at a PSL Quarterly Review. Fort Sumner was not one of the recommended sites in the Quarterly Review.

NSBF reduced the 40 site areas to 13 for which they prepared individual site surveys. However, the Contracting Officer's Technical Representative (COTR) did not review the 13 individual site surveys conducted by NSBF. The comprehensive

survey concluded that Fort Sumner should be the site of the permanent western balloon launch facility. The project office again concurred with this recommendation.

The project office and NSBF, for both the 1986 and 1988 site survey reports, established criteria for selecting sites with existing facilities that will support balloon launch operations. Although this criteria existed, neither the project office nor NSBF considered the Air Force balloon launch facility located at Holloman Air Force Base (AFB), New Mexico. Project office personnel informed us that they directed NSBF not to consider the Air Force facility as a potential site. This request was made even though NASA balloons had been successfully launched from this location in previous years. The project office's major concern was the site's proximity to Mexico. However, Air Force Balloon Program personnel informed us that, on only one occasion did a balloon, launched from Holloman, land in Mexico. Both the balloon and payload were successfully recovered.

Personnel at Holloman, including the head of the Air Force High-Altitude Balloon Program, informed us that the balloon facility was underutilized. They also stated that the facility could easily accommodate NASA's western U.S. balloon launch campaign. Further, existing facilities such as an office building, a staging building, storage areas, and a rectangular, hard-surfaced launch pad were already in place and would not have to be constructed.

In 1989, an anticipated loss of use of the leased aircraft hanger at the Fort Sumner semi-permanent site, prompted the project office, and NSBF, to consider acquiring land to begin construction of permanent facilities for the balloon program at Fort Sumner. The audit showed the project office has expended approximately \$495,000 on a building and has plans to acquire additional buildings and land for about \$1,250,000 for the Fort Sumner facility. The table below shows acquisitions that have occurred or are planned since the selection of Fort Sumner as the permanent balloon site.

<u>Project</u>	<u>FY</u>	<u>Status</u>	<u>Cost</u>
Pre-Engineered Balloon Staging Facility	91	Completed	\$495,000
Addition to Balloon Staging Facility	93	Planned	740,000
Land (8.149 acres)	92	Planned	10,000
Launch Vehicle Operation/Storage Facility	94	Planned	<u>500,000</u>
Total			\$1,745,000 =====

As a result of not considering the existing Holloman AFB facilities, NASA may have unnecessarily expended a total of \$586,000, including \$495,000 for construction of a permanent staging facility at Fort Sumner. This amount will further increase with planned FY 1992 through FY 1994 expenditures of \$1,250,000.

The WFF project office informed us that the primary objective of the western launch site will be to meet the requirements of turnaround flights. Turnaround is a condition where the winds are light and variable with no predominant direction, thereby providing conditions for extended flight duration for the balloon while remaining within line of site of the telemetry tracking station at the launch site. The required area of operation for this type of flight is considered to be a circle of approximately 300 nautical mile radius about the launch site. According to the project office, turnaround flights can not be performed from the Holloman AFB launch facility because it is located just 55 miles from the Mexican border. Further, NSBF operational flight criteria requires that a 50 mile buffer be maintained between the balloon and any non-operational flight areas for termination purposes. The project office maintains that this requirement could result in a termination on almost every flight from Holloman immediately after launch because of only a five mile operating area in the direction of the border. Therefore, it was WFF's conclusion that launching from Holloman constituted an unacceptable operational risk for the NASA Balloon Program.

Although WFF stated that the Fort Sumner site was to be used to meet the requirements for turnaround flights, the majority of the flights conducted from Fort Sumner since 1987 were flown in an easterly direction. An internal project office study, dated March 30, 1992, analyzed every balloon flight to date from Fort Sumner and transposed the trajectories as if the flights had been launched from Holloman AFB. The study concluded that of

the 43 flights to date from Fort Sumner, 12 flights, or 28 percent, would have been terminated or cancelled due to the proximity to Mexico. However, this study showed that 31 flights, or 72 percent of the flights to date from Fort Sumner could have been flown from the existing launch facility at Holloman AFB.

We question whether the project office should continue with plans to construct facilities for a permanent launch facility at Fort Sumner when their own internal study has shown that over 70 percent of the flights to date could have been launched from the existing Holloman AFB facility. Further, the existing facilities at Fort Sumner are more than adequate, to support the limited number of flights that the study showed could not be flown from Holloman AFB. In our opinion, the Balloon Project Office should thoroughly evaluate the use of Holloman AFB as the permanent balloon launch site before constructing any new government facilities. The potential exists for NASA to save \$1,250,000 if it is determined that Holloman AFB would satisfy the requirements of the balloon project office.

RECOMMENDATION 1

WFF Management should refrain from procuring additional buildings and land at the Fort Sumner, New Mexico balloon facility until all other alternatives of using existing Government facilities have been considered.

RECOMMENDATION 2

WFF Management should conduct discussions with appropriate Air Force officials to determine the potential of using the Holloman AFB balloon launch facility for NASA's permanent western balloon launch site.

MANAGEMENT RESPONSE TO RECOMMENDATIONS 1 AND 2

Concur (Nonconcur with Dollar Savings). NASA's original conclusion regarding the use of the Holloman Air Force Base (HAFB) balloon launch site as its western launch site was based on our knowledge of the Holloman facility, particularly in relation to its inability to meet the Balloon Program's "wind turnaround" launch requirement. In March 1992, in response to the OIG's continuing interest in that site, we revisited our evaluation of Holloman and again confirmed our original conclusion that the HAFB could not adequately support the NASA requirement. We explained this in detail to the OIG at the exit conference, and the OIG acknowledged the significance of the Balloon Program's "wind turnaround" requirement by revising its Discussion Draft Report. The OIG's conclusion and assertion that dividing flights between HAFB and the Fort Sumner site as an acceptable approach is incorrect because the "turnaround" trajectory a balloon experiences is random based on winds, and it is not possible to predict which

flight would have to be launched from the Fort Sumner site to avoid premature termination. Therefore, the approach offered by the OIG is unworkable. To date, the dollar loss to NASA for the balloons required for the 12 premature mission terminations referred to in the OIG report would be \$900,000. This figure does not include dollars associated with additional significant resources that would be required to meet the OIG's two-site scenario. In addition, WFF management has recently discussed with Air Force Balloon Project personnel the Holloman Facility's capability of meeting the NASA permanent launch site requirement. The Air Force personnel indicated that their balloon launch facilities and equipment could not meet the largest balloon volume and heaviest payload requirements of the NASA program. Based on NASA's internal deliberations and on NASA's discussions with Air Force Balloon Program officials, we think we have complied with the OIG's Recommendations 1 and 2 and that due consideration be given to the use of other government facility alternatives, including HAFB.

EVALUATION OF MANAGEMENT RESPONSE (RECOMMENDATIONS 1 AND 2)

The actions taken by management as detailed in the center's response do not adequately meet the intent of recommendations 1 and 2. The center's response indicates the Holloman Air Force Base (HAFB) site cannot meet the balloon program's wind turnaround launch requirement. While Fort Sumner is a viable location for conducting turnaround flights, documentation obtained during the audit indicates that Fort Sumner was also justified for easterly flights that could not be conducted from Palestine, Texas because of safety considerations. The OIG's observations and recommendations concerning Fort Sumner are based on the premise that construction of permanent facilities is not justified because the majority of flights conducted from this facility since 1987 were flown in an easterly direction and could have been launched from HAFB.

We believe that serious consideration should be given to utilizing the HAFB launch site for those flights that do not have to be launched from Fort Sumner. An internal project office study concluded that over 70 percent of the flights conducted from Fort Sumner to date, could have been launched from the HAFB launch facility. The audit clearly showed that utilization of HAFB could provide NASA with an opportunity to limit program costs by \$1,250,000. Further, the existing facilities at Fort Sumner were more than adequate to support the limited number of flights that could not be flown from HAFB. As a result of the audit, the center has decided to forgo construction of the planned launch vehicle operation/storage facility estimated to cost \$500,000. NASA could save an additional \$750,000 if the HAFB launch site is utilized.

The center's response states that significant additional resources would be required to meet the OIG's two-site

scenario. Since no details were provided, we question what significant additional resources would be required to launch from HAFB as opposed to other sites from which balloons are launched. Between 1976 and the present, approximately 40 percent of all balloons were launched from sites in foreign countries and other parts of the continental United States (other than Palestine, Texas or Fort Sumner). NASA did not have to construct permanent facilities at these locations to accommodate launches. The audit showed that not only has NASA launched from HAFB in the past, but that permanent facilities already exist at this location.

The center's response also states that discussions with Air Force personnel indicated that the HAFB launch facilities and equipment could not meet the largest balloon volume and heaviest payload requirements of the NASA program. To our knowledge, this information was obtained telephonically by the balloon project office from the Air Force's assistant contracting officer. Our discussions were held with the director of the Air Force's balloon program who informed us that HAFB could accommodate NASA's flights. As a minimum, the balloon project office should formally meet with Air Force program personnel, discuss program requirements, and document why HAFB can or cannot be utilized.

We will remain in the concurrence cycle for each of these recommendations. In doing so, we will be able to review all documentation and assess the results of all discussions before the recommendations can be closed.

2. National Scientific Balloon Facility Maintains Potentially Defective Balloons In Inventory

The National Scientific Balloon Facility (1) maintains a \$1.1 million inventory of potentially defective balloons and (2) does not inspect balloons for potential defects until immediately preceding launch. These conditions exist because (1) previous ascent failures occurred using balloons manufactured from similar material, and (2) WFF has not directed the NSBF to require inspection upon receipt or implement a warranty clause in the contract. As a result, NSBF is storing balloons unusable for science flights, and could potentially acquire additional defective balloons.

The Federal Acquisition Regulation (FAR) instructs Government officials in evaluating and reviewing inventory and materials. For example, FAR Subpart 46.102 entitled "Policy", states:

- agencies shall ensure that contracts include inspection and other quality requirements, including warranty clauses when appropriate, that are determined necessary to protect the Government's interest; and

- Government contract quality assurance is conducted before acceptance, by or under the direction of Government personnel.

FAR Subpart 46.405 entitled, "Subcontracts", states that Government contract quality assurance on subcontracted supplies shall be performed only when required in the Government's interest. The primary purpose is to assist the contract administration office cognizant of the prime contractor's plant in determining the conformance of subcontracted supplies or services with contract requirements. Further, FAR 46.407, entitled "Nonconforming Supplies or Services", states that contracting officers should reject supplies or services not conforming in all respects to contract requirements.

The audit showed that NSBF maintains in inventory, 36 balloons identified as being potentially defective, with no specific plans for future use or disposition. The rationale provided by WFF and NSBF for not using them was that past failures occurred with other balloons manufactured with the same lot of materials. Despite being identified as potentially defective, no physical inspections of any of the 36 balloons have ever been performed to confirm this claim.

These defective balloons, with a value of approximately \$1.1 million, represent 40 percent of the total NSBF balloon inventory at the end of FY 1990. The majority of these balloons, have been maintained in inventory since the early 1980's. The table below shows how the defective balloons were obtained, the number, and the acquisition cost.

<u>How Obtained</u>	<u>Number</u>	<u>Cost</u>
Transferred to NASA from NSF	10	196,412
NASA-Acquired (Prior Contract)	25	886,569
NASA-Acquired (Current Contract)	<u>1</u>	<u>30,000</u>
Total	<u>36</u>	<u>\$1,112,981</u>

As the table shows, 26 of the defective balloons were obtained with NASA funds, but only one under the current contract with New Mexico State University, Physical Science Laboratory. Twenty-five were procured under the previous contract and ten were provided to NASA when the National Science Foundation transferred the program in 1982. Between FY 1986 and 1990, an average of 44 new balloons per year were procured and subsequently launched while the 36 defective balloons remained in inventory. No plan has been formulated addressing the use or disposition of the defective balloons.

Although the majority of defective balloons were manufactured in the early 1980's, the potential exists that this condition could also occur on the present contract. For example, the audit showed that NSBF does not inspect new balloons for potential defects until immediately preceding their launch. Although quality assurance is performed on individual balloon components during manufacturing, there is no warranty provision in the contract with NSBF to ensure that balloons currently being procured meet NASA specifications. Without such provisions, NASA has no recourse with the contractor if defective balloons are received.

FAR section 46.407 states that "the contracting officer shall ordinarily reject supplies or services when the nonconformance adversely affects safety, ..., reliability, durability, performance, ..., or any other basic objective of the specification." In our opinion, balloons made with defective material should not be accepted and the contract should be appropriately credited. Further, quality assurance can be improved by physically testing balloons upon receipt. WFF Management stated that inspection upon receipt was not viable because it could result in damage to the balloon.

Representatives of the Air Force's Balloon Program informed us that in a few instances, they have received defective balloons. In these instances, the balloon manufacturer either replaced the defective balloon or appropriately credited the contract. Since both NASA and the Air Force use the same prime contractor; and the same manufacturers fabricated the balloons; NASA should receive the same consideration. In discussions with WFF Management personnel, we asked whether a warranty clause had ever been considered for the NSBF contract. They

informed us that a warranty clause had been considered in the past. However, none was implemented because of the cost and the difficulty in identifying responsibility on failures.

When balloon failures originally started to occur, WFF Management initiated efforts to improve quality assurance techniques. Examples of improvements made include: (1) testing of balloon film in a Research and Development laboratory at WFF; (2) on-site visits of balloon manufacturers; and (3) requiring the prime contractor to perform quality assurance tests. Despite these efforts, further improvements can be made to protect the Government's interest.

In our opinion, if the manufacturer makes significant changes in balloon materials, WFF Management should either require additional quality assurance procedures, or insert a warranty clause in the contract with NSBF, to ensure that NASA receives appropriate credit when defective material is received.

RECOMMENDATION 3

WFF Management should modify the contract with NSBF to include additional quality assurance procedures or a warranty clause if any significant changes in balloon materials are made by the balloon manufacturer.

MANAGEMENT RESPONSE

Concur. The existing contract for the Operation and Maintenance of the Balloon Facility requires that all material, including balloons and balloon materials, purchased under the contract conform to established and approved specifications and criteria. The new contract that will take effect October 1, 1992, will include this same requirement as well as a special contract requirement for additional quality assurance testing or other procedures in subcontracts for balloons or balloon materials where any significant change in balloon materials, components, or manufacture thereof, are made by the suppliers. With the inclusion of these clauses in the new contract, this recommendation would be considered closed as of the effective date.

EVALUATION OF MANAGEMENT RESPONSE

The actions planned are considered responsive to the intent of the recommendation.

RECOMMENDATION 4

WFF Management in conjunction with the NSBF should formulate a plan for either the use or disposition of the 36 potentially defective balloons.

MANAGEMENT RESPONSE

Concur. NASA's plan for the use and disposition of the 36 "suspect" balloons in inventory is to continue our current practice of using these balloons for flights in which balloon success is not a requirement for mission success. These "suspect" balloons will be used on a case-by-case basis for testing in support of new launch techniques, qualifying new launch personnel, and conducting flight test of new ground and flight equipment. The rate at which these balloons will be used will be dependent upon the yearly testing requirements of the program. Since these balloons represent a resource that can be used for these types of tests, their disposal would require buying new balloons at additional cost. As a matter of interest, four balloons from this inventory have been used this year in support of testing for the program, and the use of as many as six additional balloons is anticipated before the end of the fiscal year. This approach has been documented to the NSBF and this recommendation should be considered closed.

EVALUATION OF MANAGEMENT RESPONSE

The actions taken are considered responsive to the intent of the recommendation.

3. National Scientific Balloon Facility Physical Security Needs Improvement

Physical security at the NSBF needs improvement. During a site visit, several potential security risks were identified such as: (1) the main gate was unoccupied during non-duty hours; (2) buildings, particularly warehouses, were unlocked with no security personnel nearby; and (3) employees were not openly displaying required identification badges. These conditions exist because (1) GSFC security has not performed routine surveys at NSBF and (2) the contractor was not performing in compliance with contract terms and conditions and the NASA Balloon Program Management Plan. As a result, the protection and safeguarding of Government property and assets are at risk.

The contract statement of work for operation of NSBF requires the contractor to provide all services necessary for the operation and maintenance of the facility, including plant security and visitor control.

Section 1.2.3.8, of the NASA Balloon Program Management Plan; entitled "Physical Security"; states that NSBF security personnel will be used to ensure plant security. In addition, the plan states that security guards will be responsible for overall security within NSBF to include vandalism prevention, door and lock security, and routine security patrols.

During an initial site visit to NSBF, several potential security risks were noticed. For example, upon entering NSBF during early morning, but prior to regular business hours, the main guard gate was observed unlocked and unattended. At the same time, we found unlocked warehouses containing a wide variety of Government-owned equipment, with no visible security nearby.

GSFC security personnel informed us that even though NSBF was a Government-owned facility, they had never conducted any type of survey to determine whether existing security was adequate. After these observations were brought to GSFC/WEF and NSBF management's attention, we were informed that changes would be implemented. On a later visit to NSBF, we noted that improvements had been made. These included the guard locking the gate when unattended during off-duty hours, and warehouse entry ways locked when security was not nearby.

Although some corrective actions have been taken to ensure compliance with the contract and the NASA Balloon Program Management Plan, we believe that further improvements are needed. For example, although employees carry identification, we observed that it is not openly displayed at NSBF. This is contrary to procedures at the contractor's headquarters at New Mexico State University, where personnel are required to display identification badges at all times while on-duty.

Proper display of identification ensures that only authorized personnel are on the premises.

Security measures should be proactive in nature and require continuous monitoring to be successful. Periodic, unannounced reviews by GSFC security personnel would ensure that potential security risks are identified and necessary changes are implemented.

RECOMMENDATION 5

GSFC security should perform periodic, unannounced reviews at NSBF to ensure that potential security risks are identified and necessary changes implemented.

MANAGEMENT RESPONSE

Concur. We concur with this audit recommendation as a means of providing long-term security oversight of the NSBF contract. The results of a physical security survey conducted in May 1992 by a representative of the GSFC Security Office (GSO) will serve as the baseline for future reviews.

EVALUATION OF MANAGEMENT RESPONSE

The actions taken are considered responsive to the intent of the recommendation.

RECOMMENDATION 6

WFF management should consider requiring NSBF employees to wear identification badges at all times.

MANAGEMENT RESPONSE

Concur. Based on the result of GSO's physical security survey, we are considering implementation of a requirement for NSBF employees and/or visitors to display identification badges at all times while on the facility. Our final decision will become effective upon renewal of the NSBF contract.

EVALUATION OF MANAGEMENT RESPONSE

The actions planned are considered responsive to the intent of the recommendation.

4. Improvements Needed In Scientific Reporting

Results of scientific research performed by grantees are not being properly disseminated to the scientific community. This is occurring because technical officers are not ensuring that grantees submitted required semiannual status or interim reports detailing the results of research accomplishments. As a result, NASA cannot ensure that (1) grantees are performing in accordance with proposals or with grant provisions; (2) research previously performed is not being duplicated; and (3) research accomplishments are properly disseminated.

NASA Research Grants and Cooperative Agreements contain a clause entitled Technical Reports and Publications. Section (c) of the clause states that brief, informal semiannual status reports, which shall include concise statements of research accomplished during the reporting period shall be submitted. This is a minimum reporting requirement. Grantees are further urged to submit interim reports to publish, whenever the research has reached a point where it is logical to summarize the results, a phase has been completed, or significant new findings are made. Copies of all reports shall be submitted to NASA and the Center for Aerospace Information (CASI) whose purpose is to assure proper dissemination to the scientific community.

As part of the audit, we interviewed six technical officers responsible for monitoring grants for scientific proposals that would eventually be launched as payloads on NASA balloons. None of the six interviewed required their grantees to submit semiannual or interim reports. We found only two grantees that voluntarily, or at all, provided these reports. We were informed that documentation technical officers rely upon for assessing research results is the annual grant renewal proposals. Grantees prepare renewal proposals as justification for funding for the next fiscal year. Each renewal proposal includes a description and results of the previous year's research accomplishments.

Although the renewal proposal contains details of the previous year's research accomplishments, it does not provide for timely reporting of results as the semiannual or interim reports would. Further, the results detailed in renewal proposals are not being provided to CASI for dissemination to the scientific community. Our review of 23 grant proposal renewals submitted between 1985 and 1991 showed that none of the research results were submitted to CASI. For example, one grant with the University of Washington was for basic research on primary cosmic radiation. The annual grant proposal renewal requested funding of \$300,056; starting November 1, 1990; to continue the research. The prior year's performance period occurred from November 1, 1989 to October 31, 1990. We reviewed the information and report listing from CASI for any semiannual or interim reports issued on this research. We found no mention

of any reports issued to support any of the research completed.

Had the required semiannual reports been prepared and submitted to CASI, the results of the research completed to date would have been available for dissemination to the scientific community. Further, by not submitting these reports, NASA cannot ensure the grantee is performing in accordance with the proposal or that similar research has not already been accomplished. In our opinion, proper steps should be taken to ensure that the results of all research performed under NASA grants is properly reported and disseminated to the scientific community.

RECOMMENDATION 7

The Associate Administrator for the Office of Space Science and Applications should remind Technical Officers of the requirement to receive semiannual and interim reports from grantees and that appropriate copies should be provided to CASI for dissemination to the scientific community.

MANAGEMENT RESPONSE

Concur. We concur in the first portion of this recommendation and have taken steps to remind all OSSA Technical Officers of the established requirement for submission of these reports.

However, we do not agree with the second half of the recommendation which calls for dissemination of copies of these reports to the scientific community through CASI. These interim reports typically would not be expected to contain complete or even good science data. Instead, dissemination of results from our science programs is made through the long-standing procedure of publication in peer-reviewed journals and at scientific meetings; this process filters results which are not adequately substantiated and ensures that the results of our missions are presented in the full context of contemporary research in the field. Moreover, it is our understanding that CASI is more frequently used for engineering results than for scientific results; consequently, even publication of final research results in CASI would not necessarily improve the breadth of dissemination to the science community, when compared with current practice.

EVALUATION OF MANAGEMENT RESPONSE

The actions taken are considered responsive to the intent of the recommendation. We concur with Management's position concerning the dissemination of scientific research through CASI.

5. Other Matters

a. NSBF maintains in inventory, 700 rolls of balloon film with a value of approximately \$221,000. The audit showed that no specific uses for the film have been identified. This film occupies approximately 20 percent of the space in a warehouse at NSBF, specifically constructed to store scientific equipment other than payloads. The material remains idle with no specified determination as to its future use. Some effort should be made to use this film rather than to permit the material to remain idle.

MANAGEMENT RESPONSE

The 700 rolls of balloon film in inventory are composed of primarily two elements: approximately 300 rolls of French film; and 400 rolls of Raven and Winzen film. The French film is a current film being manufactured and used by the French in their balloon program. This film was originally bought to provide options if the U.S. manufacturers were not successful in developing their own films. Since this was not the case and we have two very successful films, we do not need to build balloons from French film. We are interested however in determining what makes "good" balloon film and are therefore using this film on an as-needed basis for research and development testing. The plan for the future would be to continue this until it is determined as no longer useful. The 400 rolls of Raven and Winzen manufactured films do not meet our approved balloon film criteria and therefore cannot be used in support of the scientific program. We plan to dispose of the unusable film in the most economical way to the government.

b. During the audit, we found that balloon remnants were routinely discarded in local landfills after launch, without exploring the possibility of alternative uses such as recycling. In the draft audit report, we recommended that WFF Management perform a study to determine the feasibility of recycling balloons. WFF Management conducted a study which concluded that recycling was not a feasible process for disposing of balloons. In addition, there was not a viable market for used balloons. As a result of WFF Management's actions in this area, we have eliminated this observation and recommendation from the final audit report.

6. General Comments

We wish to acknowledge the cooperation of all NASA Headquarters, GSFC, WFF, and Contractor officials contacted during the audit.

GODDARD SPACE FLIGHT CENTER (GSFC)

RESPONSE TO

OFFICE OF INSPECTOR GENERAL (OIG)

DRAFT AUDIT REPORT A-GO-91-007

DATED JUNE 26, 1992

AUDIT OF WALLOPS FLIGHT FACILITY BALLOON PROGRAM

DATE: AUG 12 1992

ENCLOSURE

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

ATTACHMENT 1



AUG 12 1992

Reply to Attn of

100

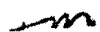
TO: 200.1/Director, Center Office of Inspector
General (OIG), GSFC

FROM: 100/Director

Subject: GSFC Response to OIG Draft Report on Audit of
Wallops Flight Facility Balloon Program
(A-GO-91-007)

Enclosed is our response to the subject audit report
dated June 26, 1992.

I would be happy to discuss this with you at any time.
You may also call Ms. JoAnn Clark at extension 6-7977 if
you need further coordination or information relating to
this response.


John M. Klineberg

Enclosure

cc:
HQ/JM-1/Ms. Troupe
HQ/SP/Mr. Norton
HQ/SS/Mr. DeMinco

INTRODUCTION

The draft report documenting the OIG audit of the Wallops Flight Facility Balloon Program, A-GO-91-007, has been completed. Of the eight recommendations made by the OIG in their report, Recommendations 1-7 are addressed to Goddard Space Flight Center. Recommendation 8 is addressed to NASA Headquarters. Recommendations 1 and 2 address WFF management's selection of Fort Sumner, New Mexico, as the new semi-permanent launch facility instead of Holloman Air Force Base. Recommendations 3 and 4 address NASA's balloon and balloon material acceptance procedures. Recommendation 5 addresses NASA's approach to disposal of expended balloons. Recommendations 6 and 7 address the National Scientific Balloon Facility's (NSBF's) physical security. Although we are able to concur with all the recommendations, our concurrence does not imply complete agreement with all the OIG's observations or all the OIG's inferences drawn from some of those observations. From our standpoint, the recommendations are not completely consistent with the observations and therefore can be agreed with even though we think some observations and resulting conclusions are incorrect. We have discussed these concerns in detail with the OIG at the April 14, 1992, exit conference.

OIG RECOMMENDATION 1: (\$0)

WFF management should refrain from procuring additional buildings and land at the Fort Sumner, New Mexico, balloon facility until all other alternatives of utilizing existing Government facilities have been considered.

GSFC RESPONSE TO RECOMMENDATION 1: (\$0)

CONCUR WITH RECOMMENDATION

See Below Narrative and Response to Recommendation 2.

This OIG recommendation and the following Recommendation 2 address the use of the Holloman Air Force Base balloon launch site as an alternative to the Fort Sumner, New Mexico, site selection made by WFF management. Our following response responds to both Recommendations 1 and 2.

OIG RECOMMENDATION 2: (\$1,250,000)

WFF management should conduct discussions with appropriate Air Force officials to determine the potential of using the Holloman AFB balloon launch facility for NASA's permanent western balloon launch site.

GSFC RESPONSE TO RECOMMENDATION 2: (\$550,000)

CONCUR WITH RECOMMENDATION

OIG DOLLAR FIGURES SHOULD BE REVISED TO \$550,000.

IN ANY CASE NO SAVINGS CAN BE ACHIEVED AS A RESULT OF MANAGEMENT ACTION, AS DESCRIBED BELOW.

NASA's original conclusion regarding the use of the Holloman Air Force Base (HAFB) balloon launch site as its western launch site was based on our knowledge of the Holloman facility, particularly in relation to its inability to meet the Balloon Program's "wind turnaround" launch requirement. In March 1992, in response to the OIG's continuing interest in that site, we revisited our evaluation of Holloman and again confirmed our original conclusion that the HAFB could not adequately support the NASA requirement. We explained this in detail to the OIG at the exit conference, and the OIG acknowledged the significance of the Balloon Program's "wind turnaround" requirement by revising its Discussion Draft Report. The OIG's conclusion and assertion that dividing the flights between HAFB and the Fort Sumner site as an acceptable approach is incorrect because the "turnaround" trajectory a balloon experiences is random based on

winds, and it is not possible to predict which flight would have to be launched from the Fort Sumner site to avoid premature termination. Therefore, the approach offered by the OIG is unworkable. To date, the dollar loss to NASA for the balloons required for the 12 premature mission terminations referred to in the OIG report would be \$900,000. This figure does not include dollars associated with additional significant resources that would be required to meet the OIG's two-site scenario. In addition, WFF management has recently discussed with Air Force Balloon Project personnel the Holloman Facility's capability of meeting the NASA permanent launch site requirement. The Air Force personnel indicated that their balloon launch facilities and equipment could not meet the largest balloon volume and heaviest payload requirements of the NASA Program. Based on NASA's internal deliberations and on NASA's discussions with Air Force Balloon Program officials, we think we have complied with the OIG's Recommendations 1 and 2 that due consideration be given to the use of other government facility alternatives, including HAFB.

The Fort Sumner facility cost figures in the OIG's June 1992 Draft Report, Page 13, should be revised based on the most recent WFF management decisions. The current estimate for completion of the facility at Fort Sumner is as follows:

Land (8.149 acres)	FY 92	Planned	\$ 10,000
Additions to the staging facility	FY 93	Planned	<u>\$540,000</u>
Total			\$550,000

Note: There are no dollar savings associated with our completion of Recommendations 1 and 2.

ACTION RESPONSIBILITY:	<u>842/R. Nock</u>
CLOSURE OFFICIAL:	<u>842/H. Needleman</u>
CONCURRING OFFICIAL:	<u>840/L. Early</u>
PROJECTED CLOSURE DATE:	<u>Completed</u>

OIG RECOMMENDATION 3: (\$0)

WFF management should modify the contract with NSBF to include additional quality assurance procedures or a warranty clause if any significant changes in balloon materials are made by the balloon manufacturer.

GSFC RESPONSE TO RECOMMENDATION 3: (\$0)
CONCUR WITH RECOMMENDATION

The existing contract for the Operation and Maintenance of the Balloon Facility requires that all material, including balloons and balloon materials, purchased under the contract conform to established and approved specifications and criteria. The new contract that will take effect October 1, 1992, will include this same requirement as well as a special contract requirement for additional quality assurance testing or other procedures in subcontracts for balloons or balloon materials where any significant change in balloon materials, components, or manufacture thereof, are made by the suppliers. With the inclusion of these clauses in the new contract this recommendation would be considered closed as of the effective date.

ACTION RESPONSIBILITY:	<u>842/R. Nock</u>
CLOSURE OFFICIAL:	<u>842/H. Needleman</u>
CONCURRING OFFICIAL:	<u>840/L. Early</u>
PROJECTED CLOSURE DATE:	<u>October 1992</u>

OIG RECOMMENDATION 4: (\$0)

WFF management in conjunction with the NSBF should formulate a plan for either their use or disposition of the 36 potentially defective balloons.

GSFC RESPONSE TO RECOMMENDATION 4: (\$0)
CONCUR WITH RECOMMENDATION

NASA's plan for the use and disposition of the 36 "suspect" balloons in inventory is to continue our current practice of using these balloons for flights in which balloon success is not a requirement for mission success. These "suspect" balloons will be used on a case-by-case basis for testing in support of new launch techniques, qualifying new launch personnel, and conducting flight test of new ground and flight equipment. The rate at which these balloons will be used will be dependent upon the yearly testing requirements of the program. Since these balloons represent a resource that can be used for these types of tests, their disposal would require buying new balloons at additional cost. As a matter of interest four balloons from this inventory have been used this year in support of testing for the program, and the use of as many as six additional balloons is anticipated before the end of the fiscal year. This approach has been documented to the NSBF and this recommendation should be considered closed.

ACTION RESPONSIBILITY:	<u>842/R. Nock</u>
CLOSURE OFFICIAL:	<u>842/H. Needleman</u>
CONCURRING OFFICIAL:	<u>840/L. Early</u>
PROJECTED CLOSURE DATE:	<u>Completed</u>

OIG RECOMMENDATION 5: (\$0)

WFF management should perform a study to determine the feasibility of recycling balloons. If recycling is feasible, the NSBF contract should be modified to require any refund provided to the contractor for recycled material be credited appropriately to NASA.

GSFC RESPONSE TO RECOMMENDATION 5: (\$0)
CONCUR WITH RECOMMENDATION

A study on the feasibility of recycling has been recently conducted. The study confirms our previous finding that recycling is not a feasible process for disposing of balloons and there is not a viable market for used balloons. Two recyclers were contacted and said that it would cost NASA from 5 to 15 cents per pound to recycle used balloon film. One recycler, POLY-AMERICA, Inc., identified by the OIG auditors, was provided a balloon to test. One of the "suspect balloons" after use in a launch technique test and in a much "cleaner" condition than the typical expended flight balloon, was shipped to the recycler. The results of his attempt at recycling were negative. His stated reasons were the cost of removing the radar yarn in the balloon and the problems created by the strips of nylon (load tape) in the material. The results of this study indicate that there is no cost advantage and this recommendation should be considered closed.

ACTION RESPONSIBILITY:	<u>842/R. Nock</u>
CLOSURE OFFICIAL:	<u>842/H. Needleman</u>
CONCURRING OFFICIAL:	<u>840/L. Early</u>
PROJECTED CLOSURE DATE:	<u>Completed</u>

OIG RECOMMENDATION 6: (\$0)

GSFC security should perform periodic, unannounced reviews at NSBF to ensure that potential security risks are identified and necessary changes implemented.

GSFC RESPONSE TO RECOMMENDATION 6: (\$0)
CONCUR WITH RECOMMENDATION

We concur with this audit recommendation as a means of providing long-term security oversight of the NSBF contract. The results of a physical security survey conducted in May 1992 by a representative of the GSFC Security Office (GSO) will serve as the baseline for future reviews.

ACTION RESPONSIBILITY:	<u>205.1/D. Moulton</u>
CLOSURE OFFICIAL:	<u>205/T. Potterton</u>
CONCURRING OFFICIAL:	<u>200/F. Moore</u>
PROJECTED CLOSURE DATE:	<u>Completed</u>

OIG RECOMMENDATION 7: (\$0)

WFF management should consider requiring NSBF employees to wear identification badges at all times.

GSFC RESPONSE TO RECOMMENDATION 7: (\$0)
CONCUR WITH RECOMMENDATION

Based on the result of the GSO's physical security survey (refer to the response to Recommendation 6), we are considering implementation of a requirement for NSBF employees and/or visitors to display identification badges at all times while on the facility. Our final decision will become effective upon renewal of the NSBF contract.

ACTION RESPONSIBILITY:	<u>205.1/D. Moulton</u>
CLOSURE OFFICIAL:	<u>205/T. Potterton</u>
CONCURRING OFFICIAL:	<u>200/F. Moore</u>
PROJECTED CLOSURE DATE:	<u>October 1992</u>

OIG RECOMMENDATION 8: (\$0)

The Associate Administrator for the Office of Space Science and Applications should remind Technical Officers of the requirement to receive semiannual and interim reports from grantees and that appropriate copies should be provided to CASI for dissemination to the scientific community.

Note: This recommendation will be addressed by NASA Headquarters.

Other Matters

NSBF maintains in inventory, 700 rolls of balloon film with a value of approximately \$221,000. The audit showed that no specific uses for the film have been identified. This film occupies approximately 20 percent of the space in a warehouse at NSBF, specifically constructed to store scientific equipment other than payloads. The material remains idle with no specified determination as to its future use. Some effort should be made to use this film rather than to permit the material to remain idle.

GSFC RESPONSE TO OTHER MATTERS:

The 700 rolls of balloon film in inventory are composed of primarily two elements: approximately 300 rolls of French film; and 400 rolls of Raven and Winzen film. The French film is a current film being manufactured and used by the French in their balloon program. This film was originally bought to provide options if the U.S. manufacturers were not successful in developing their own films. Since this was not the case and we have two very successful films, we do not need to build balloons from French film. We are interested however in determining what makes "good" balloon film and are therefore using this film on an as-needed basis for research and development testing. The plan for the future would be to continue this until it is determined as no longer useful. The 400 rolls of Raven and Winzen manufactured films do not meet our approved balloon film criteria and therefore cannot be used in support of the scientific program. We plan to dispose of the unusable film in the most economical way to the government.

ACTION RESPONSIBILITY:
CLOSURE OFFICIAL:
CONCURRING OFFICIAL:
PROJECTED CLOSURE DATE:

842/R Nock
842/H Needleman
840/L Early
September 1992



National Aeronautics and
Space Administration

Washington, D.C.
20546

ATTACHMENT II

AUG 20 1992

Reply to Attn of: SP

TO: W/Assistant Inspector General for Auditing

FROM: SP/Deputy Director, Administration and Resources
Management Division

SUBJECT: Draft Report on Audit of Wallops Flight Facility (WFF)
Balloon Program, (A-GO-91-007)

We have reviewed the draft report on WFF balloon operations and the recommendations for modifications to existing practice which it contains. We understand that Goddard Space Flight Center management will address the first 7 recommendations in the report.

One recommendation (Number 8) is specifically within the purview of the Office of Space Science and Applications (OSSA):

"The Associate Administrator for Space Science and Applications should remind Technical Officers of the requirement to receive semiannual and interim reports from grantees and that appropriate copies should be provided to CASI for dissemination to the scientific community."

We concur in the first portion of this recommendation and have taken steps to remind all OSSA Technical Officers of the established requirement for submission of these reports.

However, we do not agree with the second half of the recommendation, which calls for dissemination of copies of these reports to the scientific community through CASI. These interim reports typically would not be expected to contain complete or even good science data. Instead, dissemination of results from our science programs is made through the long-standing procedure of publication in peer-reviewed journals and at scientific meetings; this process filters results which are not adequately substantiated and ensures that the results of our missions are presented in the full context of contemporary research in the field. Moreover, it is our understanding that CASI is more

frequently used for engineering results than for scientific results; consequently, even publication of final research results in CASI would not necessarily improve the breadth of dissemination to the science community, when compared with current practice.

Douglas R. Norton

cc:

GSFC/200/Ms. S. Foster

SS/ Dr. G. Withbrooks

Mr. P. Deminco

Mr. L. Demas

AUDIT REPORT

Audit of The
Extreme Ultraviolet Explorer Project

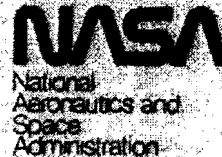
May 15, 1989

NASA
National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109



Reply to Attn of:

JP

May 16, 1989

TO: Manager, NASA Resident Office-JPL
FROM: Director, Center OIG-JPL
SUBJECT: Final Report on Audit of the Extreme
Ultraviolet Explorer Project
A-JP-88-001

The NASA Office of Inspector General has completed an audit of the Extreme Ultraviolet Explorer (EUVE) project at the Jet Propulsion Laboratory and Goddard Space Flight Center (GSFC). Three copies of the final report are enclosed for your review and further distribution. Five copies have been provided to JPL.

The audit was performed to evaluate JPL management of the EUVE project prior to its transfer to GSFC.

The audit disclosed a need for JPL to fully inform onsite JPL personnel of prior problems experienced with a particular subcontractor and for onsite personnel to more closely monitor those subcontractor(s). The report also contains recommendations to GSFC.

A draft report was provided to the NASA Resident Office (NRO) on February 22, 1989 and a written response received on April 18, 1989. The NRO's response to Recommendation 2 is summarized after the recommendation and is included in its entirety as Attachment II to this report. The OIG does not wish to be included in the concurrence process for the recommendation addressed to the NRO.

Daniel W. Bromley

Office of Inspector General

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109



Reply to Attn of:

JP

May 16, 1989

TO: -- Director, Goddard Space Flight Center

FROM: Director, Center OIG-JPL

THRU: Director, Center OIG-GSFC

SUBJECT: Final Report on Review of Extreme
Ultraviolet Explorer Project
A-JP-88-001

The NASA Office of Inspector General has completed an audit of the Extreme Ultraviolet Explorer (EUVE) project at the Goddard Space Flight Center (GSFC) and Jet Propulsion Laboratory (JPL). Six copies of the report are included for your review and further distribution. Copies have also been provided to JPL.

The audit was performed to evaluate GSFC management of the project after its transfer to GSFC from JPL. The audit also included JPL management prior to the transfer.

The audit disclosed a need for GSFC to submit a project plan and to closely monitor the work performed at the University of California, Berkeley, a major subcontractor. The report also contains a recommendation to JPL.

A draft report was provided to GSFC on February 22, 1989 and a written response received on March 24, 1989. GSFC's response is summarized after recommendations 1 and 3 and is included in its entirety as Attachment I to this report. The OIG does not wish to be included in the concurrence process for the recommendations addressed to GSFC, however please advise OIG-JPL when the Project Plan is issued.

^

Daniel W. Bromley

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
DIGEST	2
INTRODUCTION	3
OBJECTIVES AND SCOPE	6
OBSERVATIONS AND RECOMMENDATIONS	
Project Plan For Management of EUVE Not Prepared and Submitted	7
Improper Utilization of EUVE Resources	7
GENERAL COMMENTS	10
ATTACHMENT I GSFC Written Response	
Attachment II NRO Written Response	

AUDIT OF EXTREME
ULTRAVIOLET EXPLORER (EUVE)
DIGEST

INTRODUCTION

The Office of Inspector General (OIG), Jet Propulsion Laboratory (JPL) has completed an audit of the Extreme Ultraviolet Explorer (EUVE) Project. The purpose of the audit was to evaluate JPL's management of the EUVE Project prior to its transfer to Goddard Space Flight Center (GSFC) and to assess the transfer of the project. Subsequently, the scope of the audit was expanded to include GSFC management of the project.

OBSERVATIONS AND RECOMMENDATIONS

We found JPL management to be generally adequate with respect to following NASA directions identified in the EUVE Task Order. However, it was characterized by disagreements and difficulty in dealing with the University of California, Berkeley (UCB), a major subcontractor. JPL needs to thoroughly brief its on-site personnel regarding known problems with subcontractors to ensure adequate control of resources. GSFC managed EUVE without the required Project Plan. GSFC needs to closely monitor the UCB subcontract and to submit a Project Plan for management of EUVE.

Project Plan For GSFC Management of EUVE Not Prepared and Submitted

A Project Plan for GSFC management of EUVE has not been prepared and submitted to NASA Headquarters as required. In order to provide for a basic project agreement and project guidelines and constraints, a Project Plan should be prepared and submitted as soon as possible (page 7).

Improper Utilization of EUVE Resources

During JPL management of EUVE, UCB improperly used EUVE resources on another NASA project. Thorough briefing of its on-site personnel regarding known problems with subcontractors should be initiated by JPL to ensure adequate control of project funding and resources on future subcontracts (page 7).

INTRODUCTION

The Office of Inspector General (OIG), Jet Propulsion Laboratory (JPL) has completed an audit of JPL and Goddard Space Flight Center (GSFC) management of the Extreme Ultraviolet Explorer (EUVE) Project. JPL was responsible for management of the EUVE Project from 1981 until June 1986 when responsibility for project management was transferred to GSFC. Current plans provide for GSFC to manage the project to its completion, currently estimated to be 1994. The audit was performed in accordance with authority and responsibility contained in NASA Management Instruction (NMI) 9910.1.

Background

Development of EUVE Project

The EUVE mission was proposed by the University of California at Berkeley (UCB) and was accepted by NASA in 1977. Initial technical studies and preliminary assessments were performed by GSFC and the Applied Physics Laboratory of John Hopkins University. These studies resulted in a detailed mission definition and initial project cost estimate.

In April 1980, NASA's Office of Space Science and Applications (OSSA) requested JPL to study modes of project implementation and in March 1981 JPL was assigned management responsibility for developing the proposed project as a new start. Under the proposed new start, UCB would provide the experiment instrument package (payload) consisting of three scanning telescopes and a deep survey spectrometer and conduct the science mission while JPL would provide project management and a spacecraft to support the payload. JPL developed a technical design and cost presentation, which resulted in NASA's submission of the proposed project to Congress and the President for approval and appropriation of development funding in fiscal year 1984. The project was approved based upon NASA's total project cost estimate of approximately \$77 million. Total EUVE Project cost is currently estimated at \$188 million. Originally, EUVE was to be launched from the Shuttle in 1988. EUVE is now scheduled for launch in 1991 by a Delta II expendable launch vehicle.

The primary EUVE mission objectives were defined as: (1) to conduct an all-sky survey in the Extreme Ultraviolet band of the electromagnetic spectrum (wavelengths from about 100 to 1000 Angstroms), (2) to conduct a higher sensitivity deep survey of a portion of the sky at wavelengths from 100 to 500 angstroms, and (3) to produce maps and catalogues of positions and intensities of the EUVE sources. EUVE's science mission objectives were to be accomplished in 12 months. During the first six months of the science mission, the sky will be almost completely mapped. In the following six months the sky will be remapped to fill in the gaps in the initial survey. Concurrent with the remapping, the deep survey spectrometer will be pointed at selected sources identified during the survey.

JPL/UCB Subcontract for EUVE Payload and Science Mission

JPL is a Federally Funded Research and Development Center and is an operating division of the California Institute of Technology (Caltech). JPL executed a \$1,667,248 cost-type subcontract with UCB on September 30, 1983 for the preliminary design and definition phase of the EUVE Project. This amount had increased to \$4,037,691 in March 1985, when a modification to the subcontract in the amount of \$17,488,503 was executed. This modification incorporated additional equipment and a final design and fabrication phase. The cumulative value of the subcontract was increased to \$21,526,194.

At the time project management was transferred to GSFC in June 1986, the amount of the UCB subcontract had increased to \$24,988,408. Increases in contractual amount, in addition to the \$17,488,503, consisted of twenty-five subsequent subcontract modifications ranging from \$0 to \$1,743,268. However, only \$12,606,416 of the total subcontract value had been billed to JPL by UCB when the EUVE Project was transferred. The unbilled balance of the subcontract was transferred to a GSFC contract with UCB.

The period that JPL managed the UCB subcontract was characterized by disagreements between JPL and UCB regarding the level of EUVE redundancy, difficulty in locating a qualified UCB project manager, a change in UCB principal investigators, inability to agree on a definitive schedule and resistance to JPL direction. During this period, a Review Board assessed JPL management of the EUVE Project. The Review Board identified numerous problems in the interaction between JPL and UCB. These problems were attributed to both JPL management and UCB attitude including difficulties with the respective organizations dealing with each other.

GSFC/UCB Contracts for EUVE Payload and Science Mission

Subsequent to the transfer of the UCB subcontract from JPL to GSFC, a net increase of \$16,834,715 was negotiated to the subcontract. This increase was for major programmatic and technical changes and financial reporting revisions. Programmatic and technical changes included: development of a science payload compatible with a Multimission Modular Spacecraft (MMS) Explorer Platform, development of a science payload compatible with a Delta expendable launch vehicle in addition to the Shuttle, and a revised payload delivery date consistent with funding constraints and platform delivery. In addition, the EUVE mission objectives (science effort) previously included in the JPL/UCB subcontract was separately contracted for in the amount of \$4,625,000. As of June 3, 1988, total UCB subcontract value was \$46,448,123.

Selection of EUVE Spacecraft and Transfer of Project Management from JPL to GSFC

In February 1985, OSSA notified JPL to terminate design and development of a spacecraft because NASA was initiating a GSFC managed program for leasing spacecraft and JPL was expected to subcontract for a spacecraft to support the EUVE payload from the GSFC source. As a result of the OSSA notification, JPL terminated preparation of a Request for Proposal for a spacecraft. Subsequently, NASA decided that a GSFC MMS would be used to support the payload; and that management of the EUVE Project should be transferred from JPL to GSFC to reduce Contractor-to-Center and Center-to-Center interfaces. The transfer was completed in June 1986 with the novation of the UCB subcontract.

Standard MMS Program

The EUVE Project is one of a series of planned missions using a standardized MMS. NASA Headquarters authorized GSFC to proceed with full-scale development of a MMS in the mid 1970s. This standardized spacecraft could be serviced in-orbit by the Space Shuttle or retrieved by the Shuttle and refurbished for reuse. The Solar Maximum Mission (SMM) was the first mission utilizing the MMS. In addition, the MMS was selected for Earth Resources, Landsat Observatories, Upper Atmospheric Research and the Explorer Program including EUVE.

EUVE was originally selected to be launched on the Shuttle and placed on the retrieved and refurbished Solar Max MMS. The Challenger accident, however required NASA to significantly change Shuttle mission priorities and SMM will not be retrieved and refurbished as a MMS for EUVE. Instead, EUVE will now be launched on a Delta expendable launch vehicle, which will require a new MMS to support the Payload. GSFC studies indicated significant cost savings would have resulted from reuse of the refurbished Solar Max MMS as compared to the acquisition of a new MMS for EUVE.

OBJECTIVES AND SCOPE

The initial objectives of the audit of the EUVE Project were as follows:

- (1) Evaluate JPL's management of EUVE Project prior to transfer of the project from JPL to GSFC.
- (2) Assess the transfer of responsibilities to GSFC.

Subsequently, the objectives and scope of the audit were expanded to include an evaluation of GSFC's management of EUVE Project from transfer of the project to GSFC to the present.

The audit was performed in accordance with generally accepted Government auditing standards and included such tests of records and documents as was considered necessary under the circumstances. In addition, interviews were conducted with JPL, UCB, NASA Headquarters and GSFC personnel responsible for the EUVE Project. Field work was completed at UCB in the latter part of February 1988, at JPL in the latter part of May 1988 and at GSFC in the latter part of October 1988.

OBSERVATIONS AND RECOMMENDATIONS

We found the JPL management to be generally adequate with respect to following NASA directions identified in the EUVE Task Order. However, it was characterized by disagreements and difficulty in dealing with UCB, a major subcontractor. JPL needs to thoroughly brief its on-site personnel regarding known problems at subcontractors to ensure adequate control of project resources. GSFC managed EUVE without a required Project Plan. GSFC needs to closely monitor the UCB contract and to submit an EUVE Project Plan for management of EUVE. In addition, the General Comments section contains several observations which do not require formal recommendations.

Project Plan for GSFC Management of EUVE Not Prepared and Submitted

GSFC Explorer Project Management has not prepared and submitted an EUVE Project Plan as required by NMI 7120.3. This NMI requires a Project Initiation Agreement (PIA) and a Project Plan to be prepared and submitted by the implementing center once authorization and funding for a project have been approved. The Project Plan, when formally approved, serves as the basic agreement for the project and defines the guidelines and constraints under which the project will be executed. The PIA outlines a new project's management and technical interfaces, procurement or in-house acquisition strategy, schedules, resources estimates, and all other key ground rules. The PIA is superseded by the approved Project Plan.

The EUVE Project Plan has not been prepared and submitted as required because the PIA used as a basis for the Project Plan was lost during the review process by OSSA. Because the PIA was lost, the preparation and submission of the Project Plan has been delayed and the EUVE Project is being managed without the required Project Plan.

RECOMMENDATION 1

GSFC Explorer Project Management should prepare and submit a Project Plan for management of EUVE in accordance with requirements of NMI 7120.3.

MANAGEMENT RESPONSE

Concur. The EUVE Project Plan has been drafted and is in final preparation for GSFC Center-level review.

Improper Utilization of EUVE Resources

EUVE resources were improperly utilized by UCB on a NASA rocket project without prior approval. This improper utilization was discovered by an on-site JPL representative several weeks after it occurred. JPL advised NASA Headquarters of this improper use

in a letter dated March 25, 1986. A NASA Headquarters Memorandum issued April 2, 1986, advised the Principal Investigator, UCB, EUVE Project, that he may have inappropriately diverted funds and/or hardware from NASA's EUVE Project to NASA's Sounding Rocket Payload. Since the Sounding Rocket Payload Project was nearing launch, removal of EUVE hardware from the rocket would have resulted in the inability to fly the rocket payload on schedule. Accordingly, after the fact approval was granted by the Director, NASA Astrophysics Division, to launch the rocket with EUVE hardware. However, the Memorandum emphasized that approval of the rocket flight with EUVE hardware and/or funds was in no way to be construed as an endorsement of the inappropriate use of EUVE resources.

Improper utilization of EUVE resources occurred because the UCB Principal Investigator apparently had little regard or concern for government requirements regarding the use of government property. JPL was responsible for ensuring that EUVE resources were used only for EUVE. JPL's Project Plan, Section V, Part A, provided that "The Project Manager is responsible for the direction, organization, and staffing necessary to conduct the EUVE mission, including control of project funding, resources, and schedules." Section V, Part B 4 of JPL's Project Plan provided for contractor monitoring by requiring two on-site JPL engineers to monitor UCB operations daily. In addition, the need for close monitoring of the UCB subcontract by JPL was apparent because JPL was aware of past project management problems at UCB and had discussed the problems with OSSA officials during the project implementation phase. The existence of prior project management problems at UCB was not communicated to the resident JPL engineers. Timely communication of known problems at UCB to JPL's on-site engineers would have provided for more effective subcontract monitoring and discouraged improper use of EUVE equipment.

This unauthorized usage of EUVE resources had a disruptive effect on the EUVE Project, further strained the relationship between JPL and UCB, and required additional effort and work around in an attempt to maintain the schedule. The JPL EUVE Project Manager could not estimate the additional cost incurred or schedule slippage, if any, that resulted from the improper use of EUVE resources on the rocket project.

RECOMMENDATION 2

NRO should advise JPL to thoroughly brief its on-site personnel regarding known problems with subcontractors to ensure that project resources are being used properly when circumstances including past history indicate a particular need for closer monitoring.

MANAGEMENT RESPONSE

Concur. The NASA Resident Office concurs that JPL, in the future, should more closely monitor subcontract effort to ensure that program resources are being utilized properly.

RECOMMENDATION 3

GSFC EUVE Explorer Project Management should monitor work performed by UCB closely to ensure no further misuse of EUVE resources occurs.

MANAGEMENT RESPONSE

Concur. Since assuming project management for the EUVE Project, the GSFC Project has closely monitored the UCB performance and will continue to do so.

GENERAL COMMENTS

EUVE Cost Avoidance Resulting From Elimination Of Dual Launch Compatibility

During our audit we noted an exchange of correspondence between the GSFC EUVE Project Manager and the OSSA (Code E) Manager, Explorer Platform Mission Program, regarding maintenance of dual launch compatibility for EUVE. GSFC's Project Manager indicated in a letter dated January 12, 1988, that maintenance of dual Shuttle and Delta launch compatibility was becoming inefficient, non-cost effective and schedule threatening, and requested permission to cease maintenance of dual launch compatibility. The letter also indicated that in order to maintain dual launch compatibility, additional work would have to begin in a number of areas in the near future. The estimated cost for this work was \$1,850,000 of which \$750,000 was applicable to a solar array hinge configuration development and \$1.1 million for flight support system changes. The \$750,000 could be avoided and the \$1.1 million deferred if dual launch compatibility was abandoned.

On July 7, 1988, the OSSA Acting Chief, Explorer Project Branch, Astrophysics Division, issued a letter to the GSFC Project Manager, Explorer and Attached Payloads, directing him to abandon dual launch compatibility. According to representatives from GSFC and Fairchild Space Company, the supplier for the solar array hinge, minimal cost had been incurred for maintaining dual launch compatibility at the time the decision was made and approximately \$1,850,000 cost avoidance and/or deferral resulted from NASA's decision to discontinue dual launch compatibility.

Funding Transfer Delay

Funding on JPL's EUVE Task Order was not deobligated for three months after the transfer of the EUVE Project from JPL to GSFC. During the period prior to transfer of the EUVE Project from JPL to GSFC, numerous letters were exchanged among OSSA, GSFC, and JPL officials identifying a need to provide for expeditious transfer of EUVE funding. The actual transfer of the EUVE project responsibility occurred on June 19, 1986, when OSSA, JPL, and UCB representatives entered into an agreement by which responsibility, but not funding, for the EUVE Project was transferred from JPL to GSFC.

Paragraph 3 of the Transfer Agreement stated that UCB retained the right to enforce against Caltech/JPL any rights it has or had under the original Caltech/JPL-UCB subcontract with respect to work performed under the JPL subcontract prior to June 19, 1986, which did not by the June 19, 1986 Agreement subsequently become enforceable against NASA. Caltech/JPL estimated this contingent liability at approximately \$1,370,000.

In June 1986, at the suggestion of the Caltech legal counsel, the UCB subcontract was novated transferring it to GSFC. At that

time, Caltech/JPL officials would not agree to deobligate and transfer the funds without NASA assuring Caltech that any contingent liability would be resolved. On September 30, 1986, NASA Headquarters issued a memorandum to the NASA Resident Office (NRO) at JPL. This memo stated that uncertainty surrounding NASA's FY 1987 budget and the prospect of a continuing resolution made it highly desirable that \$1,000,000 of \$1,370,000 being retained by JPL be made available to OSSA for reprogramming to NASA projects having urgent funding requirements. This Memo also directed NRO to assure Caltech that OSSA would reimburse Caltech up to a total of \$1,370,000 to cover allowable contingent liabilities which could arise under the Caltech/UCB subcontract for the EUVE Project. Accordingly, on September 30, 1986, \$1,000,000 was finally removed from the EUVE Task Order. Proper management of Government programs require that funding be transferred at the time the project is transferred.

The delay in transferring funding occurred because an agreement could not be reached among OSSA, GSFC and JPL representatives to implement the funding transfer. Future transfer agreements should include adequate provisions for expeditious transfer of funding when programs are terminated and/or transferred including provisions for NASA assumption of contingent liabilities.

Support Contractor Use and Accounting for Cost

During the audit we noted a GSFC support contractor had been performing work which should have been the responsibility of UCB under the Instrument Development Contract. This effort was charged to the EUVE Project Support Account and not to Payload Development. The GSFC support contractor was used to procure and test small quantities of parts for UCB to help maintain the EUVE project on schedule and within budget. The cost for procuring and testing parts for the construction of the EUVE instrument is provided for in the UCB Payload Development Contract.

Government contracting principles require that an adjustment be made to the UCB contract price for reduction in the work to be performed. This condition has evolved from the routine practice of GSFC project offices using the GSFC quality assurance contractor to examine nonstandard parts, approval requests, and reviewing the implementation of quality assurance program procedures.

Although the value of work performed by the GSFC support contractor was minor relative to total UCB effort, this practice distorts the true cost of instrument development and could potentially result in non-disclosure of a UCB contract cost overrun. This condition was brought to the attention of the GSFC Project Management during the audit. They examined this issue and have advised OIG that most of the work performed by GSFC's support contractor was new work which was not included in

the UCB contract. In addition, on December 13, 1988, GSFC executed Modification 15 to the UCB contract which included a \$10,000 reduction in the contract price for work performed by the GSFC support contractor.

We wish to express our appreciation to representatives of JPL, GSFC, NRO, Headquarters, OSSA, and UCB for their cooperation and support during our audit of EUVE.

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771



MAR 24 1989

Reply to Attn of: 201

TO: NASA/Jet Propulsion Laboratory
Attention: Director, Center Office of Inspector
General (OIG)
Daniel Bromley/180-301

THRU: Director, Center OIG

FROM: Director

SUBJECT: GSFC Response to OIG Draft Report on
Extreme Ultraviolet Explorer (EUVE)
Program, Report No. A-JP-88-001

Enclosed is our response to your draft report dated
February 22, 1989, on the EUVE Program.

Please call Ms. JoAnn Clark, GSFC Audit Liaison Officer, at
FTS 888-7977 if you have any questions or actions requiring
further coordination on this.

John W. Townsend, Jr.

Enclosure

Date MAR 24 1989

GODDARD SPACE FLIGHT CENTER (GSFC)
RESPONSE TO
JET PROPULSION LABORATORY (JPL)
OFFICE OF INSPECTOR GENERAL (OIG)
FINAL DRAFT REPORT
ON
EXTREME ULTRAVIOLET EXPLORER (EUVE) PROGRAM

OIG REPORT NO. A-JP-88-001
FORWARDED 2/22/89 FROM JPL OIG

The GSFC Explorer and Attached Payloads (EAP) Project has reviewed the February 22, 1989, JPL OIG final draft report on the EUVE Program audit. The Project accepts and has been implementing Recommendations 1 and 3 contained therein, which apply to the Goddard Space Flight Center. (Recommendation 2 applies to the JPL.)

RECOMMENDATION 1

GSFC Explorer Project Management should prepare and submit a Project Plan for management of EUVE in accordance with requirements of NMI-7120.3.

GSFC RESPONSE - Concur

The EUVE Project Plan has been drafted and is in final preparation for GSFC Center-level review.

RECOMMENDATION 3

GSFC EUVE Explorer Project Management should closely monitor work performed by the University of California, Berkeley (UCB) to ensure no further misuse (reference Recommendation 2, JPL) of EUVE resources occurs.

GSFC RESPONSE - Concur

Since assuming project management for the EUVE Program, the GSFC Project has closely monitored the UCB performance and will continue to do so.

NASA Resident Office
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109



Reply to Attn of EJP(DEB)

April 18, 1989

TO: Director, Center OIG-JPL
FROM: Manager, NASA Resident Office-JPL
SUBJECT: Comments on Draft Audit Report on Extreme Ultraviolet
Explorer Program, Report No. A-JP-88-001

Both the Jet Propulsion Laboratory and the California Institute of Technology had no further comments or input to the subject report. Copies of their replies are attached.

With reference to Recommendation 2 of the report, this office concurs that JPL, in the future, should more closely monitor subcontract effort to ensure that program resources are being utilized properly.

It is believed, however, that JPL did provide extraordinary support and guidance to UCB in an attempt to alleviate the management problems being experienced by UCB.

Fred W. Bowen

Attachments a/s

AUDIT REPORT

CONTINGENCY PLANNING FOR THE SHUTTLE CARRIER AIRCRAFT

JOHNSON SPACE CENTER

October 14, 1987



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General



Johnson Space Center
Houston, TX 77058

W-JS

October 14, 1987

Reply to Attn of.

TO: Johnson Space Center
Attn: AA/Director

FROM: W-JS/Director, Center OIG

SUBJECT: Final Report on Contingency Planning for
Shuttle Carrier Aircraft
A-JS-87-003

We have completed an audit of Contingency Planning for Shuttle Carrier Aircraft (SCA). Our final report is enclosed.

The objective of the audit was to evaluate contingency plans for maintaining the carrier capability in the event the existing carrier aircraft could not be used due to accident, damage, and/or extended maintenance. The audit included: (1) a review of JSC engineering and cost studies for backup SCA support; (2) interviews with JSC and NASA Headquarters personnel; (3) an evaluation of the internal administrative controls for ensuring the adequacy of existing carrier capability and for monitoring the cost of operating, modifying, and maintaining the SCA; and (4) an assessment of plans for maintenance and/or replacement of the tailcone assembly used in ferrying the Shuttle.

The results of the audit showed that NASA does not have approved, finalized contingency plans for maintaining Shuttle carrier capability. Budgetary and procurement actions to acquire a second SCA were, however, recently initiated. We also noted that management actions are needed to ensure: (1) the ferry tailcone is not damaged during shipments to Edwards Air Force Base (AFB); and (2) adequate hangar facilities for the SCA are obtained.

We recommended that the Associate Administrator for Space Flight: (1) develop adequate contingency plans and ensure sufficient funds are made available for procurement actions as soon as practical; and (2) take immediate action to ensure the tailcone is adequately protected during future shipments to Edwards AFB. Additionally, we recommended that JSC obtain hangar facilities for the SCA.

A discussion draft was provided to JSC on May 11, 1987, and exit conferences were held with JSC management officials, including the Deputy Director, National Space Transportation System Program Office on May 29, 1987, and June 16, 1987. An exit conference with NASA Headquarters officials was conducted on June 22, 1987. Necessary report changes resulting from the exit conferences were included in the draft report, dated July 21, 1987.

NASA's comments are presented, as appropriate, after each recommendation and are included in their entirety in Appendix A (Headquarters comments, dated August 20, 1987) and Appendix B (JSC comments, dated September 2, 1987).

W. Preston Smith

Enclosure:

a/s

cc: HQs-W/Assistant Inspector General
for Auditing
JSC-BY/Chief, Management Analysis Office

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	3
III.	OBJECTIVES AND SCOPE	5
IV.	OBSERVATIONS AND RECOMMENDATIONS	6
	1. Contingency Plans for Shuttle Carrier Aircraft Backup Support	6
	2. Existing Tailcone Structure Subsystem	11
	3. Hangar Facilities for the Shuttle Carrier Aircraft	13
V.	GENERAL COMMENTS	15
EXHIBIT I	PHOTOGRAPH	16
APPENDIX A	Headquarters Response, dated August 20, 1987	A-1
APPENDIX B	JSC Response, dated September 2, 1987	B-1

ACRONYMS

AFB	Air Force Base
ALT	Approach and Landing Test
CRAF	Civil Reserve Air Fleet
DFRF	Dryden Flight Research Facility
FAA	Federal Aviation Administration
FY	Fiscal Year
JSC	Johnson Space Center
KSC	Kennedy Space Center
NMI	NASA Management Instruction
NSTS	National Space Transportation System
OMB	Office of Management and Budget
OSF	Office of Space Flight
POP	Program Operating Plan
RFP	Request for Proposal
SCA	Shuttle Carrier Aircraft
STS	Space Transportation System

October 14, 1987

CONTINGENCY PLANNING FOR THE SHUTTLE CARRIER AIRCRAFT
JOHNSON SPACE CENTER (JSC)

DIGEST

Introduction

The purpose of this audit was to evaluate contingency plans for maintaining the carrier capability in the event the existing carrier aircraft could not be used due to accident, damage, and/or extended maintenance.

Results of Audit

NASA management recognizes the critical need for adequate Shuttle Carrier Aircraft (SCA) backup support, and numerous options have been considered. Budgetary and procurement actions to acquire a second SCA were also recently initiated. NASA has not, however, developed specific contingency plans for maintaining Shuttle carrier capability. We also noted that management actions are needed to ensure: (1) the ferry tailcone is not damaged during shipments to Edwards Air Force Base (AFB); and (2) adequate hangar facilities for the SCA are obtained. These areas are discussed in the "Observations and Recommendations" section of this report and summarized in the following paragraphs.

1. Contingency Plans for Shuttle
Carrier Aircraft Backup Support

The SCA is a "single-point-failure mode" in the Space Transportation System (STS). Although budgetary and procurement actions to acquire a second SCA were recently initiated, NASA does not have specific contingency plans for maintaining Shuttle carrier capability in the event the existing SCA is unavailable due to accident, damage, and/or extended maintenance. We recommended the Associate Administrator for Space Flight develop and implement appropriate contingency plans, and ensure sufficient funds are made available for needed procurement actions. The Headquarters response did not specifically state whether the Office of Space Flight agreed or disagreed with our recommendation. However, NASA's actions to procure a second SCA are considered responsive to the intent of the recommendation. (Page 6)

2. Existing Tailcone Structure Subsystem

The ferry tailcone has been damaged during shipments to Edwards AFB. Specifically, the "top panel" of the tailcone has been damaged because the wooden shipping containers did not provide adequate support and protection. The Kennedy Space Center (KSC) has directed the responsible support contractor to prepare and submit a proposal for redesigning the wooden containers. Edwards AFB will be used as the primary landing site for future Shuttle missions. The tailcone, therefore, will have to be shipped from KSC to Edwards on numerous times. As a result, it is imperative that proper containers be used to protect the tailcone during future shipments. We recommended the Associate Administrator for Space Flight take immediate action to ensure the tailcone is adequately protected during future shipments to Edwards AFB. The Headquarters response indicated that appropriate plans for protecting the tailcone have been established. Furthermore, the JSC response to this recommendation stated that plans for acquiring a tailcone pallet have been developed, and this method of shipment will eliminate the need for wooden containers in the future. These actions are responsive to the recommendation. (Page 11)

3. Hangar Facilities for the Shuttle Carrier Aircraft

The SCA is kept outside on a parking ramp at the Dryden Flight Research Center, Edwards AFB. The constant exposure to changing weather conditions accelerates structural corrosion of the SCA and could result in increased maintenance costs and safety hazards. We recommended that, if possible, JSC obtain hangar facilities for the SCA. The Center concurred with the recommendation. JSC plans to negotiate an agreement with the Air Force for use of hangar space at Edwards. (Page 13)

INTRODUCTION

The NASA Office of Inspector General has completed an audit of Contingency Planning for the Shuttle Carrier Aircraft (SCA) at the Johnson Space Center (JSC). The audit was performed in accordance with the authority and responsibility contained in NASA Management Instruction (NMI) 9910.1, dated January 28, 1980.

The SCA is uniquely configured for transporting the Shuttle Orbiter from Edwards Air Force Base (AFB), California, to the launch site at Kennedy Space Center (KSC); or retrieving the Orbiter from a contingency landing field (after an emergency landing) and returning it to the launch site; or returning the Orbiter to the final assembly site. This aircraft has three potential configuration modes:

- o Type I - The aircraft with its fuselage structurally modified (i.e., skin reinforced, "attach points" added, internal bulkheads installed, and passenger seats removed from inside of the airplane, as required);
- o Type II - The Type I-configured aircraft with the struts and the horizontal stabilizer tip fins installed; and
- o Type III - The Type II-configured aircraft with a Shuttle Orbiter mounted and ready for ferry.
(See Exhibit I)

The SCA is a series 100 Boeing 747 and is identified as NASA 905. It was the 86th series 100 aircraft to come off the Boeing production line. American Airlines bought the aircraft from Boeing in October 1970 and sold it to JSC in June 1974. Boeing began modifying the aircraft to the SCA configuration in April 1976, and completed the modification in January 1977. The total SCA costs (i.e., the aircraft and modifications) were approximately \$45.6 million.

The SCA is based at the Hugh F. Dryden Flight Research Facility (DFRF), Edwards AFB, California. On February 18, 1977, it was used to carry the first Orbiter (OV-101) to altitude in support of the approach and landing tests (ALT) program. Subsequent to ALT, the SCA is flown for ferry missions and every 28 days on maintenance continuation flights. The aircraft's operating systems are tested every 10 days.

Flight operations for the SCA are managed by the Chief, Aircraft Operations Division, Flight Crew Operations Directorate, JSC. Since March 1984, Northrop Worldwide Aircraft Services, Incorporated, has been the responsible contractor for maintenance and modification of the SCA.

Research and development funds expended for SCA operations averaged about \$2.0 million annually during the period Fiscal Year (FY) 1983 through FY 1986. Of that amount, the cost of spares averaged approximately \$233,000.

A discussion draft was provided to JSC on May 11, 1987, and exit conferences were held with JSC's management officials, including Deputy Director, National Space Transportation System Program Office on May 29, 1987, and June 16, 1987. An exit conference with NASA Headquarters officials was conducted on June 22, 1987. Necessary report changes resulting from the exit conferences were incorporated in the draft report. The draft report was released on July 21, 1987, and NASA Headquarters and JSC provided written comments on August 20, 1987, and September 2, 1987, respectively.

NASA's comments were generally responsive to the audit recommendations. These comments are presented in their entirety as Appendices A and B. Actions taken or planned in response to our observations and recommendations will be evaluated during our normal follow-up.

OBJECTIVES AND SCOPE

The basic purpose of the audit was to evaluate contingency plans for maintaining the carrier capability in the event the existing carrier aircraft could not be used due to accident, damage, and/or extended maintenance.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances. Our audit included:

- A review of JSC engineering and cost studies for backup SCA support;
- Interviews with JSC and NASA Headquarters personnel;
- An evaluation of the internal administrative controls for ensuring the adequacy of existing carrier capability and for monitoring the cost of operating, modifying, and maintaining the SCA; and
- An assessment of plans for the maintenance and/or replacement of the tailcone assembly used in ferrying the Shuttle.

Except as noted in the "Observations and Recommendations" section, the internal controls tested during the audit were considered satisfactory. We did not note any information deemed privileged or confidential.

OBSERVATIONS AND RECOMMENDATIONS

NASA management acknowledges that the SCA and the tailcone ferry kit are "single-point-failure modes" in the Space Transportation System (STS). For example, one NASA Headquarters study concluded that a catastrophic loss of the present SCA could cause an 18-month or longer delay in the STS Program. This issue has been reviewed and evaluated numerous times during the last 6 years, but no specific contingency plans have been developed and/or implemented. NASA needs to establish specific contingency plans for ensuring adequate backup SCA support. We believe appropriate SCA backup support is essential for effective long-term Shuttle operations.

1. Contingency Plans for Shuttle Carrier Aircraft Backup Support

NASA does not have specific contingency plans for maintaining carrier capability in the event the existing carrier aircraft cannot be used due to accident, damage, and/or extended maintenance. However, according to various NASA officials, budgetary and procurement actions to acquire a second SCA were recently initiated.

On several past occasions, JSC has sought budget approval for a second 747 aircraft for the STS Program. A JSC cost study prepared in April 1986 estimated the total cost for purchasing and modifying a Boeing 747 to the SCA configuration was between \$57 to \$59 million for a series 100, and \$67 to \$82 million for a series 200. The study further projected that about 2 years would elapse between the date of acquisition and the completion of modification. (Note: During a post-audit interview, some JSC officials referenced data compiled since April 1986 which estimated total costs of \$52 million to purchase and modify a Boeing 747 series 100 to the SCA configuration.)

NASA Headquarters has stated that previous initiatives to purchase a backup aircraft have been deleted from the SCA Program Plan because of budget constraints. Higher priority program requirements have precluded the purchase of a backup aircraft. However, during exit conferences with JSC and Headquarters officials, we learned that the Administrator is preparing a Supplemental Budget to address NASA program overruns. In this regard, JSC has initiated budgetary actions to reprogram some FY 1987 funds in order to acquire a second SCA. JSC's Program Operating Plan (POP) 87-2 proposes \$57 million, spread over 4 years, for the acquisition and modification of a Boeing 747 to the SCA configuration. If these funds are approved, JSC officials believe an SCA modification could be completed during FY 1990 (approximately December 1989). The NASA Administrator was scheduled to make a final funding decision during late August 1987 or early

September 1987. However, as of September 30, a final decision had not been made. If the Administrator approves the SCA line item, it will then be included in the Supplemental Budget and submitted to the Office of Management and Budget (OMB) for Congressional approval.

Funds totalling \$4.5 million have been approved for the purchase of a second SCA tailcone assembly structure. JSC issued a Request for Proposal (RFP) for a second tailcone on February 26, 1987; contractor proposals have been received and are being evaluated; and contract award is expected during October 1987. The second tailcone will have an identical design as the existing tailcone. JSC predicts that the selected contractor will require 1 year to fabricate the new tailcone.

Over the past several years, NASA Headquarters has considered the following options for providing SCA backup support:

- Investigated the possibility of the Air Force E-4 squadron obtaining a 747 training aircraft, and NASA modifying it to a Type I, SCA configuration. The Air Force was unable to make the desired aircraft available. (March 1981)
- The U.S. Air Force (via New York Air National Guard) was to provide a Type I Boeing 747 backup. The program was changed to C-5 aircraft. (mid-1983)
- Suggested joint ownership (with the Air Force) of a 747 as possible backup SCA. The Air Force was unable to fund its portion of the cost for the 747. (September 1983)
- Investigated the designation of a Civil Reserve Air Fleet (CRAF) Boeing 747, 200 series aircraft, for call-up use as backup to NASA's SCA. Airline industry studies estimated that an SCA-modification to a CRAF airplane would cost \$93 million. This option was considered too expensive. (October 1984)

The SCA has a design life of 15 years and two critical structural regions which limits its ferry flight hours (i.e., Horizontal Stabilizer, Skin Splice has a useful life of 1630 ferry flight hours and Horizontal Stabilizer, Rear Spar Web Shear Panel has 2,302 ferry flight hours). Based upon the Orbiter ferry flight history (as of March 1986), the SCA has flown approximately 313 ferry flight hours. The SCA has been a dependable aircraft without record of excessive downtime for unscheduled maintenance. However, JSC estimates that similar aircraft (i.e., the Boeing 747s series 100) currently being flown by commercial airlines have more than 65,000 flight

hours, which exceeds its 60,000 design service life. Therefore, the SCA belongs to a class of aircraft that is likely to be affected by a Federal Aviation Administration (FAA) Airworthiness Directive. Such a directive could result in the SCA being "out of service" for an extended period of time while repairs are made.

More recently (June 1986), NASA Headquarters considered the following options for providing SCA backup support:

- Immediately purchase a backup tailcone and ferry kit.
- Identify a number of series 100 Boeing 747 aircraft suitable for modification into an SCA and consummate an agreement with an operator for a quick call-up purchase of one aircraft.
- Consummate an agreement with an aircraft outfitter for a quick call-up conversion of the 747 into an SCA.
- Immediately engineer and manufacture the SCA modification kit and store it until needed.
- When needed exercise the option to purchase the 747 and rapidly convert it into an SCA (5 months).

Although the above options were considered, NASA did not identify an aircraft suitable for modification into an SCA. No final agreements were reached at that time for either the quick call-up purchase or conversion of a Boeing 747. However, on September 1, 1987, JSC awarded a letter contract to the Boeing Company for locating and identifying an appropriate aircraft to be converted into a SCA configuration.

During October 1987, we learned that JSC has awarded a letter contract for locating and identifying an appropriate aircraft to be converted into a SCA configuration. This contract (NAS9-17857) was awarded to the Boeing Company on September 1, 1987.

When Shuttle flights resume, it appears that Edwards AFB will be used as the primary landing site. Furthermore, based on observations made by the Rogers Commission concerning safety considerations associated with Shuttle landings at KSC, Edwards will remain as a primary landing site in the future.

The Rogers Commission report stated:

"...even if NASA eventually were to resume routine operations at Kennedy, experience indicates the Orbiter will divert into Edwards more than 30 percent of the time. NASA must, therefore, plan to use Edwards routinely. This requires reserving six days in the post-landing schedule for the Orbiter's ferry trip back to Florida. It also requires redundancy in the ferry aircraft. The single Shuttle carrier aircraft, with some one-of-a-kind support items, is presently the only way to get the Orbiter from California back to its launch site in Florida."

The Commission report concluded that: "Shuttle program officials must recognize that Edwards is a permanent, essential part of the program. The cost associated with regular, scheduled landing and turnaround operations at Edwards is thus a necessary program cost" (emphasis added).

We believe specific contingency plans for SCA backup support should be developed and implemented as soon as possible. These actions are essential for ensuring safe and efficient long-term Shuttle operations.

RECOMMENDATION 1

We recommend the Associate Administrator for Space Flight develop and implement contingency plans for maintaining carrier capability in the event the existing carrier aircraft cannot be used due to accident, damage, or extended maintenance. Sufficient funds should be made available for procurement actions as soon as practical.

MANAGEMENT RESPONSE (NASA HEADQUARTERS)

The Associate Administrator for Space Flight stated in his response that he has already approved plans for a backup SCA and has given budgetary and programmatic approval to proceed with the procurement. He also stated that NASA is currently negotiating with Boeing Aircraft Company for the selection and modification of a 747-100 aircraft to be converted into an SCA. Finally, he stated that contingency plans have been in effect for years to limit the risks associated with flying the aircraft. For example, the SCA has very strict operations criteria, including clear flying and short flying duration.

The Associate Administrator concluded that the statements and conclusions in the report are therefore incorrect because there is an approved and adequate contingency plan in existence and the report must be corrected to reflect the efforts in this area.

ADDITIONAL COMMENTS

Throughout the entire course of this review, including three exit conferences with NASA officials, we have attempted to obtain an approved, written contingency plan for maintaining Shuttle carrier capability in the event the existing carrier could not be used due to accident, damage, and/or extended maintenance. Although NASA has recently initiated a procurement action to acquire a backup SCA, it has not developed such a plan. NASA has been unable to provide any evidence that a contingency plan of this nature had been developed. Consequently, our basic observation that NASA does not have specific contingency plans for SCA backup support is still valid. The second SCA will not be available for use until approximately December 1989.

Although the Headquarters response did not indicate either agreement or disagreement with our recommendation, we consider NASA's plans to procure a second SCA responsive to the intent of the recommendation. Progress in this area will be evaluated during our follow-up review.

2. Existing Tailcone Structure Subsystem

The ferry tailcone has been damaged during each previous shipment to Edwards AFB. The "top panel" of the tailcone has not been properly supported and protected, and, therefore, it has continuously sustained damage during shipment. Repeated damage to the tailcone has resulted in additional repair costs and extended turnaround times. Future damages could result in the tailcone not being available when needed for ferry missions.

The tailcone is attached to the Orbiter during actual ferry missions in order to stabilize and reduce the effects of the wake turbulence and base drag. After ferry flights to KSC, the tailcone is disassembled into six parts, packed in wooden containers, and shipped by truck to Edwards AFB.

Under JSC Contract NAS9-14000, Rockwell International Corporation engineered the wooden containers that are used to ship the tailcone. Although this effort was performed under a JSC contract, KSC is responsible for maintenance and safety of the tailcone during shipments to Edwards AFB. KSC has directed Rockwell to prepare and submit a proposal for improving the containers.

Like the SCA, the tailcone is a single-point-failure mode in the STS Program. Successful and timely ferry missions depend on the availability of both the SCA and the tailcone. If the tailcone is not available due to damage, ferry missions cannot be conducted.

As previously stated, it appears that Edwards AFB will continue to be used as a primary landing site for Shuttle missions. The tailcone, therefore, will have to be shipped from KSC to Edwards on numerous occasions. Furthermore, NASA is in the process of acquiring a second tailcone (see report page 8). Due to these circumstances, it is imperative that proper containers are used to protect the tailcone during future cross-country shipments.

RECOMMENDATION 2

We recommend the Associate Administrator for Space Flight take immediate actions to ensure the tailcone is adequately protected during future shipments to Edwards AFB.

MANAGEMENT RESPONSE

The Associate Administrator's response indicated that the following actions have been, or are being, initiated to correct this condition: (1) the ferry boxes have been redesigned by Rockwell with no further excessive damage noted after shipment; (2) contingency plans have been instituted to reduce the risk associated with cross-country shipment of the tailcone ferry boxes, including reducing truck speed to no

more than 45 mph, monitoring accelerometers placed on trucks, limiting loads, escorting the trucks in route, and traveling in convoy; and (3) the Office of Space Flight (OSF) is in the process of procuring a second tailcone. The Associate Administrator added that once the first two actions were initiated, no major structural damage has occurred to the tailcone. He also stated the contract for the second tailcone would be awarded within one month, and the fabrication and manufacturing will take approximately 18 months to complete.

The JSC response to this recommendation indicated appropriate actions have been initiated. The JSC response stated that: "...we have taken positive action to prevent damage to the tailcone during shipment. The JSC has solicited a tailcone pallet for use on the Super Guppy. This shipment method will eliminate the need for wooden containers in the future."

ADDITIONAL COMMENTS

Taken as a whole, we consider the management comments responsive to this recommendation. Our follow-up review will assess JSC's planned methods for future shipments of the tailcone.

3. Hangar Facilities for the Shuttle Carrier Aircraft

No aircraft hangar facilities for the SCA have been obtained. Consequently, the SCA is left outside when it is not in use. This practice could result in greater maintenance costs and potential safety hazards.

When the SCA is not involved in flight, testing, and/or maintenance operations, it is left outside on a parking ramp at DFRF, Edwards AFB, California. The SCA is guarded by security personnel to preclude vandalism; however, it is left unprotected from changing weather conditions (i.e., sun, wind, rain, snow, etc.). Exposure to climatic conditions tends to greatly accelerate the corrosion process of an aircraft. Structural corrosion of the SCA leads to much greater maintenance costs and can result in safety hazards.

One of the basic reasons the SCA was permanently stationed at Edwards AFB, rather than Houston, Texas, was to avoid the inherent corrosion problems resulting from the environmental conditions in the Houston area. Although the general environmental conditions at Edwards are much less severe than those in Houston, the constant exposure of the SCA to changing weather conditions greatly reduces the benefits of locating the aircraft in California.

NASA does not have any aircraft hangars sufficient to house the SCA at DFRF. We were advised, however, that the Air Force has vacant hangar space which is adequate to accommodate the SCA. Various JSC personnel believe the Air Force hangar space could be used to house the SCA. We believe this matter should be assessed and, if possible, hangar space for the SCA should be obtained.

RECOMMENDATION 3

We recommend that the JSC Director of Flight Crew Operations determine whether adequate hangar space for the SCA is available at Edwards AFB. If sufficient space is available, appropriate arrangements should be made for NASA's use of these facilities.

MANAGEMENT RESPONSE (JSC)

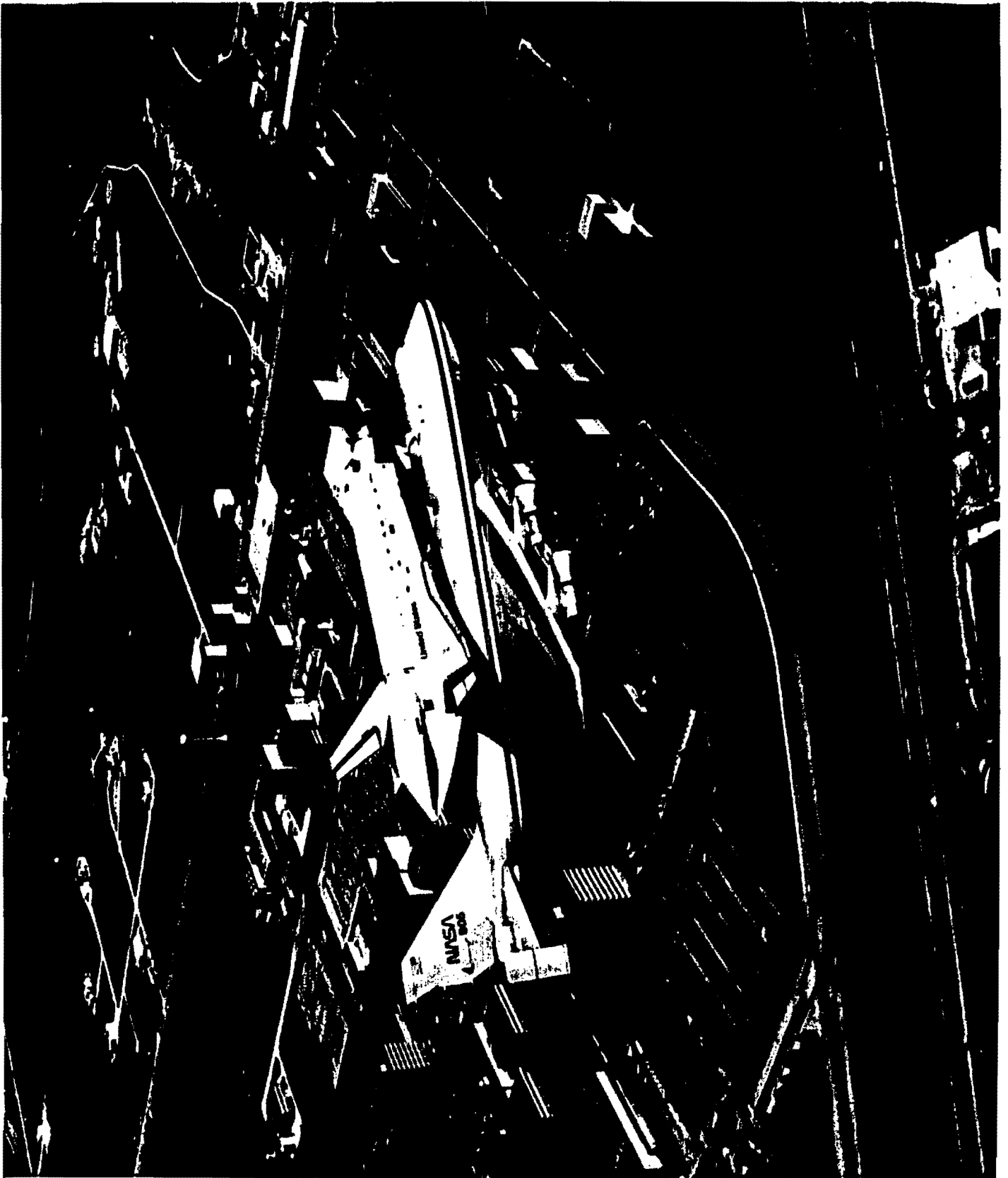
The Associate Administrator indicated that NASA would use a hangar for the SCA, if one was available. In addition, JSC's response stated that an appropriate hangar is available at Edwards AFB and preliminary discussions with Air Force officials have indicated a willingness on their part to permit storage of the SCA when it does not interfere with other Air Force aircraft storage needs. JSC will attempt to obtain an agreement with the Air Force to formalize arrangements for storage of the SCA.

ADDITIONAL COMMENTS

JSC's plans to negotiate an agreement with the Air Force for hangar space at Edwards AFB are responsive to the recommendation. We will review JSC's progress in this area during our follow-up review.

GENERAL COMMENTS

We appreciate the courtesy, assistance, and cooperation extended by JSC personnel contacted during this review.





National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX A

100 20

Reply to Attn of: MO

TO: W/Assistant Inspector General for Auditing
FROM: M/Associate Administrator for Space Flight
SUBJECT: Draft Report on Contingency Planning for Shuttle Carrier Aircraft (SCA)

Thank you for the opportunity to review the subject draft report on SCA contingency planning. My understanding is that during the exit conference, agreement was reached between Mr. Wayne Miller, Director, Operations Utilization, and Mr. Ken Wood of the Inspector General's Office to include the following comments in the executive summary of the report:

- 1) The Associate Administrator for Space Flight has already provided approval for budgetary funding for the purchase of a backup SCA. Work is in progress with Boeing for the selection and modification of a 747-100 aircraft to be converted to an SCA.
- 2) Funds have been provided in the budget to allow for the purchase of a second tailcone for SCA flights. Therefore, in the event of damage, no delay would be experienced.
- 3) Since SCA hangar space is not available at Edwards AFB, an acceptable alternative is to house the SCA outside at Edwards AFB in the dry desert environment. Ten years of experience have shown no adverse conditions for SCA storage in the Edwards AFB environment.

We have reviewed the draft, and have enclosed specific comments with this memorandum. I would appreciate your giving these comments careful consideration in the preparation of the final report.

Richard H. Truly

Enclosure

RECOMMENDATION 1

We recommend that the Associate Administrator for Space Flight develop and implement adequate contingency plans for backup Shuttle Carrier capability. Sufficient funds should be made available to initiate needed procurement actions as soon as practical.

The Associate Administrator for Space Flight has already approved plans for a backup SCA. He has given budgetary and programmatic approval to proceed with the procurement of the backup SCA. An Amendment to the Master Buy (for procurements over \$10M) was approved by Admiral Truly in June 1987. NASA is currently negotiating with Boeing Aircraft Company for the selection and modification of a 747-100 aircraft to be converted to an SCA.

In addition, contingency plans have been in effect for years to limit the risks associated with flying the aircraft. The SCA has very strict operations criteria. These include clear flying and short flying duration.

The statements and conclusions in the report are therefore incorrect because there is an approved and adequate contingency plan in existence. The report must be corrected to reflect the efforts in this area.

RECOMMENDATION 2

We recommend the Associate Administrator for Space Flight take immediate actions to ensure the tailcone is adequately protected during future shipments to Edwards AFB.

The damage to the existing tailcone was due to improper design of the tailcone ferry boxes. The ferry boxes have been re-designed by Rockwell with no further excessive damage noted after shipment.

Contingency plans have been INSTITUTED to reduce the risk associated with cross-country shipment of the tailcone ferry boxes. Since these plans have been operational, no major structural damage has occurred on the tailcone. These plans include; reducing truck speed to no more than 45 mph, monitoring accelerometers placed on trucks, limiting loads, escorting the trucks in route, and traveling in convoy.

Finally, the Office of Space Flight is in the process of procuring a second tailcone. We expect the contract to be let within one month. The fabrication and manufacturing of the tailcone will take approximately 18 months to complete.

Please correct the report to reflect the actions taken and the procedures now in effect.

RECOMMENDATION 3

We recommend that the JSC Director of Flight Crew Operations determine whether adequate hangar space for the SCA is available at Edwards AFB. If sufficient space is available, appropriate arrangements should be made for NASA's use of these facilities.

There is no doubt that the ideal place to store the SCA is in a hangar. Where a hangar is not available or hangaring is infeasible, the military agencies responsible for long and short duration aircraft storage choose a dry desert environment for their storage locations. NASA has done the same thing. Outdoor storage presents no corrosion problem at Edwards AFB, and the on-going periodic maintenance insures good upkeep. The SCA has been exposed to the elements at Edwards for more than ten years and has not experienced any corrosion.

Notwithstanding the above rationale, NASA would use a hangar for the SCA if one were available; there are none available at Edwards for other than very short duration storage.

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas
77058



APPENDIX B

SEP 2 1987

BY/8-245

Reply to Attn of:

MEMORANDUM

TO: W-JS/Director, Center Office of Inspector General

FROM: AA/Director

SUBJECT: Inspector General's Comment Draft Audit Report on Contingency
Planning for Shuttle Carrier Aircraft (A-JS-87-003 dated
July 21, 1987)

Enclosed are JSC comments in response to the subject draft report.

As indicated by our detailed reply, we agree with your recommendation which requires a response from the JSC. In addition, we have commented on the remaining two recommendations even though they require a reply from NASA Headquarters.

If you have any questions about our reply, please contact BY/Lloyd Lovelace at extension 34213.

 Aaron Cohen 

Enclosure

cc:
CA/G. W. S. Abbey
CA/H. W. Hartsfield
CA/R. W. Mygren
CB/R. D. Cabana
CC/J. S. Algranti
CC42/W. F. Ready
GA/R. H. Kohrs
GA/J. F. Honeycutt
TA/H. M. Draughon

BY/LLovelace:11:8/18/87:34213

JSC COMMENTS ON RECOMMENDATIONS
AUDIT ON CONTINGENCY PLANNING FOR
SHUTTLE CARRIER AIRCRAFT
A-JS-87-003

1. Contingency Plans for Shuttle Carrier Aircraft (SCA) Backup Support

Auditor's Findings

"The SCA is considered a "single-point-failure mode" in the Space Transportation System (STS). However, NASA does not have approved, final contingency plans for SCA backup support. Specific plans for acquiring a second SCA or utilizing some other alternative support method are needed immediately."

Auditor's Recommendation and JSC Comments

Recommendation 1

"We recommend that the Associate Administrator for Space Flight develop and implement adequate contingency plans for backup Shuttle carrier capability. Sufficient funds should be made available to initiate needed procurement actions as soon as practical."

JSC Comments

Although your recommendation requires a response from the Associate Administrator for Space Flight, we have funded a backup SCA in the latest POP 87-2 Budget Submission. Contract negotiations are currently in progress to obtain the backup SCA.

2. Existing Tailcone Structure Subsystem

Auditor's Findings

"The ferry tailcone has been damaged during shipments to Edwards AFB. Specifically, the "top panel" of the tailcone has been damaged because the wooden shipping containers do not provide adequate support and protection. The Kennedy Space Center (KSC) has directed the responsible support contractor to prepare and submit a proposal for redesigning the wooden containers. Edwards AFB will be used as the primary landing site for future Shuttle missions. The tailcone, therefore, will have to be shipped from KSC to Edwards on numerous times. As a result, it is imperative that proper containers be used to protect the tailcone during future shipments."

Auditor's Recommendation and JSC Comments

Recommendation 2

"We recommend the Associate Administrator for Space Flight take immediate action to ensure the tailcone is adequately protected during future shipments to Edwards AFB."

JSC Comments

Although your recommendation requires a response from the Associate Administrator for Space Flight, we have taken positive action to prevent damage to the tailcone during shipment. The JSC has solicited a tailcone pallet for use on the Super Guppy. This shipment method will eliminate the need for wooden shipping containers in the future.

3. Hangar Facilities for the Shuttle Carrier Aircraft

Auditor's Findings

"The SCA is kept outside on a parking ramp at the Dryden Flight Research Center, Edwards AFB. The constant exposure to changing weather conditions accelerates structural corrosion of the SCA and could result in increased maintenance costs and safety hazards."

Auditor's Recommendation and JSC Comments

Recommendation 3

"We recommend that the JSC Director of Flight Crew Operations determine whether adequate hangar space for the SCA is available at Edwards AFB. If sufficient space is available, appropriate arrangements should be made for NASA's use of these facilities."

JSC Comments

We concur. We have determined that an appropriate hangar is available at Edwards AFB. Preliminary discussions with Air Force officials have indicated a willingness on their part to permit storage of the SCA when it does not interfere with other Air Force aircraft storage needs. We will attempt to obtain an agreement with the Air Force to formalize arrangements for storage of the SCA.

AUDIT REPORT

SPACE TRANSPORTATION SYSTEM
OPERATIONS CONTRACT (STSOC)
NAS9-18000

JOHNSON SPACE CENTER

February 16, 1988



OFFICE OF INSPECTOR GENERAL

Office of Inspector General



Johnson Space Center
Houston, TX 77058

Reply to Attn of: W-JS

February 16, 1988

TO: Johnson Space Center
Attn: AA/Director

FROM: W-JS/Director, Center OIG

SUBJECT: Final Report on Space Transportation System
Operations Contract (STSOC) NAS9-18000
A-JS-87-005

We have completed an audit of JSC's procedures for managing and monitoring the work performed under Contract NAS9-18000, Space Transportation System Operations Contract (STSOC). Our final report is enclosed for your review and comment.

The objectives of the audit were to: (1) review the procedures for managing and monitoring the work performed under the STSOC contract; (2) assess JSC's payment practices on the STSOC; and (3) ensure payments are being made in accordance with appropriate regulations.

The results of the audit showed that JSC's management of the work being performed under the STSOC contract was generally adequate, and appropriate methods for monitoring contract performance have been established. We noted, however, that additional management actions are needed to: (1) adjust or modify the STSOC contract to reflect the current suspension of Shuttle flights and the reduced flight schedule for future operations; (2) ensure payments are made in accordance with NASA cash management regulations; (3) ensure the contractor takes appropriate and timely actions to correct various performance problems concerning Safety, Reliability, and Quality Assurance (SR&QA) and subcontract management; (4) complete contractor award fee evaluations in a more timely manner; and (5) properly account for and/or locate equipment items transferred to the STSOC contractor.

A discussion draft report was issued On October 22, 1987. Exit conferences were conducted at JSC and NASA Headquarters. Necessary report changes resulting from the exit conferences were included in the draft report, dated November 6, 1987.

NASA's comments are presented after each report recommendation and are included in their entirety in Appendix A (JSC comments, dated January 21, 1988) and Appendix B (Headquarters comments, dated December 2, 1987).

W. Preston Smith

Enclosure:
a/s

cc: HQs-W/Assistant Inspector General
for Auditing
JSC-BY/Chief, Management Analysis Office

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	4
III.	OBJECTIVES AND SCOPE	6
IV.	OBSERVATIONS AND RECOMMENDATIONS	7
	1. Adjusting or Modifying the STSOC Contract	7
	2. STSOC Payment Practices	11
	3. Contractor Performance Under the STSOC Contract	14
	4. Timeliness of Contractor Award Fee Evaluations	20
	5. Property Transfers and Property Accountability for the STSOC Contract	22
V.	GENERAL COMMENTS	24
APPENDIX A	JSC Response, dated January 21, 1988	A-1
APPENDIX B	Headquarters Response, dated December 2, 1987	B-1

ACRONYMS

CPAF	Cost-Plus-Award-Fee
CO	Contracting Officer
FDO	Fee Determination Official
FMM	Financial Management Manual
FY	Fiscal Year
GFE	Government-Furnished Equipment
JSC	Johnson Space Center
JSCMD	Johnson Space Center Management Directive
MTBF	Mean Time Between Failure
NASA	National Aeronautics and Space Administration
NMI	NASA Management Instruction
PADS	Problem Action Data System
PEB	Performance Evaluation Board
PEC	Performance Evaluation Committee
PERP	Parts and Equipment Reliability Program
QA	Quality Assurance
RFP	Request for Proposal
RSOC	Rockwell Shuttle Operations Company
SOW	Statement of Work
SR&QA	Safety, Reliability, and Quality Assurance
STS	Space Transportation System
STSOC	Space Transportation System Operations Contract
TFCS	Treasury Financial Communication System
TM	Technical Manager

SPACE TRANSPORTATION SYSTEMS OPERATIONS CONTRACT (STSOC)
NAS9-18000

JOHNSON SPACE CENTER (JSC)

Digest

Introduction

The NASA Office of Inspector General has completed an audit of the Space Transportation System Operations Contract (STSOC), NAS9-18000. The overall purpose of the audit was to evaluate the procedures for managing and monitoring the work performed under the STSOC contract. The audit also included an assessment of JSC's payment practices on the contract.

Results of Audit

JSC's management of the work being performed under the STSOC contract was generally adequate. We noted, however, that additional management actions are needed to: (1) adjust or modify the STSOC contract to reflect the current suspension of Shuttle flights and the reduced flight schedule for future operations; (2) ensure payments on the contract are made in accordance with applicable NASA cash management regulations; (3) ensure the contractor takes appropriate and timely actions to address various performance problems concerning Safety, Reliability, and Quality Assurance (SR&QA) and subcontract management; (4) complete contractor award fee evaluations in a more timely manner; and (5) properly account for and/or locate equipment items transferred to the STSOC contractor. These areas are discussed in the "Observations and Recommendations" section of this report and are summarized in the following paragraphs.

1. Adjusting or Modifying the STSOC Contract

The Challenger accident occurred in January 1986. The accident initially resulted in the indefinite suspension of all Shuttle flights. This significantly reduced the work requirements specified in the STSOC contract. Actions have been initiated to renegotiate the contract. However, as of January 1988, the contract had not been adjusted or modified to reflect the delay of Shuttle flights and/or the reduced flight schedule for future operations. Since the incentive fees paid to the STSOC contractor, Rockwell Shuttle Operations Company (RSOC), are directly related to the costs associated with actual flight operations and the contract has not been properly adjusted, RSOC has received unjustified fees for cost performance since April 1986. We recommended the JSC Director of Procurement take appropriate actions to ensure the STSOC

contract is adjusted or modified as soon as possible. As part of the contract renegotiation process, the STSOC Contracting Officer (CO) should recover an equitable portion of the \$5.6 million of incentive fees paid to RSOC since April 1986. JSC concurred with the recommendation. The contract will be modified, and appropriate incentive fee adjustments will be made. (Page 7)

2. STSOC Payment Practices

Payments on the STSOC contract were not always made in accordance with NASA Financial Management Regulations. We found payments were being made earlier than required. Early payments result in excess interest costs to the Department of Treasury. We estimated the Government could save approximately \$763,000 (or \$190,750 annually) if payments on the STSOC contract are made in accordance with applicable cash management regulations. We also noted that the NASA Financial Management Manual (FMM) has not been updated to include current Treasury reporting requirements for large disbursements made by electronic transfer. We recommended that: (1) the CO for NAS9-18000 and the Chief, Financial Management Division, ensure all future payments on the STSOC contract are made in accordance with applicable cash management regulations; and (2) the Director, Financial Management Division, NASA Headquarters, update the FMM to include current Treasury requirements for reporting large disbursements made by electronic funds transfer. The Center has initiated appropriate actions to prevent early payments on the STSOC contract, and NASA Headquarters agreed to revise the FMM. (Page 11)

3. Contractor Performance Under the STSOC Contract

RSOC's performance on the STSOC contract has been generally adequate. The contractor's overall performance evaluations have ranged from "good" to "very good." We noted, however, that previous contractor performance evaluations indicated various management problems concerning SR&QA activities and subcontract management. We recommended the CO for NAS9-18000 ensure RSOC addresses and corrects all SR&QA and subcontract management problems identified in the previous performance evaluations. JSC concurred with our recommendations and indicated that appropriate corrective actions have been initiated. (Page 14)

4. Timeliness of Contractor Award Fee Evaluations

As of September 1987, JSC had completed three award fee evaluations for the STSOC contract. We found these evaluations were not completed in accordance with the timeframes specified in JSC Management Directive 5150.7E, "Performance Evaluation

and Notification Procedures for Award Fee Contracts." We recommended the Director of Procurement take appropriate actions to ensure future award fee evaluations for the STSOC contract are completed in a more timely manner. The Center concurred with the report recommendation. (Page 20)

5. Property Transfers and Property Accountability for the STSOC Contract

Under the STSOC contract, millions of dollars of Government-Furnished Equipment was transferred to RSOC. Although it has been over 1-1/2 years since the initial equipment transfers were made, 270 items valued at about \$475,965 have not been accounted for or located. We recommended the STSOC CO and the JSC Industrial Property Officer determine the disposition of the missing equipment items, and properly adjust all applicable property records. JSC has taken appropriate actions to account for the missing property. (Page 22)

INTRODUCTION

The Office of Inspector General, Johnson Space Center (JSC), has completed an audit of the Space Transportation System Operations Contract (STSOC), NAS9-18000. The audit was performed in accordance with the authority and responsibility contained in NASA Management Instruction (NMI) 9910.1, dated January 28, 1980.

The basic purpose of the STSOC was to consolidate most of the operational support functions associated with the Space Transportation System (STS) into one single contract. The work previously performed by 16 contractors under 22 separate contracts was consolidated under the STSOC contract.

NASA's intent to award a single, consolidated contract for STS operations was published in the Commerce Business Daily on October 26, 1983. This announcement, along with letters sent to the 16 incumbent contractors, resulted in 50 companies attending an "industry briefing" which was held on November 11, 1983. A formal Request for Proposal (RFP) was issued on January 14, 1985. On September 12, 1985, the NASA Administrator selected the Rockwell Shuttle Operations Company (RSOC), a division of Rockwell International Corporation, for the contract award. Contract negotiations with RSOC were completed on November 19, 1985, and the contract was signed on December 5, 1985.

The STSOC is a combination cost-plus incentive fee/award fee contract. The incentive fee applies to cost performance, and the award fee is on work performance. The contract covers a 4-year period, which includes: (1) a "transition period" of January 1, 1986, through March 31, 1986; (2) a base period of April 1, 1986, through December 31, 1987; and (3) a "firm option period" of January 1, 1988, through December 31, 1989. The total cost and fee negotiated for the entire 4-year period was approximately \$823 million. Ultimately, follow-on awards could result in a 15-year contract valued at about \$6 billion.

Part of this STSOC contract is on a level-of-effort basis and part is on a "completion form" basis. The contract requires RSOC to perform the following major functions:

- Project Management;
- Maintenance and Operations;
- Sustaining Engineering;

- Flight Preparation Requirements and Analysis;
- Flight Preparation Production; and
- Direct Mission Operations, Testing and Support.

A major portion of the STSOC effort is being performed by five subcontractors. These subcontractors are:

- Bendix Field Engineering Corporation;
- Unisys;
- Omniplan;
- Systems Management American Corporation; and
- RMS Technologies, Incorporated.

A JSC CO has overall responsibility for managing and controlling the work performed under the contract. A Technical Manager and 13 Technical Manager's Representatives monitor contract performance. In addition, the JSC Quality Assurance (QA) Division and the Logistics Division are the central points of contact for reliability and quality assurance and industrial property functions.

A discussion draft report was issued on October 22, 1987. Exit conferences were held at JSC and NASA Headquarters. Necessary report changes resulting from the exit conference were included in the draft report, dated November 6, 1987. JSC and NASA Headquarters provided written comments on January 21, 1988, and December 4, 1987 respectively.

NASA's comments were responsive to the audit recommendations. These comments are presented in their entirety as Appendices A and B. Actions taken or planned in response to our observations and recommendations will be evaluated during our normal follow-up process.

OBJECTIVES AND SCOPE

The basic purpose of the audit was to review the procedures for managing and monitoring the work performed under Contract NAS9-18000. The audit objectives included assessing JSC's payment practices on the STSOC, and ensuring payments were being made in accordance with appropriate regulations.

The scope of the audit included: (1) reviewing the contract award process; (2) ascertaining which contract administration functions were retained by the CO and those that were delegated to other Government agencies; (3) determining whether the CO delegated the contract administration functions in accordance with applicable procurement regulations; (4) reviewing the functions performed by the Technical Manager (TM) and Property Administrator; (5) reviewing all payments made to RSOC; and (6) assessing the contractor's overall performance. Numerous RSOC, JSC Procurement, and Financial Management Division officials were interviewed to obtain pertinent data.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances. The audit also included a review of the internal administrative controls related to managing and monitoring the STSOC contract. The internal controls associated with JSC's payment procedures and practices were also reviewed. Except as noted in the "Observations and Recommendations" section, the internal controls tested during the audit were considered generally satisfactory.

OBSERVATIONS AND RECOMMENDATIONS

JSC's management of the work being performed under the STSOC contract was generally adequate, and appropriate methods for monitoring contractor performance have been established. We noted, however, that additional management actions are needed to: (1) adjust or modify the STSOC contract to reflect the current suspension of Shuttle flights and the reduced flight schedule for future operations; (2) ensure payments on the contract are made in accordance with applicable cash management regulations; (3) ensure the contractor takes appropriate and timely actions to correct various performance problems concerning Safety, Reliability and Quality Assurance (SR&QA) and subcontract management activities; (4) complete award fee evaluations in a more timely manner; and (5) properly account for and/or locate equipment items transferred to the STSOC contractor.

1. Adjusting or Modifying the STSOC Contract

When existing contractual requirements change, Government contracts should be properly adjusted or modified to reflect the new requirements. Although the requirements for supporting actual flight operations specified in the STSOC contract have been significantly reduced, the contract has not been modified accordingly. Since the incentive fees paid to RSOC are directly related to the costs associated with flight operations, we believe RSOC has received unjustified incentive fees for cost performance.

The "Changes" clause in the STSOC contract allows the CO to make changes or modifications to the contract. Article 52.243-2 of the contract states that the CO shall make an equitable adjustment to the contract and modify it accordingly whenever a change results in "...an increase or decrease in the estimated cost of, or the time required for, performance of any part of the work under this contract". Furthermore, Article H-9, "Advance Agreement on Equitable Adjustment," lists several conditions which would result in the need to adjust or change the existing contract. One of these conditions is: "An increase or decrease in the number of planned flights...in effect on the date of this contract."

Due to the Challenger accident which occurred in January 1986, all planned Shuttle flights were indefinitely suspended. Consequently, the mission support requirements specified in the STSOC contract are no longer valid. However, as of January 1988, JSC had not adjusted or modified the contract to reflect the delay of Shuttle flights and/or the reduced future flight schedule.

As previously stated, the STSOC contract includes both award and incentive fees. The award fee is on work performance, and the incentive fee is on cost control. The incentive fee provision applies to the basic and option contract periods (April 1, 1986, through December 31, 1989).

Incentive fees are based on RSOC's cost performance in relation to an established "target cost" for both the basic and option contract periods. A target cost is defined as that cost which both the contractor and Government believe to be the most realistic (best estimate) or the most likely final cost based on known (existing) requirements. The target cost specified in the STSOC contract is \$342,542,000 for the base period and \$381,126,000 for the option period. These target costs were based on the flight schedule specified in the Statement of Work (SOW). This schedule included 14 missions in Fiscal Year (FY) 1986, 17 in FY 1987, 19 in FY 1988, and 24 in FY 1989.

The STSOC contract states that the incentive fee payable for the base contract period "...shall be the target fee increased by 26 cents for every dollar that the total allowable cost is less than the target cost or decreased by 26 cents for every dollar that the total allowable cost exceeds the target cost." This same basic arrangement applies to the option period, except the incentive fee will be increased or decreased by 33 cents in relation to each dollar of allowable costs.

Several months after the Challenger accident, JSC Procurement officials recognized that the mission or flight schedule specified in the contract was no longer valid. As a result, during June 1986, JSC proposed to eliminate the incentive fee provisions for cost control. Essentially, this proposed change would have resulted in converting the STSOC contract to a cost-plus-award-fee (CPAF) contract. RSOC rejected the proposed change, but agreed to submit a contract adjustment proposal and renegotiate the contract.

In a letter dated July 7, 1986, JSC Procurement informed the Assistant Administrator for Procurement that the remaining base contract period would be converted to a CPAF arrangement. The letter stated that: "This is necessary since the delays caused by STS 51-L have negated the basis for the STSOC incentive on cost (emphasis added)." This letter also indicated that the "hard option period," January 1, 1988,

through December 31, 1989, would remain unchanged, but it may be necessary to renegotiate this part of the contract when a "firm flight schedule is known." Further, the letter stated that:

"We are currently identifying the SOW changes necessary in view of STS 51-L plus other contract activity to date. Upon completion of that action, Rockwell will begin preparation of their overall adjustment proposal with submittal expected in September 1986. Negotiations should occur during November 1986."

RSOC did not submit the adjustment proposal until January 9, 1987. Furthermore, as of January 1988, JSC had not renegotiated the contract.

During the period April 1, 1986, through July 31, 1987, JSC paid RSOC \$5.6 million of incentive fees for cost control. Due to the circumstances resulting from the Challenger accident, the payment of these incentive fees is highly questionable. We recognize that RSOC was entitled to some portion of the \$5.6 million. However, since the target costs specified in the contract are no longer valid, some portion of the incentive fee payments may not have been justified.

The Challenger accident occurred about 2 years ago. JSC, however, has not adjusted or modified the STSOC contract to reflect the operational changes resulting from the accident. We believe the contract should be renegotiated and modified as soon as possible. As part of the renegotiation process, JSC should recover an equitable portion of the incentive fees paid to RSOC. This "recovery" could be accomplished by negotiating a downward adjustment of the \$5.6 million of incentive fees paid since April 1, 1986.

RECOMMENDATION 1

We recommend the Director of Procurement take appropriate actions to ensure the STSOC contract is adjusted or modified as soon as possible. During the contract renegotiation process, the STSOC Contracting Officer should recover an equitable portion of the \$5.6 million of incentive fees paid to RSOC during the period April 1, 1986, through July 31, 1987. The amount recovered, or the resulting downward cost adjustment, should be fully documented in appropriate contract files.

MANAGEMENT RESPONSE (JSC)

We concur. The Director of Procurement has taken appropriate action to ensure that the STSOC contract is adjusted or modified. We are actively pursuing an adjustment that will reflect the new contract cost base and provide an equitable resolution of fee. The amount of the equitable adjustment and both cost and fee will be fully documented in the contract files.

ADDITIONAL COMMENTS

The Center's comments are responsive to the report recommendation. The resulting downward adjustment or recovery of incentive fees will be verified during our follow-up review.

2. STSOC Payment Practices

Payments on the STSOC contract were not always made in accordance with NASA Financial Management Regulations. We found payments were being made earlier than required. Early payments result in increased interest costs to the Department of Treasury. We estimated the Government could save approximately \$763,000 (or \$190,750 annually) if payments on the STSOC contract are made in accordance with applicable cash management regulations. We also noted that the NASA Financial Management Manual (FMM) has not been updated to include current Treasury reporting requirements for large disbursements made by electronic funds transfer.

a. Early Payments

The STSOC contract provision concerning payments allows RSOC to submit cost and fee invoices monthly. If these invoices are paid within 15 days after receipt, NASA is entitled to discount the payment at a rate commensurate with the quarterly Treasury rate effective at the time of payment. According to NASA FMM 9050-7d:

"Payment systems will incorporate procedures which will automatically take advantage of cash discounts as a matter of routine....All discount payments must be scheduled for check issuance as close as possible to, but no later than, the last day of the discount period." (emphasis added).

In addition to the above requirements, FMM 9050-7d also states that payments made by electronic funds transfer "...will be made on the last day of the discount period..." (emphasis added). All payments on the STSOC contract are made by electronic transfer.

We reviewed 47 payments totalling approximately \$238 million made to RSOC during the period February 1986 through May 1987. Forty-three (91 percent) of these payments were made within the discount period. The total discount taken was about \$751,000. Although JSC has taken advantage of the time discount, we found that payments were not being made on the last day of the discount date. Our review showed that, on the average, payments were made 6 days before the discount date. Some payments were made as early as 11 days before the discount date. Due to these early payments, the Government incurred about \$238,000 of excess interest costs during February 1986 through May 1987. If this practice is continued, we estimate that an additional \$525,000 of excess interest cost will be incurred during the remaining two years of the current contract period.

Future payments on the STSOC contract should be made in accordance with applicable NASA regulations. To ensure cost-effective cash management, payments should be made as close as possible to the discount date.

b. Large Disbursements Reporting Requirements

Our review did not identify any problems concerning reporting requirements for the disbursements made on the STSOC contract. However, during this segment of the audit, we noted that current Treasury regulations require disbursements of \$50 million dollars or more made by electronic transfer be reported to the Department of Treasury. The NASA FMM has not been updated to include this reporting requirement.

The Treasury Financial Manual, Part 4, 2550.20f, Large Treasury Financial Communications System (TFGS) states:

"Agency financial officers certifying payments of \$50 million or more in a single transaction or in multiple transactions of a common nature that will be disbursed via the TFCS will report to Treasury at least 2 days prior to the date of payment the name of the agency, the intended date of issuance, the identification of the intended recipient, and the amount to be disbursed."

The current NASA FMM does not include the large disbursement reporting requirements stated above. FMM 9630.2b, Large Disbursements, only specifies reporting requirements for large disbursements (\$10 million or more) to be made by issuing a Treasury check. We believe the NASA FMM should be updated to incorporate current Treasury requirements for reporting large disbursements made by electronic transfer.

RECOMMENDATION 2

We recommend the Contracting Officer for NAS9-18000 and the Chief, Financial Management Division, ensure all future payments on the STSOC contract are made in accordance with applicable NASA regulations. Payments should be made on the last day of the discount period.

MANAGEMENT RESPONSE (JSC)

We concur. The Chief, Financial Management Division (FMD), Johnson Space Center (JSC), has taken action to ensure that payments on the STSOC contract are made in accordance with applicable NASA Financial Management regulations. The FMD recently implemented an automated cash management system which will provide positive control concerning invoice due dates. A recent audit of this system by FMD personnel indicates that

payments are being made in accordance with the applicable NASA Financial Management regulations. In addition, the Contracting Officer will also monitor payments to ensure that they are in compliance with the regulations.

ADDITIONAL COMMENTS

JSC's plans for implementing an automated cash management system, and monitoring future payments on the STSOC contract are responsive to the recommendation. These actions will prevent early payments in the future, and result in a \$763,000 cost savings to the Government.

Appropriate follow-up will be performed to ensure the new cash management system is functioning properly.

RECOMMENDATION 3

We recommend the Director, Financial Management Division, NASA Headquarters, update the FMM to include the current Treasury requirements for reporting large disbursements made by electronic funds transfer.

MANAGEMENT RESPONSE (NASA HEADQUARTERS)

We concur with the finding and recommendation and will incorporate the 2-day Treasury notification requirement for payments of \$50 million or more in the next revision to our cash management policies section of the FMM.

ADDITIONAL COMMENTS

The Headquarters' comments are fully responsive to the recommendation. The revised FMM will be reviewed during our normal follow-up process.

3. Contractor Performance Under the STSOC Contract

RSOC's performance on the STSOC contract has been generally adequate. The contractor's overall performance evaluations have been "good." We noted, however, that previous performance evaluations indicated various management problems concerning RSOC's SR&QA and subcontract management activities. We believe additional management actions are needed to ensure these problems are corrected in a timely manner.

a. SR&QA Performance Problems

Previous contractor performance evaluations indicated numerous problems associated with RSOC's SR&QA activities. Appropriate management actions are needed to ensure these problems are corrected, and RSOC establishes and maintains an efficient and effective SR&QA program.

The STSOC contract states that the contractor "...shall maintain an effective and timely SR&QA program, planned and developed in conjunction with all the related engineering and maintenance and operations functions for which the contractor is responsible." The contract also requires RSOC to: (1) be "totally responsible" for the SR&QA functions within the STSOC contract; and (2) comply with applicable requirements of NASA Handbook 5300.4(1D-2), SR&QA Functions for the Space Shuttle Program.

As of August 1987, three award fee evaluations had been completed. Our review of the Performance Evaluation Committee (PEC) reports for these three evaluations revealed various problems relating to RSOC's SR&QA activities. For example: The PEC report for the period April 1, 1986, through June 30, 1986, included the following "areas of concern."

- "Although the procedure, RSOC QA 506, for conducting audits of STSOC activities has been approved, there have been no audits performed by RSOC....There is no available schedule as to when audits will be conducted by STSOC QA. It is a concern of NASA QA that during the present time by not having any commitment to formal mission support and training activities, STSOC QA will not take advantage of the situation to debug/dry run the STSOC QA program...."
- "The reliability program is vague and general. It consists of only the data base transitioned from MCC."

- "Detailed reliability procedures covering the JSC facilities (under this contract) are not sufficiently detailed for the job."
- "The parts and equipment reliability program (PERP) or the problem action data system (PADS) do not identify how the reliability data base will be maintained and managed."

In addition, the PEC report for the period of July 1, 1986, through December 31, 1986, included the following "areas of concern."

- "Performance of safety management function appears to be deficient with regard to interface and communication with subcontractor safety personnel."
- "The most significant deficiency identified in the STSOC Reliability Program is the lack of management controls to assure that vital data needed in determining mean time between failure (MTBF) of equipment will be gathered and utilized by STSOC reliability personnel. Since the beginning of the STSOC Reliability Program, there has not been any equipment operating time logged (in order to compute MTBF data); this data has been lost up to date. MTBF determinations for equipment are required by the SOW."

The July-December 1986 performance report also included the following "weaknesses" concerning RSOC's SR&QA functions. (Note: A weakness is defined as "an area of performance that is below standard. Performance is deficient and is lacking in what would normally be expected of a contractor, i.e., work that is behind schedule, contains unacceptable errors, does not detect problems. etc.")

1. "The STSOC Reliability Program was inadequate throughout this reporting period. Procedures for accumulating reliability data were finally put in place in December, but the capability to perform basic reliability assessment remains absent."

2. "The STSOC QA Program is inadequate and has failed to establish itself in the facility operations and configuration management flow."
3. "The proposed Reliability Plan is not acceptable. There has been no progress in STSOC reliability management to identify how required reliability data will be gathered in order to evaluate equipment in each facility...."
4. "RSOC QA management does not have an effective communication method between the individual STSOC facility QA activities and RSOC QA management. Consequently, RSOC QA management is not cognizant of the QA problems and issues arising in the STSOC facilities."
5. "There is no documentation available to indicate that a software QA program is being implemented in the STSOC facilities."

Due to the problems outlined above and various other SR&QA concerns, RSOC has established a QA management review board. This review board plans to evaluate and revise STSOC QA and procedures. Furthermore, the JSC QA Division plans to conduct a review of RSOC's SR&QA program during Calendar Year 1988.

Although some actions have been initiated and/or planned to address the SR&QA problems relating to the STSOC contract, we believe additional management attention is needed to ensure RSOC establishes an adequate SR&QA program. The significance and importance of an effective SR&QA program for Shuttle operations cannot be overemphasized. Specific plans are needed to address and correct the SR&QA problems identified in previous performance evaluations.

b. Subcontract Management Under the STSOC Contract

A major portion of the work required under the STSOC contract is being performed by subcontractors. RSOC is responsible for managing and controlling this effort. Our review indicated that RSOC's subcontract management activities could be improved.

As part of the overall STSOC effort, RSOC has awarded subcontracts to: (1) Bendix Field Engineering Corporation; (2) Unisys; (3) Omniplan; and (4) Systems Management American Corporation. In addition, RMS Technologies, Incorporated, is a second-tier subcontractor to Bendix. The total estimated value of these five subcontracts was approximately \$358 million. This amount represents about 47 percent of the total estimated costs, excluding fees, for the STSOC contract.

Our review of PEC reports for the STSOC contract revealed numerous problems concerning RSOC's management and administration of the subcontracts. For example, the PEC report for the April-June 1986 performance evaluation period stated that, "RSOC management continues to lack insight into the subcontractors work on the contract." The PEC performance report for July-December 1986 included the following "area of concern" relating to subcontract management:

"Where RSOC has the prime responsibility for an effort across its subcontractors, there usually seems to be a fragmented team effort. This is especially evident in the areas of resource management data, logistics, SR&QA, and facilities management. RSOC needs to address and resolve this situation as a top priority."

The July-December 1986 performance report also included the following "weaknesses" associated with RSOC's subcontracting activities.

1. "The STSOC QA Program is inadequate and has failed to establish itself in the facility operations and configuration management flow. Communication and coordination difficulties between the prime and subcontractor personnel is a contributing factor."
2. "In instances where RSOC has the overall responsibility for an effort, there seems to be a fragmented team effort (among RSOC and its subcontractors)."
3. "NASA could not obtain the required detail on subcontractor resource management data."
4. "The contractor seems to have much difficulty in providing answers about the major subcontractors financial data. Several examples are the Omniplan attrition rate, SDC fee increase, and Omniplan's award fee in November."
5. "STSOC management failed to establish formal policies between RSOC users and SDC (Unisys) developers regarding baselining and configuration control of design software tools previously under user control."

Due to the importance of the tasks assigned to RSOC subcontractors and the significant dollar value of the subcontracts, effective management and control of subcontract activities are essential. Furthermore, one of the primary reasons JSC awarded the STSOC contract was to reduce the workload associated with managing and administering the large number of contracts for STS operations. The basic concept was that by consolidating the many existing contracts into one major contract and assigning overall responsibility to the prime contractor, JSC would have an adequate level of management control without maintaining direct interface with many different contractors. This approach is generally referred to as "self-sufficiency" contracting. The effectiveness of this type of contract is highly dependent on the prime contractor's methods and procedures for managing and controlling the work performed by the various subcontractors.

We believe RSOC's management of subcontractor activities requires improvement. Appropriate management actions are needed to address and correct the subcontract management problems identified in the PEC reports and to ensure future subcontracting activities are effectively controlled and administered.

RECOMMENDATION 4

We recommend the Contracting Officer for NAS9-18000 ensure RSOC establishes an effective SR&QA program. Specific plans should be developed to address and correct the SR&QA problems identified in previous performance evaluations. Failure to adequately correct these problems in a timely manner should be considered in future award fee determinations.

MANAGEMENT RESPONSE (JSC)

We concur. Both the Mission Operations Directorate and the Contracting Officer for NAS9-18000 have taken prompt action to correct the deficiencies identified in your findings. This process began during January 1987. Since that time, NASA has directed the contractor to develop new SR&QA plans to correct the deficiencies identified in previous performance evaluations. A follow-up survey by NASA SR&QA personnel was conducted during December 1987 to ensure compliance with the new SR&QA plans. Failure to adequately correct the deficiencies in a timely manner will be considered in future award fee determinations.

ADDITIONAL COMMENTS

The Center's response satisfies the intent of the recommendation. RSOC's new SR&QA plans and the results of JSC's "survey" will be assessed during the follow-up process.

RECOMMENDATION 5

We recommend the Contracting Officer for NAS9-18000 ensure RSOC adequately controls and administers STSOC subcontracting activities. Specific plans should be developed to ensure the subcontracting problems identified in previous performance evaluations are corrected as soon as possible. Failure to correct these matters in a timely manner should be considered during future award fee determinations.

MANAGEMENT RESPONSE (JSC)

We concur. Both the Mission Operations Directorate and the Contracting Officer for NAS9-18000 have taken action to ensure RSOC adequately controls and administers STSOC subcontracting activities. RSOC has hired experienced SR&QA subcontractor personnel, and is in the process of implementing necessary contract change procedures to ensure that the subcontracting deficiencies are resolved. Failure to correct the deficiencies will be considered during future award fee determinations.

ADDITIONAL COMMENTS

JSC's comments are responsive to the recommendation. The specific actions taken or planned for correcting the subcontracting deficiencies will be evaluated as part of our normal follow-up.

4. Timeliness of Contractor Award Fee Evaluations

As of September 1987, JSC had completed three award fee evaluations for the STSOC contract. We found these evaluations were not completed in accordance with the time frames specified in JSC Management Directive (JSCMD) 5150.7E, "Performance Evaluation and Notification Procedures for Award Fee Contracts."

The payment of award fees is based on the contractor's overall performance during prescribed evaluations periods. The award fee determination process includes the following basic steps.

1. Contract monitors periodically assess the contractor's performance in their assigned areas of responsibility. The results of these evaluations are provided to a "performance evaluation committee."
2. The PEC accumulates the input from contract monitors and prepares a performance report. This report, which includes a recommended performance rating, is presented to a Performance Evaluation Board (PEB).
3. After appropriate review of the PEC report, the PEB makes a formal award fee recommendation to the designated Fee Determination Official (FDO).
4. The FDO determines the contractor's final performance rating (or score) and the related award fee.

JSCMD 5150.7E emphasizes the need for making award fee determinations in a timely manner, and establishes specific time frames for completing certain performance evaluation steps. The primary time requirements are as follows:

1. "The PEC will complete its work in time to have the PEC report and presentation charts delivered to the PEB secretary no later than 30 days following the completion of the performance period being evaluated."
2. "The PEB secretary will review the report and presentation charts to assure they are in good order. Should changes in the report or charts be necessary, the PEB secretary and the PEC chairperson will place priority emphasis on getting the corrections made, and complete the process no later than 15 days after initial receipt by the PEB secretary."

3. "A PEB meeting to review the PEC findings will be scheduled within 15 days after review by the PEB secretary is complete."

We found the PEC reports for the three award fee evaluations were, on the average, submitted to the PEB secretary 72 days after the end of the evaluation period. The PEC report for the April-June 1986 performance period was not submitted to the PEB secretary until approximately 3-1/2 months after the evaluation period ended. Due to the late submissions of the PEC reports, the PEB meetings were also delayed. We noted that, on the average, the PEB meetings were held 140 days (or approximately 4-1/2 months) after the end of the performance evaluation period.

We recognize the complexity of the STSOC contract and that numerous high-level management officials are involved in the evaluation process. However, we believe additional management actions are needed to ensure future award fee evaluations are completed in a more timely manner. As stated in JSCMD 5150.7E: "Timeliness is essential. Delay of the periodic evaluations or the reporting could lessen the benefits occurring both to the Government and the contractor."

RECOMMENDATION 6

We recommend the Director of Procurement take appropriate actions to ensure future award fee evaluations for the STSOC contract are completed in accordance with the time requirements specified in JSCMD 5150.7E.

MANAGEMENT RESPONSE (JSC)

We concur. It should be noted, however, that the STSOC contract is large and complex. JSC has attempted to comply with the appropriate regulations, and continued emphasis will be placed on scheduling activities in order to meet the time requirements specified in the regulations. It should be noted, however, that we are currently up-to-date in STSOC award fee evaluations. In view of the magnitude of this task, we believe the time required to-date for each evaluation period fee determination has not been considered overly excessive.

ADDITIONAL COMMENTS

Although JSC did not indicate what specific actions will be taken, we consider the Center's comments responsive to the intent of the recommendation. Appropriate follow-up will be performed to ensure future award fee evaluations are completed in a timely manner.

5. Property Transfers and Property Accountability for the STSOC Contract

Under the STSOC contract, millions of dollars of Government-Furnished Equipment (GFE) was transferred to RSOC. Although it has been over 1-1/2 years since the initial equipment transfers, 270 items have not yet been accounted for or located. The estimated value of these missing equipment items was \$475,965.

The STSOC contract consolidated the work previously performed by 16 contractors under 22 separate contracts. Consequently, most of the equipment assigned to the previous contractors had to be transferred to RSOC. For example, the RFP for the STSOC contract stated that approximately 12,000 items of GFE would be assigned to the selected contractor. The RFP included this equipment listing as "Volume 2 - Government-Furnished Facilities/Systems."

Many of the GFE items transferred to RSOC were previously assigned to the Ford Aerospace Corporation under Contract NAS9-16315. During the transfer process between Ford and RSOC, it was determined that 1,454 items valued at approximately \$9 million could not be located. JSC and RSOC initiated numerous actions to locate or determine the disposition of the missing equipment. Many items have been accounted for and/or located. However, as of November 1987, 270 equipment items valued at \$475,965 had not been located.

JSC and RSOC initially became aware of the missing property in September 1986. Since this time, various efforts have been made to account for or locate the missing property. However, this matter has not been fully resolved. We believe additional management actions are needed to locate and/or properly account for the remaining 270 equipment items.

RECOMMENDATION 7

We recommend the Contracting Officer for NAS9-18000 and the JSC Industrial Property Officer determine the disposition of the 270 missing equipment items. All applicable property records should be properly updated and, if appropriate, contract cost adjustments on the Ford and/or RSOC contracts should be initiated.

MANAGEMENT RESPONSE (JSC)

We concur. A draft summary of the missing items has been submitted to the contract technical manager, the contracting officer, and the property administrator. It should be noted, however, that the missing equipment now totals 266 items with a value of \$469,345. The missing items of equipment are

accountable to Ford Aerospace Corporation. A final determination of the number and value of the missing items has been conducted, and relief from accountability for the equipment has been requested and approved by the JSC Property Administrator. Because Ford Aerospace Corporation has an approved property control system, applicable regulations prohibit JSC from obtaining contract cost adjustments. A follow-up review by the JSC Property Administrator will be made to ensure that the appropriate property records have been adjusted.

ADDITIONAL COMMENTS

JSC's actions are responsive to the report recommendation. The final determination of the number and value of the missing items, and the Property Administrator's review will be assessed during our follow-up.

GENERAL COMMENTS

We appreciate the courtesy, assistance, and cooperation extended by the RSOC and JSC personnel contacted during our review.

Lyndon B. Johnson Space Center
Houston, Texas
77058

APPENDIX A

Reply to Attn of: BY/11-341

JAN 21 1988

MEMORANDUM

TO: W-JS/Director, Center Office of Inspector General

FROM: AA/Director

SUBJECT: Inspector General's Comment Draft Report on Review of Space
Transportation Systems Operations Contract (STSOC) NAS9-18000
(A-JS-87-005 dated November 6, 1987)

Enclosed are JSC comments in response to the subject draft report.

As indicated by our detailed reply, we agree with your recommendations which require a response from the Johnson Space Center. In addition, one recommendation requires a response from NASA Headquarters. We have commented on this recommendation in order to provide a JSC position on the issues.

If you have any questions, please contact BY/Lloyd Lovelace at extension 34212.

Aaron Cohen

Enclosure

cc:
BB/J. L. Neal
BG2/R. L. Mueller
BR/J. E. McIver
DA/J. D. Shannon
DA5/J. E. Petersen
JF/E. M. Easley
JF12/L. R. Whitaker

BY/LLovelace:ej:12/23/87:34212

JSC COMMENTS ON RECOMMENDATIONS
AUDIT ON SPACE TRANSPORTATION SYSTEMS
OPERATIONS CONTRACT (STSOC) NAS9-18000
A-JS-87-005

1. Adjusting or Modifying the STSOC Contract

Auditor's Findings

"The Challenger accident occurred in January 1986. The accident initially resulted in the indefinite suspension of all Shuttle flights. This significantly reduced the work requirements specified in the STSOC contract. Actions have been initiated to renegotiate the contract. However, as of October 1987, the contract had not been adjusted or modified to reflect the delay of Shuttle flights and/or the reduced flight schedule for future operations. Since the incentive fees paid to the STSOC contractor, Rockwell Shuttle Operations Company (RSOC), are directly related to the costs associated with actual flight operations and the contract has not been properly adjusted, RSOC has received unjustified fees for cost performance since April 1986."

Auditor's Recommendation and JSC Comments

Recommendation 1

"We recommend the Director of Procurement take appropriate actions to ensure the STSOC contract is adjusted or modified as soon as possible. During the contract renegotiation process, the STSOC Contracting Officer should recover an equitable portion of the \$5.6 million of incentive fees paid to RSOC since April 1, 1986. The amount recovered, or the resulting downward cost adjustment, should be fully documented in appropriate contract files."

JSC Comments

We concur. The Director of Procurement has taken appropriate action to ensure that the STSOC contract is adjusted or modified. We are actively pursuing an adjustment that will reflect the new contract cost base and provide an equitable resolution of fee. The amount of the equitable adjustment and both cost and fee will be fully documented in the contract files.

2. STSOC Payment Practices

Auditor's Findings

"Payments on the STSOC contract were not always made in accordance with NASA Financial Management regulations. We found payments were being made earlier than required. Early payments result in excess interest costs to the Department of Treasury. We estimated the Government could save approximately \$763,000 (or \$190,750 annually) if payments on the STSOC contract are made in accordance with applicable cash management regulations. We also noted that the NASA Financial Management Manual (FMM) has not been updated to include current Treasury reporting requirements for large disbursements made by electronic transfer."

Auditor's Recommendation and JSC Comments

Recommendation 2

"We recommend the Contracting Officer for NAS9-18000 and the Chief, Financial Management Division, ensure all future payments on the STSOC contract are made in accordance with applicable NASA regulations. Payments should be made on the last day of the discount period."

JSC Comments

We concur. The Chief, Financial Management Division (FMD), Johnson Space Center (JSC), has taken action to ensure that payments on the STSOC contract are made in accordance with applicable NASA Financial Management regulations. The FMD recently implemented an automated cash management system which will provide positive control concerning invoice due dates. A recent audit of this system by FMD personnel indicates that payments are being made in accordance with the applicable NASA Financial Management regulations. In addition, the Contracting Officer will also monitor payments to ensure that they are in compliance with the regulations.

Recommendation 3

"We recommend the Director, FMD, NASA Headquarters, update the FMM to include the current Treasury requirements for reporting large disbursements made by electronic funds transfer."

JSC Comments

Although your recommendation requires a reply from the Director, FMD, NASA Headquarters, we believe that the NASA FMM should be revised to include disbursements made by electronic funds transfer. The Chief, FMD, JSC, recently submitted a letter to the Director, FMD, NASA Headquarters, informing him of the need to update the FMM to be in accordance with the Treasury regulations.

3. Contractor Performance Under the STSOC Contract

Auditor's Findings

"RSOC's performance on the STSOC contract has been generally adequate. The contractor's overall performance evaluations have ranged from 'good' to 'very good.' We noted, however, that previous contractor performance evaluations indicated various management problems concerning RSOC's SR&QA activities and subcontract management."

Auditor's Recommendations and JSC Comments

Recommendation 4

"We recommend the Contracting Officer for NAS9-18000 ensure RSOC establishes an effective SR&QA program. Specific plans should be developed to address and correct the SR&QA problems identified in previous performance evaluations. Failure to adequately correct these problems in a timely manner should be considered in future award fee determinations."

JSC Comments

We concur. Both the Mission Operations Directorate and the Contracting Officer for NAS9-18000 have taken prompt action to correct the deficiencies identified in your findings. This process began during January 1987. Since that time, NASA has directed the contractor to develop new SR&QA plans to correct the deficiencies identified in previous performance evaluation. A followup survey by NASA SR&QA personnel was conducted during December 1987 to ensure compliance with the new SR&QA plans. Failure to adequately correct the deficiencies in a timely manner will be considered in future award fee determinations.

Recommendation 5

"We recommend the Contracting Officer for NAS9-18000 ensures that RSOC adequately controls and administers STSOC's subcontracting activities. Specific plans should be developed to ensure the subcontracting problems identified in previous performance evaluations are corrected as soon as possible. Failure to correct these matters in a timely manner should be considered during future award fee determinations."

JSC Comments

We concur. Both the Mission Operations Directorate and the Contracting Officer for NAS9-18000 have taken action to ensure RSOC adequately controls and administers STSOC subcontracting activities. RSOC has hired experienced SR&QA subcontractor personnel, and is in the process of implementing necessary contract change procedures to ensure that the subcontracting deficiencies are resolved. Failure to correct the deficiencies will be considered during future award fee determinations.

4. Timeliness of Contractor Award Fee Evaluations

Auditor's Findings

"As of September 1987, JSC had completed three award fee evaluations for the STSOC contract. We found these evaluations were not completed in accordance with the time frames specified in JSC Management Directive 5150.7E, 'Performance Evaluation and Notification Procedures for Award Fee Contracts.'"

Auditor's Recommendation and JSC Comments

Recommendation 6

"We recommend the Director of Procurement take appropriate action to ensure future award fee evaluations for the STSOC contract are completed in accordance with the time requirements specified in JSCMD 5150.7E."

JSC Comments

We concur. It should be noted, however, that the STSOC contract is large and complex. JSC has attempted to comply with the appropriate regulations, and continued emphasis will be placed on scheduling activities in order to meet the time requirements specified in the regulations. It should be noted, however, that we are currently up-to-date in STSOC award fee evaluations. In view of the magnitude of this task, we believe the time required to-date for each evaluation period fee determination has not been considered overly excessive.

5. Property Transfers and Property Accountability for the STSOC Contract

Auditor's Findings

"Under the STSOC contract, millions of dollars of Government-furnished equipment was transferred to RSOC. Although it has been over 1-1/2 years since the initial equipment transfers were made, 270 items valued at about \$475,965 have not been accounted for or located."

Auditor's Recommendation and JSC Comments

Recommendation 7

"We recommend the Contracting Officer for NAS9-18000 and the JSC Industrial Property Officer determine the disposition of the 270 missing equipment items. All applicable property records should be properly updated and, if appropriate, contract cost adjustments on the Ford and/or RSOC contracts should be initiated."

JSC Comments

We concur. A draft summary of the missing items has been submitted to the contract technical manager, the contracting officer, and the property administrator. It should be noted, however, that the missing equipment now totals 266 items with a value of \$469,345. The missing items of equipment are accountable to Ford Aerospace Corporation. A final determination of the number and value of the missing items has been conducted, and relief from accountability for the equipment has been requested and approved by the JSC Property Administrator. Because Ford Aerospace Corporation has an approved property control system, applicable regulations prohibit JSC from obtaining contract cost adjustments. A followup review by the JSC Property Administrator will be made to ensure that the appropriate property records have been adjusted.



National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX B

DEC 2 1987

Reply to Attn of: BFC

TO: W/Assistant Inspector General for Auditing

FROM: B/Office of the Comptroller

SUBJECT: Draft Report on Space Transportation
System Operating Contract (STSOC) NAS 9-18000 at
Johnson Space Center (JSC), A-JS-87-005

Thank you for the opportunity to review the subject draft report. In response to your Finding 2.b entitled "large Disbursements Report Requirements" and the related Recommendation 3; we concur with the finding and recommendation and will incorporate the two day Treasury notification requirement for payments of \$50 million dollar or more in the next revision to our Cash Management policies section of the financial management manual.

Currently, FMM 9630-2d. contains a Large Disbursement requirement to notify Treasury on the day of any disbursement of \$10 million or more.

Two other changes you might want to make prior to issuing the final official report are:

1. The reference to the Treasury Fiscal Requirements Manual is incorrect and should be changed to Treasury Financial Manual (TFM) Part 4 Section 2550.20 f and
2. The title Treasury Fiscal Requirements Manual was changed in March 1983 to Treasury Financial Manual.

Mr. Ed Speake has discussed the above with Mr. Ken Wood of your staff. If further information is required contact Ed Speake on 453-2291.

 Thomas Campbell

Office of Inspector General

Johnson Space Center
Houston, TX 77058



W-JS: 130-89

December 1, 1988

Reply to Attn of:

TO: Johnson Space Center
Attn: AA/Director

FROM: W-JS/Director, Center OIG

SUBJECT: Alternative Sources of Electricity
A-JS-88-004

INTRODUCTION

The NASA Office of Inspector General (OIG), Johnson Space Center (JSC), has completed an audit of Alternative Sources of Electricity. The audit was performed under the authority of NASA Management Instruction (NMI) 9910.1, dated January 28, 1980.

The objective of the audit was to determine whether JSC is obtaining electrical power from the most economical source available. The audit included a review of JSC's: (1) energy systems and operating plans; (2) conservation procedures and projects; (3) current electricity costs; and (4) studies and research on energy utilization and conservation activities.

On October 15, 1984, the Houston Lighting & Power Company (HL&P) entered into a 10-year areawide public utility contract with the United States Government through the General Services Administration. Under this agreement, HL&P furnishes electric services to Federal agencies in its certificated service area within the state of Texas. Accordingly, HL&P provides electric power to JSC under Negotiated Areawide Contract GS-00B-02343. For calendar year 1987, JSC consumed 183,682,952 kilowatt hours (KWHs) of electricity and paid HL&P \$6.2 million.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances.

A discussion draft report was provided to JSC management on September 7, 1988, and an Exit Conference was held on September 23, 1988. Necessary report changes resulting from the Exit Conference were incorporated in the draft report. The draft report was issued on October 4, 1988, and JSC provided a written response on November 2, 1988.

The Center's comments were fully responsive to the audit recommendation. JSC's comments are presented after the report recommendation and included in their entirety as Enclosure I to this final report. Actions taken or planned in response to our observation and recommendation will be evaluated during the normal follow-up process.

RESULTS OF AUDIT

JSC has considered alternative sources of electricity other than HL&P. The Center has also studied the feasibility of a Co-Generation Plant, but concluded the project was unacceptable due to estimated high costs (i.e., approximately \$8.8 million) and the long-term payback period. The Texas-New Mexico Power Company (Texas City, Texas) and Gulf-State Utilities (Beaumont, Texas) are located approximately 20 and 100 miles, respectively, away from JSC. The Texas-New Mexico Power Company does not have a power plant and obtains electricity from HL&P. Furthermore, a JSC official explained that only HL&P has the necessary local facilities to ensure standby electricity in case of a power failure during Shuttle flights.

Electric services are rendered to JSC and other Federal activities in the Houston area pursuant to HL&P's effective rates, tariffs, rules, regulations, and practices which are subject to the jurisdiction of and regulation by the Texas Public Utility Commission (PUC). In response to an inquiry from this office concerning electric services provided to JSC, HL&P wrote an April 7, 1988, letter stating:

"...All electric services provided by our Company are done so solely under rate schedules and service agreements by the Public Utility Commission of Texas. These "rates," including their respective customer qualifications for each, are compiled in a document entitled Tariff For Electric Service.... The service voltage at NASA is 138 KV; hence, NASA qualifies for the rates offered to 138 KV customers, which are the most economical (lowest) of all of the rates we offer (as opposed to a lower service voltage of 480 volts, 12 KV, 35 KV, etc.).

NASA presently takes service under our LOS-A Rate Schedule, which we assure you is the most economical (lowest) rate we offer, considering the electrical usage profile (which we call load factor) at NASA.

We further assure you that the availability of service under our LOS-A Rate Schedule (and all other rate schedules) is the same, whether the service agreement is negotiated by the General Services Administrator or by Johnson Space Center personnel...."

The audit indicated that JSC is obtaining electrical power from the most economical source currently available. However, we noted one area that requires management consideration. This area concerns using energy-efficient light fixtures in new JSC facilities. This matter is discussed in the following paragraphs.

Utilization of Energy-Efficient Light Fixtures

JSC is currently constructing two new facilities, and several more will be built during the next few years. We believe future electricity costs could be substantially reduced by using energy-efficient light fixtures in new JSC facilities.

The Center currently uses standard 40-watt lamps throughout its various buildings. We found, however, that 35-watt "super saver" lamps are available. These lamps produce the same level of illumination as the standard 40-watt lamps.

The cost of the super saver lamps is about 2.2 times greater than the current cost of the standard 40-watt lamps (\$3.37 for the super saver versus \$1.50 for the standard lamp). However, this cost increase would be offset by reduced electricity costs. We estimate the increased acquisition costs will be fully recouped in only 3.3 years, and significant cost savings would result during the remaining useful life (4.3 years) of the 35-watt lamps. An even shorter "payback" period and greater cost savings would result if electricity rates increase in the future.

The construction of two new JSC facilities (Buildings 46 and 9B) are near completion. The cost of these buildings is about \$11 million. Furthermore, approximately \$75 million has been budgeted for constructing new facilities during Fiscal Years 1989 and 1990. The largest of these new buildings will be the Neutral Buoyancy Facility (NBF). The estimated cost of the NBF is about \$67 million.

The effectiveness of the Center's energy conservation program could be enhanced by using energy-efficient lamps. Consequently, we believe JSC should consider the use of 35-watt super saver lamps in new facilities planned for the future construction.

RECOMMENDATION 1

We recommend the Director of Center Operations thoroughly review the potential for using energy-efficient lamps in new facilities. The cost benefits of using 35-watt super saver lamps, rather than the standard 40-watt lamps, should be evaluated. If appropriate, the Center should use 35-watt super saver lamps in new facilities planned for future construction.

MANAGEMENT RESPONSE

We agree that action should be taken to specify that energy-efficient lamps be used in new facilities. Therefore, during the design phase for each new facility, the Facilities Design Division will make the necessary changes to their master specification documents (SPECSINTACT). These specifications are used on all facility projects, including construction, rehabilitation, modification, maintenance, and repair projects. Following the guidelines suggested in the master specifications will result in energy-efficient lamps being installed in new facilities. In addition, burned-out lamps will be replaced with energy-efficient lamps.

ADDITIONAL COMMENTS

JSC's actions are fully responsive to the recommendation. JSC's methods for ensuring master specifications documents include requirements for energy-efficient lamps will be evaluated during the follow-up review process.

GENERAL COMMENTS

We greatly appreciate the courtesy, assistance, and cooperation extended to us by the JSC personnel contacted during our review.

W. Preston Smith

Enclosure:

JSC Response, dated November 2, 1988

cc: HQs-W/Assistant Inspector General for Auditing
JSC-BY/Chief, Management Analysis Office

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas
77058





ENCLOSURE

NOV 2 1988

Reply to Attn of BY/10-268

TO: W-JS/Director, Center Office of Inspector General
FROM: AA/Director
SUBJECT: JSC Reply to Inspector General's Draft Report on Alternative
Sources of Electricity (A-JS-88-004, dated October 4, 1988)

Enclosed are JSC's comments on the subject audit report. As indicated by our
reply, we have concurred with the audit recommendation.

 Aaron Cohen 

Enclosure

cc:
AB/P. J. Weitz
AC/D. A. Nebrig

BY/WThrower:am:10/25/88:34211

JSC COMMENTS ON RECOMMENDATION

AUDIT ON ALTERNATIVE SOURCES OF ELECTRICITY

A-JS-88-004

Auditor's Findings

"The audit indicated that JSC is obtaining electrical power from the most economical source currently available. However, we noted one area that requires management consideration. This area concerns using energy-efficient light fixtures in new JSC facilities."

Auditor's Recommendation and JSC Comments

Recommendation 1

"We recommend the Director of Center Operations thoroughly review the potential for using energy-efficient lamps in new facilities. The cost benefits of using 35-watt super saver lamps, rather than the standard 40-watt lamps, should be evaluated. If appropriate, the Center should use 35 watt super saver lamps in new facilities planned for future construction."

JSC Comments

We agree that action should be taken to specify that energy-efficient lamps be used in new facilities. Therefore, during the design phase for each new facility, the Facilities Design Division will make the necessary changes to their master specification documents (SPECSINTACT). These specifications are used on all facility projects, including construction, rehabilitation, modification, maintenance, and repair projects. Following the guidelines suggested in the master specifications will result in energy-efficient lamps being installed in new facilities. In addition, burned-out lamps will be replaced with energy-efficient lamps.

AUDIT REPORT

SUPER GUPPY OPERATIONS

JOHNSON SPACE CENTER

September 29, 1989



OFFICE OF INSPECTOR GENERAL

Office of Inspector General



Johnson Space Center
Houston, TX 77058

Reply to Attn of: Office of Inspector General

September 29, 1989

TO: M/Associate Administrator for Space Flight
N/Associate Administrator for Management
S/Associate Administrator for Space Station

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report on Audit of Super Guppy Operations
Johnson Space Center (JSC)
A-JS-88-008

We have completed an audit of Super Guppy Operations. The purpose of the audit was to evaluate the program requirements and use of the Super Guppy aircraft. A copy of our final report is enclosed.

The audit objectives were to: (1) review the justification and use of the Super Guppy; (2) determine if NASA has been fully reimbursed for Guppy flight operations; and (3) evaluate the overall efficiency and effectiveness of Super Guppy operations.

The audit showed that the Super Guppy has generally been effectively used in past years, and NASA has been reimbursed for Guppy flights performed for other Government agencies. However, we found that: (1) NASA's use of the Super Guppy has significantly diminished; (2) although the Office of Space Flight (OSF) budgeted \$6 million for re-engining the Guppy, OSF no longer plans to use the Guppy to support the National Space Transportation System; and (3) the Office of Space Station (OSS) was considering using the Super Guppy to fulfill future transportation needs, but OSS had not fully evaluated the requirements for and cost of using the Guppy. Our audit also determined that as much as \$28 million may be needed to fully upgrade the Super Guppy for use on the Space Station Freedom Program. Because of NASA's uncertain future requirements for the Super Guppy, we do not believe these expenditures are warranted at this time.

A Discussion Draft was issued on February 13, 1989, and Exit Conferences with Headquarters and JSC officials were conducted on March 1, 1989, and March 3, 1989, respectively.

Our Draft Report was issued on March 8, 1989, and OSF and OSS provided written responses during May 1989. However, subsequent to providing these responses, we determined that OSF and OSS revised their budgets and deleted a total of \$13.1 million which had been previously programmed for re-engining the Super Guppy and for developing a lightweight canister for use in the Guppy. As a result, the initial responses from OSF and OSS have not been incorporated into this final report. Instead, we held additional discussions with OSF, OSS and Office of Management (OM) officials during September 1989. The results of these discussions are presented as the "Management Response" for each of the three report recommendations. These responses were provided to and reviewed by OSF, OSS and OM officials on September 26 and 27, 1989.

We consider Recommendations 1, 2, and 3 to be significant. As a result, we request to be included in the NASA Headquarters concurrence cycle for closing these recommendations.

Richard J. Pelletier

Enclosure

cc: ADB/O'Brien
MA/Alonso
MI/Malone
MO/Krier
NA/Darraugh
NI/Sutton
NIF/Driver
SS/Sisson
SSO/Taylor
SSU/Cox
JSC/Cohen
W/Smith (w/o encl)

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	3
III.	OBJECTIVES AND SCOPE	5
IV.	OBSERVATIONS AND RECOMMENDATIONS	6
	Reduced NASA Requirements for the Super Guppy	6
	\$28 Million May Be Needed to Upgrade the Super Guppy	8
	Conclusion	9
V.	GENERAL COMMENTS	12
EXHIBITS	Super Guppy Pictures	

ACRONYMS

AOD	Aircraft Operations Division
DOD	Department of Defense
FERD	Facilities and Equipment Requirements Document
FY	Fiscal Year
JSC	Johnson Space Center
KSC	Kennedy Space Center
NSTS	National Space Transportation System
OIG	Office of Inspector General
OM	Office of Management
OSF	Office of Space Flight
OSS	Office of Space Station
POP	Program Operating Plan
SSFTWG	Space Station Freedom Transportation Working Group

SUPER GUPPY OPERATIONS
JOHNSON SPACE CENTER (JSC)

Digest

Introduction

The Office of Inspector General (OIG), Johnson Space Center (JSC), has completed an audit of Super Guppy operations. The Super Guppy is a modified YC-97J aircraft. It is powered by four Pratt and Whitney T-34-P7WA turboprop engines and can accommodate oversized cargoes weighing up to 40,000 pounds. NASA acquired the Guppy in 1979 from Aerospace Lines for \$2.94 million. The Super Guppy was primarily intended for transporting National Space Transportation System (NSTS) oversized cargo. The aircraft has also been used extensively, on a reimbursable basis, to transport hardware and cargo for the Department of Defense (DOD).

The objectives of the audit were to: (1) review the justification and use of the Super Guppy; (2) determine if NASA has been fully reimbursed for Guppy flight operations; and (3) evaluate the overall efficiency and effectiveness of Super Guppy operations.

Results of Audit

The results of the audit showed that the Super Guppy has generally been effectively utilized in past years, and NASA has been reimbursed for Guppy flights performed for other Government agencies. However, we found: (1) the use of the Super Guppy in support of NASA programs has significantly diminished; (2) the Office of Space Flight (OSF) no longer plans to use the Super Guppy to support the NSTS Program, and no institutional needs for the Guppy have been identified; and (3) the Office of Space Station (OSS) was considering using the Guppy to fulfill future transportation needs, but OSS had not fully evaluated the requirements for and costs of using the Guppy to support the Space Station Freedom Program. We also determined that the OSF budget included \$6 million for re-engining the Super Guppy, and an additional \$22 million may be needed to upgrade the Guppy for use on the Space Station Freedom Program. Because of NASA's uncertain future requirements for the Super Guppy, we believe these expenditures are not warranted at this time. We recommended that: (1) OSF revise its current budget and delete the \$6 million previously programmed for re-engining the Super Guppy;

(2) OSS ensure all oversized transportation requirements are identified, and detailed cost estimates are developed to ensure the most efficient and cost-effective method of transportation is used for future shipments; and (3) the Director, Aircraft Management Office, take appropriate actions, if necessary, to excess the Super Guppy. NASA Headquarters concurred with each recommendation, and indicated that appropriate corrective actions have been completed and/or planned. (Page 9)

INTRODUCTION

The Office of the Inspector General, Johnson Space Center (JSC), has completed an audit of Super Guppy operations. The audit was conducted in accordance with the authority and responsibility contained in NASA Management Instruction 9910.1, dated January 28, 1980.

The Super Guppy is a modified YC-97J aircraft with an inside diameter of 25 feet and a cargo length of 94 feet. It is powered by four Pratt and Whitney T-34-P7WA turboprop engines and can accommodate a maximum weight of 40,000 pounds, including cargo pallets and adapters. (Pictures of the Super Guppy are included as exhibits.)

The Super Guppy is primarily intended for transporting National Space Transportation System (NSTS) oversized payloads that are either too large for shipment by conventional means or require special handling. The aircraft has also been used extensively, on a noninterference and reimbursable basis, to transport oversized hardware and cargo for other Government agencies. Transportation services for private industry may be provided only if it can be shown that the Guppy's use is in the public interest and no other alternative means of transportation are available.

The Super Guppy was acquired in February 1979 from Aerospace Lines for \$2.94 million, including spares, support equipment, and training. The Guppy, along with many other NASA aircraft, is managed and operated by the JSC Aircraft Operations Division (AOD). This division includes the Aircraft Systems Quality Assurance Branch, Flight Operations Branch, Shuttle Training Support Branch, and the Aircraft Maintenance and Data Management Office. Three hundred and sixty-one employees, consisting of 85 civil servants, 2 military, and 274 contractor personnel, are assigned to AOD. Northrop Worldwide Aircraft Services, Incorporated, provides the maintenance support for all AOD aircraft under Contract NAS9-18075. As of August 31, 1989, the Northrop contract was valued at approximately \$15.3 million.

Super Guppy operations are funded by the JSC NSTS Integrations and Operations Office. An annual level of about \$300,000 is used to support basic operations and NSTS transport requirements. Unused funds are carried forward to the next year.

Requests for transport services outside NSTS are performed on a reimbursable basis. The costs for Super Guppy reimbursable services are based on the estimated costs associated with acquiring, maintaining, and operating the aircraft. The basic cost consists of two parts, transportation costs and a user fee. The user fee is applied only to nongovernment users and includes depreciation and public facilities cost.

The Guppy is located at the International Airport, El Paso, Texas. As of September 15, 1989, it was in a "mission-ready" status. Mission-ready indicates that the aircraft is immediately available for flight operations.

A Discussion Draft was issued on February 13, 1989, and Exit Conferences with appropriate NASA Headquarters and JSC officials were held on March 1, 1989, and March 3, 1989, respectively. Necessary report changes resulting from the Exit Conferences were included in our Draft Report, dated March 8, 1989.

The Office of Space Flight (OSF) and Office of Space Station (OSS) provided written responses during May 1989. However, subsequent to providing these responses, we determined that OSF and OSS revised their budgets, and deleted \$13.1 million which had been previously programmed for re-engining/upgrading the Super Guppy. Consequently, the initial responses from OSF and OSS have not been included in this report. Instead, we held additional discussions with OSF, OSS and Office of Management (OM) officials during September 1989. The results of these discussions are presented as the "Management Response" for each of the three report recommendations. These responses were provided to and reviewed by OSF, OSS and OM officials on September 26 and 27, 1989.

OBJECTIVES AND SCOPE

The purpose of the audit was to evaluate the program requirements and use of the Super Guppy. The audit objectives were to: (1) review the justification and usage of the Super Guppy aircraft; (2) determine if NASA has been fully reimbursed for Guppy operations; and (3) evaluate the overall efficiency and effectiveness of Super Guppy operations.

The scope of the audit included: (1) discussions with JSC and NASA Headquarters officials; (2) an assessment of the initial and current justification for the Super Guppy; (3) a review of flight records; and (4) evaluation of overall Guppy operations and costs. The current maintenance contract was also reviewed. The field work was performed during the period May 15, 1988, through December 31, 1988.

OBSERVATIONS AND RECOMMENDATIONS

We found the Super Guppy has generally been effectively used in past years, and NASA has been reimbursed for Guppy flights performed for other Government agencies. However, we found that: (1) NASA's use of the Supper Guppy has significantly diminished; (2) although OSF budgeted \$6 million for re-engining the Guppy, OSF no longer plans to use the Guppy to support the NSTS Program; and (3) OSS was considering using the Guppy to fulfill future transportation needs, but OSS had not fully evaluated the requirements for and costs of using the Guppy. We also determined that as much as \$28 million may be needed to fully upgrade the Super Guppy for use on the Space Station Freedom Program. Because of NASA's uncertain future requirements for the Super Guppy, we do not believe these expenditures are warranted at this time. Details follow:

Reduced NASA Requirements for the Super Guppy

In the past, the Super Guppy was used extensively to support various program needs. However, NASA's use of the Guppy has decreased significantly in recent years. The Super Guppy was acquired about 10 years ago. As of April 30, 1989, 63 NASA and 26 Department of Defense (DOD) missions had been performed. Most of the NASA missions were conducted prior to Fiscal Year (FY) 1986. In fact, during the period October 1, 1985, through April 30, 1989, only 6 of 19 Super Guppy flights were in support of NASA activities. We also noted that from September 1986, through April 30, 1989, no NASA support missions were flown. All Guppy flights during this time period were performed for DOD on a reimbursable basis.

Previously, the Super Guppy has been used to support NSTS requirements. NASA missions in direct support of the NSTS Program included transporting: (1) the Space Telescope; (2) Galileo/Ulysses Centaurs; (3) Shuttle Rocket Booster Skirts; (4) Orbital Maneuvering System Pods/Body Flaps; and (5) various other miscellaneous cargoes. In total, 2.3 million pounds of cargo have been transported. However, the Guppy's future role in support of NASA programs appears highly questionable. For example:

- The Guppy was not used to support the last three Shuttle missions.
- During June 1988, the Deputy Associate Administrator for Institutions conducted a study to assess the future transportation requirements for the Guppy. This study did not identify any institutional requirements for the Super Guppy.

-- The NSTS Director also conducted a program-wide study on the future need for the Guppy. No specific NSTS needs or requirements were identified.

We discussed the above studies with OSF officials. They reiterated that neither of the studies identified any specific future needs for the Super Guppy. However, during our March 1, 1989, Exit Conference at NASA Headquarters, we were told that Marshall Space Flight Center recently requested the Guppy be used to transport Space Telescope hardware. Nevertheless, only two Guppy flights will be needed to fulfill Marshall's requirements.

During our review, we were told the Guppy may be needed to support the Space Station Freedom Program. Consequently, we reviewed the following two studies concerning Guppy support for the Space Station Freedom Program.

The first study entitled, "Space Station Program Transportation Implementation Plan," dated June 12, 1987, was performed by the Boeing Aerospace Company. It stated that the operational readiness of the Super Guppy was "highly questionable;" and therefore, it was not considered a viable option for fulfilling the future transportation needs of the Space Station Freedom Program. The study indicated that the Air Force C-5A is a "superior and timely alternative." The report concluded that: "...timely, cost-effective intersite transport of large SS elements can be accomplished by a judicious blend of highway and C-5A SCM aircraft using standard cargo aircraft loading techniques."

The second study entitled, "Space Station Oversized Element Transportation Study," dated March 18, 1988, was performed by the MoonSPACE Corporation. This study covered the transportation of all oversized Space Station Freedom elements from point of fabrication through intra-Center moves to the ultimate launch site. The report stated that MoonSPACE reached many of the same conclusions that Boeing reported in June 1987. Furthermore, the study indicated that NASA's recently-acquired Shuttle Carrier Aircraft and/or a modified DC-10 could be used for transporting oversized Space Station Freedom cargo, provided some type of canister is developed.

The major deficiencies regarding the Super Guppy, cited in the above studies, included unpressurized cabin, obsolete turboprop engines, and limited spare parts without extensive upgrades and maintenance. Due to these problems, we believe the ability of the Guppy to support future Space Station Freedom requirements is questionable.

We discussed the potential use of the Guppy on the Space Station Freedom Program with appropriate JSC officials. They informed us that no specific requirements had been identified, but the JSC Space Station Freedom Projects Office planned to conduct a study of future transportation needs.

We also discussed this matter with OSS officials. They stated that initially the Super Guppy was not considered a viable alternative for transporting Space Station Freedom cargo, due to weight limitations and cargo environmental concerns. However, the use of the Guppy was reconsidered because: (1) the cost of using an Air Force C-5A is apparently increasing; and (2) it may be possible to use a lightweight canister in the Guppy which would eliminate the weight and environmental problems.

According to OSS officials, a canister would be required to transport Space Station Freedom cargo, and Beech Aircraft Corporation performed a feasibility study for manufacturing a lightweight canister for use in the Guppy. The Beech study concluded that developing a lightweight canister is feasible and at least three companies have the capabilities needed to design and manufacture the canister. Beech estimated that the canister would cost about \$11 million.

OSS officials also told us requirements for 23 shipments have been identified, but none would be needed until mid-1993. They further stated that: (1) the future oversized cargo transportation needs of the foreign countries participating in the Space Station Freedom Program had not been fully assessed; and (2) the actual environmental needs associated with shipping cargo for the Work Package Centers had not yet been identified.

\$28 Million May Be Needed to Upgrade the Super Guppy

NASA may have to spend as much as \$28 million to fully upgrade the Super Guppy. This includes \$9 million for airframe modifications; \$8 million for purchasing new engines, propellers and ancillary equipment; and \$11 million for a canister. There is no overhaul capability for the existing Guppy engines or propellers. Consequently, for continued operations, new engines and spare propellers may be needed. According to an AOD study entitled, "Effect of Re-engining on the Super Guppy's Oversized Cargo Capability," dated August 22, 1988, the life of the Guppy airframe may be extended indefinitely with adequate maintenance, but the engines and propellers are "high failure rate items." This study estimated that \$6 to \$9 million is needed to modify the Guppy airframe in order to install new T-56 engines. The study also indicated that an additional \$3.3 to \$4.5 million may be required to purchase the engines, propellers, and ancillary equipment.

Based on the above cost estimates, JSC requested that \$6 million (\$3 million in FY 1989 and \$3 million in FY 1990) be budgeted for re-engining the Super Guppy. This budget request was sent to the OSF during March 1988. OSF initially denied JSC's request. However, during July 1988, OSF informed JSC that \$3 million in FYs 1990 and 1991 had been budgeted for the Guppy re-engining project.

OSF officials confirmed that \$6 million was included in the Program Operating Plan (POP) for FYs 1990 and 1991. Although these funds were in the POP, the OSF representatives stated that they could not justify the need for the Guppy and they would no longer support the re-engining project. They also advised us that no surplus T56-A-14 engines were available for use on the Guppy. The estimated cost for purchasing five new engines is about \$8 million.

Conclusion

The Super Guppy is no longer needed to support the NSTS Program. Although the OSS was considering using the Super Guppy to transport Space Station Freedom cargo, all Space Station Freedom transportation needs had not been identified, and detailed cost studies and comparisons had not been completed. Previous studies also showed that the Guppy may not be a viable option for fulfilling the transportation needs of the Space Station Freedom Program, and alternative transportation modes were available.

Our review determined that \$28 million (\$9 million for airframe modifications; \$8 million for purchasing new engines; and \$11 million for a canister) may be needed to upgrade the Super Guppy, and the OSF budgeted \$6 million for re-engining the Guppy. Because of the uncertain future requirements for the Super Guppy, we believe the total costs for upgrading the Guppy should be determined, and detailed cost estimates and studies should be completed to ensure the most cost effective method of transportation is used for future Space Station Freedom requirements.

RECOMMENDATION 1

We recommend the Associate Administrator for Space Flight revise the OSF budget and delete the \$6 million previously budgeted for re-engining the Super Guppy.

MANAGEMENT RESPONSE

We concur. The \$6 million (\$3 million in FY 1990 and \$3 million in FY 1991) previously included in the OSF budget for re-engining the Super Guppy has been deleted. The action was completed during August 1989. OSF had also planned to include \$2.5 million in the FY 1992 budget for the re-engining project. However, these funds were not included in the OSF budget. No OSF funds are currently budgeted for re-engining the NASA Super Guppy.

ADDITIONAL COMMENTS

The actions taken are fully responsive to the recommendation.

RECOMMENDATION 2

We recommend the Associate Administrator for Space Station identify all oversized transportation requirements for the Space Station Freedom Program. The cost effectiveness of using the Super Guppy to fulfill these needs should then be thoroughly evaluated. Definite cost estimates, including airframe modification costs, costs for purchasing new engines, and/or modifying or refurbishing old engines, the costs for a canister, operational and maintenance costs, costs for spare parts and personnel costs, should be obtained. The total costs should then be compared with firm cost estimates for alternative modes of transportation, such as the Air Force C-5A. Once all appropriate cost comparisons are fully completed, the most efficient and cost-effective method of transportation should be selected for future use.

MANAGEMENT RESPONSE

We concur. The Space Station Freedom Transportation Working Group (SSFTWG) has completed a preliminary report which contains detailed operations and cost information for the NASA Super Guppy lightweight transportation canister, associated support cost, and descriptions of oversized Space Station cargo mission requirements. OSS has also obtained updates to preliminary figures on Air Force C-5A aircraft operations cost for the same oversize cargo missions. Previously, only rough estimates of C-5A costs were available because the aircraft was not operational. The SSFTWG report does not address costs for commercial alternatives, such as the modified DC-10, because none presently exist. We anticipate publication of the final SSFTWG report in October 1989.

It is generally recognized that a NASA canister is needed, regardless of the mode of transportation used. Use of a NASA canister, in lieu of using the Air Force canister, could reduce operations costs for the 23 known moves by up to 48 percent. Consequently, a draft Kennedy Space Center (KSC) Facilities and Equipment Document (FERD) which details structural requirements for a rigid, environmental controlled canister has been developed. The draft FERD is currently undergoing a formal review by the design Centers which should be completed in October 1989. Depending upon the results of this evaluation, we will either proceed with plans to develop a NASA canister or direct the Centers to utilize local assets to satisfy their contractual requirements. This decision will be made irrespective of Super Guppy availability.

Due to programmatic changes, all funding for re-engining the NASA Super Guppy has been deleted from the OSS budget. This includes approximately \$7.1 million that was previously budgeted for developing the lightweight canister. The budget reductions were completed during September 1989. The current OSS budget no longer contains any funds for re-engining the Super Guppy or developing a lightweight canister. However, as stated above, an appropriate NASA canister may be developed in the future.

ADDITIONAL COMMENTS

The actions taken are fully responsive to the report recommendation.

RECOMMENDATION 3

We recommend the Director, Aircraft Management Office, NASA Headquarters, take appropriate actions, if necessary, to excess and dispose of the Super Guppy.

MANAGEMENT RESPONSE

We concur. During the next several months, the Director, Aircraft Management Office (Code NIF) will assess the potential future need for the Super Guppy. The results of this evaluation will be used to determine whether or not the Guppy should be maintained in the NASA aircraft inventory. We will place the Super Guppy in flyable storage while this evaluation is being performed.

ADDITIONAL COMMENTS

NASA's planned actions are fully responsive to the recommendation.

GENERAL COMMENTS

We greatly appreciate the courtesy, assistance, and cooperation extended by the JSC and NASA Headquarters personnel contacted during our review.





AUDIT REPORT

SURVEY OF MAGNETIC DATA TAPE USAGE AND RECERTIFICATION

JOHNSON SPACE CENTER

March 29, 1990



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General



Johnson Space Center
Houston, TX 77058

Reply to Attn of: W

March 29, 1990

TO: Johnson Space Center
Attn: AA/Director

FROM: W-JS/OIG Center Director

SUBJECT: Final Report on Survey of Magnetic
Data Tape Usage and Recertification
A-JS-89-012

We have completed a survey of JSC's Magnetic Data Tape Usage and Recertification. Our final report is enclosed.

The survey objectives were to: (1) assess the cost, usage, and quantities of magnetic data tapes; and (2) determine whether sound criteria for tape retention, cleaning, and recertification have been developed and implemented.

Our survey indicated that JSC and contractor policies and procedures for magnetic data tape usage and recertification are generally adequate. In most instances, tapes were effectively controlled, and magnetic tapes were cleaned and reused when appropriate. However, we identified two problem areas associated with one of the tape libraries operated by Rockwell. We found that: (1) the staffing or manpower assigned to this tape library was not commensurate with the current workload; and (2) effective retention policies and procedures are needed to ensure flight data tapes are cleaned, recertified, and reused whenever possible.

A discussion draft was provided to JSC management on January 19, 1990, and an exit conference was conducted on February 9, 1990. Necessary report changes resulting from the exit conference were included in the draft report, dated February 16, 1990.

JSC concurred with the report recommendations. The Center's response, dated March 15, 1990, is included as Appendix B of this final report.

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	3
III.	OBJECTIVES AND SCOPE	4
IV.	OBSERVATIONS AND RECOMMENDATIONS	5
	1. Staffing for RSOC's Data Distribution Center (DDC)	5
	2. Tape Retention Policies and Procedures	10
V.	GENERAL COMMENTS	13
APPENDIX A	Magnetic Data Tape Libraries Reviewed	A-1
APPENDIX B	JSC Response, dated March 15, 1990	B-1

ACRONYMS

CSC	Computer Sciences Corporation
DDC	Data Distribution Center
JSC	Johnson Space Center
JSCMI	Johnson Space Center Management Instruction
NMI	NASA Management Instruction
ODRC	Orbiter Data Reduction Complex
RSOC	Rockwell Space Operations Company
SMA	Systems Management American
STSOC	Space Transportation System Operations Contract

March 29, 1990

SURVEY OF MAGNETIC DATA TAPE USAGE
AND RECERTIFICATION

JOHNSON SPACE CENTER (JSC)

DigestIntroduction

The NASA Office of Inspector General has completed a survey of magnetic data tape usage and recertification. The survey was conducted in accordance with the authority and responsibility contained in NASA Management Instruction 9910.1A, dated June 19, 1989.

The survey objectives were to: (1) assess the cost, usage, and quantities of magnetic data tapes; and (2) determine whether sound criteria for tape retention, cleaning, and recertification have been developed and implemented.

Results of Survey

Generally, JSC and contractor policies and procedures for using and recertifying magnetic tapes were adequate. In most instances, tapes were properly managed and controlled, and tapes were cleaned and reused when appropriate. However, we identified two problem areas associated with one tape library operated by the Rockwell Space Operations Company (RSOC). We found that: (1) the staffing or manpower assigned to this tape library was not commensurate with the current workload; and (2) effective retention policies and procedures are needed to ensure flight data tapes are cleaned, recertified, and reused whenever possible. These areas are discussed in the "Observations and Recommendations" section of this report and are summarized below.

1. Staffing for RSOC's Data Distribution Center (DDC)

Our survey disclosed that the staffing level for RSOC's DDC tape library was not commensurate with the present workload. We estimated that establishing an appropriate staffing level for the DDC could reduce future contract costs by approximately \$2.2 million. We recommended the Technical Manager for Contract NAS9-18000 evaluate the current and future staffing needs for the DDC tape library. JSC concurred with the recommendation and stated the Technical Manager has directed RSOC to reduce the DDC staffing level. (Page 5)

2. Tape Retention Policies and Procedures

JSC has not established retention policies and procedures for flight data tapes. Consequently, many tapes have remained in the DDC library for excessive periods of time. We estimated potential cost savings of approximately \$211,000 could be realized by cleaning, recertifying, and reusing unneeded magnetic tapes. We recommended that specific retention policies and procedures for flight data tapes be developed and implemented. Center management concurred with the recommendation. A retention policy for all flight data tapes, including those maintained at JSC, Marshall, and Kennedy, will be established. (Page 10)

INTRODUCTION

The Office of Inspector General, Johnson Space Center (JSC), has completed a survey of magnetic data tape usage and recertification. The survey was conducted in accordance with the authority and responsibility contained in NASA Management Instruction (NMI) 9910.1A, dated June 19, 1989.

JSC uses digital and analog magnetic tapes. Digital tapes are generally used for administrative data and certain scientific and engineering information. Analog tapes are used to record actual flight or flight-related information. JSC's annual expenditure for magnetic tapes is approximately \$824,000.

We reviewed eight tape libraries at JSC (see Appendix A). Seven of these libraries are managed and operated by the Rockwell Space Operations Company (RSOC) under the Space Transportation System Operations Contract (STSOC), NAS9-18000. The Computer Sciences Company (CSC), under the Mission Operations Support Contract, NAS9-17920, operates one tape library. As of August 1989, approximately 178,000 magnetic tapes were stored in these eight facilities. This amount represents about 98 percent of the Center's total number of magnetic tapes. Both RSOC and CSC have the capabilities and equipment needed to clean and certify tapes for reuse.

A discussion draft was provided to the Center on January 19, 1990, and an exit conference was held on February 9, 1990. Necessary report changes resulting from the exit conference were included in the draft report, dated February 16, 1990. The Center's response, dated March 15, 1990, is included as Appendix B of this final report.

OBJECTIVES AND SCOPE

The purposes of the audit were to assess the cost, usage, and quantities of magnetic data tapes, and to determine whether sound criteria for tape retention, cleaning, and recertification have been developed and implemented.

The scope of the audit included reviewing JSC and contractor policies, procedures, and practices for acquiring, distributing, controlling, and disposing of magnetic tapes. Tape library records were examined in detail to determine whether sound criteria for tape retention, cleaning, and recertification had been developed and implemented. JSC and contractor personnel were interviewed concerning the management and operation of the tape libraries.

The survey was conducted in accordance with generally accepted auditing standards, and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstance. The internal controls associated with magnetic tape retention, usage, and recertification were also reviewed. Except as noted in the "Observations and Recommendations" section, the internal controls tested were considered generally satisfactory. The field work was performed during May 16, 1989, through August 15, 1989.

OBSERVATIONS AND RECOMMENDATIONS

Generally, JSC and contractor policies and procedures for managing magnetic tapes were adequate. In most instances, tapes were effectively controlled, and tapes were cleaned and reused when appropriate. However, we identified two problem areas associated with one of the tape libraries operated by RSOC. We found that: (1) the staffing or manpower assigned to this tape library was not commensurate with the current workload; and (2) effective retention policies and procedures are needed to ensure flight data tapes are cleaned, recertified, and reused whenever possible. We estimated that establishing an appropriate staffing level and implementing specific tape retention policies and procedures could reduce future costs by approximately \$2.4 million during the remaining life of the STSOC contract. These matters are discussed in the following paragraphs.

1. Staffing for RSOC's Data Distribution Center (DDC)

Our survey disclosed that the staffing level for the RSOC's DDC tape library was not commensurate with the present workload. We estimated that establishing an appropriate staffing level for the DDC could reduce future STSOC contract costs by approximately \$2.2 million.

As a part of the STSOC contract, RSOC manages and operates seven magnetic tape libraries for JSC. Six of these facilities are located on-site and one is at an off-site location. The DDC is one of the on-site tape libraries. The DDC provides support for the Orbiter Data Reduction Complex (ODRC), and serves as a central point for receiving, storing, and distributing Shuttle test and flight data. This information may be in the form of magnetic tapes, voice tapes, microfiche, or computer printouts. These activities are coordinated with the ODRC Data Manager to ensure efficient distribution of data. The basic functions performed by the DDC are described below.

- a. Receiving - Controlling and accounting for data items and documentation, and the release of data prepared for distribution to users. This includes identifying, verifying, and accounting for all incoming items and documents and, when necessary, assigning accession numbers and storage locations.

- b. Technical Services - Activities necessary to identify, verify, and initiate the required processing of data items and documentation. Additionally, this function includes creating and updating catalogs of data received and produced, maintaining tracking systems, and internal recordkeeping.
- c. Storage - Entering data into assigned storage locations, maintaining the library system records, and retrieving data from storage for processing or retirement. This function also includes the activities required for controlled data circulation and data disposition services.
- d. Shipping - Preparing documentation and packaging items for shipping, mailing, and distribution to user organizations. This includes preparing shipping and mailing documents, and verifying and packaging items.
- e. Courier or Dispatch Services - Regular deliveries of data to designated on-site and off-site locations.

As of August 1989, 19 personnel were assigned to the DDC library. They included 3 RSOC employees and 16 subcontractor personnel. The subcontractors included 10 Omniplan employees and 6 Systems Management American (SMA) Corporation employees. The Omniplan personnel consisted of one supervisor and nine librarians who worked two 8-hour shifts. SMA employees perform the necessary courier services, and they were assigned to three 8-hour shifts.

In a letter dated August 15, 1989, RSOC informed us that the current estimated "labor related costs" for the DDC was \$667,486. RSOC management stated that these costs were "...based on headcount of those individuals located at the library and does not include related support costs." RSOC also pointed out that \$176,400 of the total estimated labor costs were associated with the courier services provided by SMA. However, according to RSOC, these courier services are "...not part of the true ODRC 'Library' type operation." Consequently, they should not be considered as DDC library operating costs. Based on this data, we determined that the current labor-related cost associated with the DDC tape library is \$504,554 (\$667,486 - \$176,400 + \$13,468 for support costs). The support costs include RSOC add-on costs for general and administrative expenses (1.9 percent) and material procurement costs (2.0 percent).

RSOC's August 15, 1989, letter also stated that the staffing level for the DDC library was based on the number of service/data requests that are processed and the desired level of response time. RSOC emphasized that the staffing level was not related to the number of magnetic tapes "warehoused" in the library.

In order to test the adequacy of RSOC's staffing rationale for the DDC library, we reviewed DDC production reports for the period January 1, 1987, through July 31, 1989. This analysis showed that an average of 13 data requests covering 48 products, i.e., magnetic tapes, voice tapes, microfiche, etc., were processed each day. This level of activity equates to an average of 1.4 data requests covering 5.3 products processed per librarian per working day. Furthermore, we noted that prior to June 1989, the librarians were operating on three 8-hour shifts. Although they have changed to a 2-shift operation, the total workforce remained the same. It should also be noted that five Shuttle missions were conducted during January 1, 1987, through July 31, 1989. Consequently, the DDC workload included increased activities associated with actual flight operations.

In October 1989, we met with DDC supervisory officials to determine the time actually used for "end-to-end" processing of magnetic data tape requests. We were informed that a "typical" data request includes multiple products, i.e., more than one item is requested. This information correlates with our analysis of the DDC production reports which showed that on the average one data request includes 3.7 products (48 products/13 data requests equal 3.7 products). The DDC officials also told us that on the average a "typical" data request is fully processed in "8 minutes." On the average, each librarian completes all required activities or functions in approximately 8 minutes.

Based on the estimate provided by DDC personnel, processing 1.4 data requests per workday would require .19 hours (or 11.2 minutes) of effort for each librarian. However, in order to allow work time for other factors, such as personal breaks, workload fluctuations, variances in the size and complexity of data requests, and miscellaneous activities, we increased the hours of effort by a factor of 5.0. Furthermore, to allow for an adequate level of responsiveness, we increased the hours of effort again by a factor of 5.0. This resulted in a composite increase by a factor of 25. We estimated, therefore, that performing all activities associated with processing an average of 1.4 data requests per workday per librarian would require 4.8 hours of effort per workday for each librarian. This analysis indicates that the DDC library may be overstaffed by as much

as 40 percent. The potential cost impact of this level of overstaffing during the remaining life of the STSOC contract is approximately \$2.2 million. Our cost impact calculation is presented below.

Current DDC Labor Costs*	\$ 504,554
Estimated Percentage of DDC Overstating	<u>x 40%</u>
Estimated Labor Costs	\$ 201,822
Number of Years Remaining on the the STSOC Contract	<u>x 11</u>
Potential Cost Saving	<u>\$2,220,042</u>

* Includes RSOC add-on costs, but excludes all labor costs for the six SMA couriers.

We believe the cost saving estimate presented above is accurate and conservative because: (1) it was based on actual DDC production reports covering 31 months of activity; (2) five Shuttle missions were flown during this period of time; (3) the actual time used to process data requests was provided by DDC officials; (4) the cost of courier services was excluded from our estimate; (5) increasing the actual processing time by a composite factor of 25 more than adequately allows for performing other duties and providing responsive service; and (6) JSC has negotiated an 11-year extension to the STSOC contract.

The staffing level for the DDC tape library is not commensurate with the current workload. Appropriate management actions are needed to ensure future staffing levels are based on actual workload requirements.

RECOMMENDATION 1

We recommend the Technical Manager of NAS9-18000 assess the current and future staffing needs for the DDC tape library. Appropriate staffing adjustments should be made to ensure DDC staffing levels do not exceed actual workload requirements.

MANAGEMENT RESPONSE

We concur with the recommendation. In addition to the routine, nonflight related support in Building 423, the DDC must provide around-the-clock flight support in Building 423 and Building 30 from launch minus 12 hours to landing. Weekend flight support is staffed through overtime.

The DDC in Building 423 is an extremely remote location. Concern over personal safety (e.g., medical emergencies) requires staffing the DDC with a minimum of two persons per shift. This also allows coverage for lunch and dinner breaks.

The workload of the third shift exceeds the workload of shifts one and two due to delivery of ODRC tapes for processing during third shift. Additionally, since Omniplan documentation personnel are available for backup only during first and second shift, three personnel are required on third shift to cover both DDC-423 and DDC-30 during flights.

The Technical Manager has directed that the DDC staffing levels be reduced from 10 personnel to 7 personnel during periods of routine operation. An additional 2 capable DDC librarians must be available "on call" from the Omniplan documentation personnel to handle the workload during missions. The staffing levels, by shift and facility, are as follows:

	<u>NON-FLIGHT PERIODS</u>	<u>FLIGHT PERIODS</u>	
	DDC-423	DDC-423	DDC-30
Shift 1	2	2	1
Shift 2	2	2	1
Shift 3	<u>3</u>	<u>2</u>	<u>1</u>
TOTALS	7	6	3
	=	=	=

EVALUATION OF MANAGEMENT RESPONSE

The Center's actions are responsive to the recommendation.

2. Tape Retention Policies and Procedures

JSC has not established retention policies and procedures for flight data tapes. Consequently, many tapes have been maintained in the DDC library for excessive periods of time. We estimated potential cost savings of approximately \$211,000 could be realized by cleaning, recertifying, and reusing unneeded magnetic tapes.

DDC records showed that, as of July 1989, 27,579 flight data tapes were stored in the library. We found that 19,437 (70 percent) of these tapes were initially placed in the library during 1981 through 1987. Our analysis also showed that:

- 11,221 flight data tapes have been in storage more than 5 years.
- 10,107 (52 percent) of the 19,437 tapes that were placed in the library prior to 1988 had "zero" usage, i.e., no requests had been made to review or use these tapes.

JSC and RSOC recognize that the costs for cleaning and recertifying tapes are significantly less than the costs for purchasing new tapes. Consequently, RSOC has recertified and reused many magnetic tapes maintained in other tape libraries or facilities. In fact, many non-flight data tapes maintained in the DDC library have also been recertified and reused. We believe flight data tapes should also be reused whenever possible. The potential cost benefits of reusing these tapes, rather than purchasing new tapes, are presented below.

Flight Data Digital Tapes With Zero Usage	8,591
Flight Data Analog Tapes With Zero Usage	<u>1,516</u>
Total Flight Data Tapes With Zero Usage	<u>10,107</u>

	<u>COST OF NEW TAPES</u>	<u>COST TO CLEAN AND RECERTIFY</u>	<u>SAVINGS</u>
Digital Tapes	8,591 <u>x \$12</u>	8,591 <u>x \$1.50</u>	
	<u>\$103,092</u>	<u>\$12,887</u>	<u>\$ 90,205</u>
Analog Tapes	1,516 <u>x \$98</u>	1,516 <u>x \$18</u>	
	<u>\$148,568</u>	<u>\$27,288</u>	<u>\$121,280</u>
Total	<u>\$251,660</u>	<u>\$40,175</u>	<u>\$211,485</u>

As previously stated, RSOC operates seven tape libraries under the STSOC contract. Except for the flight data tapes maintained in DDC tape library, RSOC has established specific tape retention policies and procedures. Generally, these procedures require that users justify the need to retain their tapes in the library beyond a specified period. If the user does not have a continuing need for the tapes, they are removed from the library and, if appropriate, cleaned, recertified, and reused.

We asked RSOC officials why retention policies and procedures for flight data tapes had not been established. They responded that JSC, not RSOC, is responsible for this area. Consequently, RSOC has not developed retention policies specifically for flight data tapes.

NMI 1440.6B, "NASA Records Management Program," stated that the Directors of Field Installations are responsible for issuing and implementing local records retention instructions. JSC Management Instruction (JSCMI) 1441.1A, "Retention of Magnetic Tapes," was issued September 25, 1978. The JSCMI required that the Program/Project Offices and Directorates that enter tapes into a tape library or local storage facility be responsible for providing retention or disposition instructions. JSCMI 1441.1A was cancelled during 1984. As of February 1990, updated magnetic tape retention policies and procedures had not been established.

We recognize that flight data tapes may require longer retention periods than other types of data. Nevertheless, this factor does not preclude reusing flight data tapes. Through the use of RSOC's "Special Telemetry Conversion System," the flight data maintained on approximately 500 magnetic tapes can be reduced to about 50 tapes. Consequently, most flight data tapes can be recertified and reused. We believe definitive flight data tape retention policies should be established for the DDC library to ensure unneeded tapes are reused whenever possible.

RECOMMENDATION 2

We recommend the Director, National Space Transportation System Program Office develop retention policies and procedures for flight data tapes. This effort should be coordinated with other JSC organizations, such as the Mission Operations and Engineering Directorates. Appropriate procedures should be implemented to ensure: (1) the continued storage of flight data tapes are fully justified; and (2) unneeded tapes are cleaned, recertified, and reused whenever possible.

MANAGEMENT RESPONSE

We concur with the recommendation. A policy for the retention and reuse of flight data tapes will be developed and documented in the Space Shuttle Program baseline requirements, specifically in "NSTS 07700, Volume V, Information Management." This means the policy will apply to all flight data tapes at JSC, as well as at Marshall and Kennedy. The process by which such policy/requirements are adopted calls for the submission and acceptance of a Change Request through the Program Requirements Control Board. Due to the time that it may take to process such a Change Request and to ensure that it is appropriate for all three Centers, an interim policy, applying specifically to the Data Distribution Center at JSC, will be developed and distributed in letter form. It is anticipated that this policy will be issued by March 30, 1990.

EVALUATION OF MANAGEMENT RESPONSE

The Center's comments are responsive to the recommendation.

GENERAL COMMENTS

We appreciate the courtesy, assistance, and cooperation extended by the JSC personnel and contractor representatives contacted during our review.

MAGNETIC DATA TAPE LIBRARIES REVIEWED

APPENDIX A

<u>Tape Library</u>	<u>Contractor</u>	<u>Librarians</u>	<u>Tapes Purchased</u>	<u>Tapes Recycled</u>	<u>Tapes Rejected</u>	<u>Cartridges Purchased</u>	<u>Tapes Retained (Library)</u>	<u>Tapes Retained (Bldg 423)</u>	<u>Tapes Retained (Archives)</u>	<u>Total Tapes Retained</u>	<u>Scratch Tape</u>	<u>Scratch %</u>	
	CSC		2,000 (FY 88) (As of Jun)	31,200/yr	4,800/yr	3,800 (FY 88) (As of Jun)							
Bldg 46	CSC	10 (3 shifts)					38,187 (Exclude Scratch)	104 (Vault)	1,500	39,791		0.00%	Digital
	RSOC		2,100 (CY 88) (As of Apr)	68,395 (FY 88) (As of Jun)	9,383 (FY 88) (As of Jun)	-0-							
Bldg 16 (SAIL)	RSOC	3 (2 shifts)					13,700	800	0	14,500	none		Digital 11,500 Analog 3,000
Bldg 30 (MCC)	Bendix	22 (3 shifts)					26,375	200	0	26,575	11,000	41.38%	Digital
Bldg 30 (SPF)	Bendix	9 (3 shifts)					30,000	500	6,000 (Bldg 12)	36,500	5,000	13.70%	Digital
Bldg 30 (FDCF)	RMS	10 (3 shifts)					10,000	0	2,000 (Bldg 12)	12,000	3,600	30.00%	Digital
Bldg 5/35 (SMS)	Bendix	7 (3 shifts)					13,324	54	0	13,378	1,296	9.69%	
Bldg 423 (DDC)	Omniplan SMA	8 (2 shifts) 8 (3 shifts)					30,700		0	30,700			Digital Analog
600 (RSOC)	RSOC						5,000	0	0	5,000			Digital

ACRONYMS

CSC: Computer Sciences Corporation
 RSOC: Rockwell Shuttle Operations Company
 SAIL: Shuttle Avionics Integration Laboratory
 MCC: Mission Control Center
 SPF: Software Production Facility
 FDCF: Flight Design Computational Facility
 SMS: Shuttle Mission Simulator
 DDC: Data Distribution Center

NOTES:

Bendix, Omniplan, and SMA are subcontractors to RSOC.
 RMS is a subcontractor to Bendix.

APPENDIX B

Reply to Attn of **BY/3-43**

JSC Comments on Recommendations
Audit on Magnetic Data Tape Usage and Recertification
A-JS-89-012

1. Staffing for RSOC's Data Distribution Center (DDC)

Auditor's Findings

"Our survey disclosed that the staffing level for RSOC's DDC tape library was not commensurate with the present workload. We estimated that establishing an appropriate staffing level for the DDC could reduce future contract costs by approximately \$2.2 million. We recommend the Technical Manager for Contract NAS9-18000 evaluate the current and future staffing needs for the DDC tape library."

Auditor's Recommendation and JSC Comments

Recommendation 1

"We recommend the Technical Manager of NAS9-18000 assess the current and future staffing needs for the DDC tape library. Appropriate staffing adjustments should be made to ensure DDC staffing levels do not exceed actual workload requirements."

JSC Comments

We concur with the recommendation. In addition to the routine, nonflight related support in building 423, the DDC must provide around-the-clock flight support in building 423 and building 30 from launch minus 12 hours to landing. Weekend flight support is staffed through overtime.

The DDC in building 423 is an extremely remote location. Concern over personal safety (e.g., medical emergencies) requires staffing the DDC with a minimum of two persons per shift. This also allows coverage for lunch and dinner breaks.

The workload of the third shift exceeds the workload of shifts one and two due to delivery of Orbiter Data Reduction Complex (ODRC) tapes for processing during third shift. Additionally, since OMNI documentation personnel are available for backup only during first and second shift, three personnel are required on third shift to cover both DDC-423 and DDC-30 during flights.

The Technical Manager has directed that the DDC staffing levels be reduced from 10 personnel to 7 personnel during periods of routine operation. An additional 2 capable DDC librarians must be available "on call" from the OMNI documentation personnel to handle the workload during missions. The staffing levels, by shift and facility, are as follows:

Enclosure

	<u>NON-FLIGHT PERIODS</u>	<u>FLIGHT PERIODS</u>	
	DDC-423	DDC-423	DDC-30
Shift 1	2	2	1
Shift 2	2	2	1
Shift 3	3	2	1
	<hr/>	<hr/>	<hr/>
<u>TOTALS</u>	7	6	3

2. Tape Retention Policies and Procedures

Auditor's Findings

"JSC has not established retention policies and procedures for flight data tapes. Consequently, many tapes have remained in the DDC library for excessive periods of time. We estimated potential cost savings of approximately \$211,000 could be realized by cleaning, recertifying, and reusing unneeded magnetic tapes. We recommend that specific retention policies and procedures for flight data tapes be developed and implemented.

Auditor's Recommendation and JSC Comments

Recommendation 2

"We recommend the Director, National Space Transportation System Program Office develop retention policies and procedures for flight data tapes. This effort should be coordinated with other JSC organizations, such as the Mission Operations and Engineering Directorates. Appropriate procedures should be implemented to ensure: (1) the continued storage of flight data tapes are fully justified; and (2) unneeded tapes are cleaned, recertified, and reused whenever possible."

JSC Comments

We concur with the recommendation. A policy for the retention and reuse of flight data tapes will be developed and documented in the Space Shuttle Program (SSP) baseline requirements, specifically in "NSTS 07700, Volume V, Information Management." This means the policy will apply to all flight data tapes at JSC as well as at MSFC and KSC. The process by which such policy/requirements are adopted calls for the submission and acceptance of a Change Request through the Program Requirements Control Board. Due to the time that it may take to process such a Change Request and to ensure that it is appropriate for all Centers associated with the SSP, an interim policy, applying specifically to the Data Distribution Center at JSC, will be developed and distributed in letter form. It is anticipated that this policy will be issued by March 30, 1990.

A-JS-91-008

**AUDIT
REPORT**

**AUDIT OF ORBITER PRODUCTION
PHASEDOWN ACTIVITIES**

JOHNSON SPACE CENTER

September 30, 1992

NASA
National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL



National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of

W

September 30, 1992

TO: M/Associate Administrator for Space Flight

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report on Audit of Orbiter Production Phasedown
Activities, Report No. A-JS-91-008

We have completed an audit of Orbiter Production Phasedown Activities. Our final report is enclosed.

The objectives of the audit were to evaluate: (1) the adequacy and effectiveness of JSC's management of Orbiter production activity; (2) decisions for identifying critical skills and level of effort needed to support minimum Orbiter production requirements; (3) Government property accountability, storage, shipment, and/or release; and (4) management actions to determine whether or not Orbiter property and facilities could be utilized in the Space Station Freedom Program.

The results of audit showed that additional management actions are needed to ensure the Government does not incur unnecessary costs during Orbiter Production Phasedown activities. We issued a February 7, 1992, draft interim report to you that disclosed: (1) NASA can save \$50 million annually in occupancy costs and avoid approximately \$55.5 million for planned facility improvements by closing the Downey, California plant; and (2) eight Fiscal Year 1991 facility projects valued at \$5.3 million were not necessary. The Office of Space Flight expressed general agreement with the three report recommendations in our draft interim report. The final interim report, dated April 10, 1992, and related NASA Headquarters' comments are presented as Appendix A. Additionally, we noted management actions are needed to: (1) reassess the need for an entire set of structural spares; (2) convert the option for structural spares to a cost-plus-award-fee contract; and (3) develop a program for Orbiter post production support to maintain critical skills. Based on the Office of Space Flight's reassessment of the structural spares program, we estimate that NASA will avoid \$220 to \$325 million by revising the content of this program.

NASA management concurred with the six report recommendations. NASA Headquarters and JSC written responses are presented after each recommendation and are included in their entirety as Appendices B and C, respectively, in this final report. The Office of Space Flight requested closure on Recommendations 1,2,3,4, and 6. However, we plan to evaluate actions taken to phase out the Downey facility, to realign the structural spares program, and to develop a program for Orbiter post production support before agreeing to close these recommendations. In accordance with the Office of Inspector General's revised audit follow-up policy, we request to be included in the concurrence cycle for closing all of the recommendations.

Richard J. Pelletier

Enclosure

cc:

JM-1/J. Troupe

JSC-AA/A. Cohen (w/o encl.)

JSC-BY/L. Sullivan (w/o encl.)

W/P. Smith (w/o encl.)

Office of Inspector General

Johnson Space Center
Houston, TX 77058



Reply to Attn of:
W

September 30, 1992

TO: Johnson Space Center
Attn: AA/Director

FROM: W/OIG Center Director, JSC

SUBJECT: Final Report on Audit of Orbiter
Production Phasedown Activities
A-JS-91-008

We have completed an audit of Orbiter production phasedown activities. Our final report is enclosed.

The objectives of the audit were to evaluate: (1) the adequacy and effectiveness of JSC's management of Orbiter production activity; (2) decisions for identifying critical skills and level of effort needed to support minimum Orbiter production requirements; (3) Government property accountability, storage, shipment, and/or release; and (4) management actions to determine whether or not Orbiter property and facilities could be utilized in the Space Station Freedom Program.

The results of audit showed that additional management actions are needed to ensure the Government does not incur unnecessary costs during Orbiter production phasedown activities. We issued a February 7, 1992, draft interim report to you that disclosed: (1) NASA can save \$50 million annually in occupancy costs and avoid approximately \$55.5 million for planned facility improvements by closing the Downey, California plant; and (2) eight Fiscal Year 1991 facility projects valued at \$5.3 million were not necessary. The Office of Space Flight expressed general agreement with the three report recommendations in our draft interim report. The final interim report, dated April 10, 1992, and related NASA Headquarters' comments are presented as Appendix A. Additionally, we noted management actions are needed to: (1) reassess the need for an entire set of structural spares; (2) convert the option for structural spares to a cost-plus-award-fee contract; and (3) develop a program for Orbiter post production support to maintain critical skills. Based on the Office of Space Flight's reassessment of the structural spares program, we estimate that NASA will avoid \$220 to \$325 million by revising the content of this program.

NASA management concurred with the six report recommendations. NASA Headquarters and JSC written responses are presented after each recommendation and are included in their entirety as Appendices B and C, respectively, in this final report. We consider all report recommendations to be significant. Consequently, we request to be included in the JSC and Headquarters concurrence cycle for closing all recommendations.

W. Preston Smith

Enclosure

cc: HQs-W/Assistant Inspector General for Auditing
JSC-BY/Chief, Management Analysis Office

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	4
III.	OBJECTIVES AND SCOPE	5
IV.	OBSERVATIONS AND RECOMMENDATIONS	6
	1. Reevaluate Need for Entire Set of Structural Spares	7
	2. Convert Structural Spares Contract Option to Award Fee	11
	3. Develop Program for Orbiter Post Production Support to Maintain Critical Skills	15
V.	GENERAL COMMENTS	18
EXHIBIT I	Structural Spares	
APPENDIX A	Final Interim Report and NASA Headquarters' Comments on Audit of Orbiter Production Phasedown Activities	A-1
APPENDIX B	NASA Headquarters' Response, Associate Administrator for Space Flight, dated September 16, 1992	B-1
APPENDIX C	JSC's Response, dated September 16, 1992	C-1

ACRONYMS

CPAF	Cost-Plus-Award-Fee
CPIF	Cost-Plus-Incentive-Fee
FY	Fiscal Year
JSC	Johnson Space Center

AUDIT OF ORBITER PRODUCTION PHASEDOWN ACTIVITIES

JOHNSON SPACE CENTER (JSC)

DigestIntroduction

The purpose of the audit was to assess overall NASA and contractor planning and actions related to Orbiter production phasedown. The specific objectives of the audit were to evaluate: (1) the adequacy and effectiveness of JSC's management of Orbiter production activity; (2) decisions for identifying the critical skills and level of effort needed to support minimum Orbiter production requirements; (3) Government property accountability, storage, shipment, and/or release; and (4) management actions to determine whether or not Orbiter property and facilities could be utilized in the Space Station Freedom program.

Results of Audit

NASA management actions are needed to ensure the Government does not incur unnecessary costs during Orbiter production phasedown activities. However, the Agency has initiated actions to identify and evaluate facilities and equipment used during Orbiter production. Rockwell International has been tasked with long-term planning for Orbiter production property disposition. The effort includes simultaneous assessment of property and equipment, facilities, and documentation. Completion is scheduled for September 1992.

We issued a February 7, 1992, draft interim report that disclosed: (1) NASA can save \$50 million annually in occupancy costs and avoid approximately \$55.5 million for planned facility improvements by closing the Downey, California plant; and (2) eight Fiscal Year 1991 facility projects valued at \$5.3 million were not necessary. The Office of Space Flight expressed general agreement with the three report recommendations in our draft interim report. The final interim report, dated April 10, 1992, and related NASA Headquarters' comments are presented as Appendix A to this report.

Additionally, we noted that management actions are needed to: (1) reassess the need for an entire set of structural spares; (2) convert the option for structural spares to a cost-plus-award-fee (CPAF) contract; and (3) develop a program for Orbiter post production support to maintain critical skills.

These areas are discussed in the "Observations and Recommendations" section of this report and summarized in the following paragraphs.

1. Reevaluate Need for Entire Set of Structural Spares

There is not a mission requirement for an entire set of structural spares. Historically, structural spares have only been used to build an Orbiter. Currently, there are no plans to build an additional Orbiter. Due to funding constraints, the original negotiated target price of \$375 million and delivery date of June 1994 are no longer realistic. Based on current estimates, the cost to NASA at completion will be between \$619 million and \$766 million depending upon which funding profile is used. The estimated delivery date is between 1998 and 2000. This represents a \$244 million to \$391 million increase in cost and an additional four to six years to complete structural spares. We estimate that by cancelling the structural spares contract option, NASA can avoid between \$471 and \$618 million of planned costs to complete spare production. We recommended the Associate Administrator for Space Flight reassess the need for the entire set of structural spares due to the increased cost, delivery schedule stretch-out, and lack of mission requirement. The Office of Space Flight agreed with the recommendation and has reassessed the content of structural spares. As a result of this reassessment, NASA will avoid between \$220 and \$325 million. (Page 7)

2. Convert Structural Spares Contract Option to Award Fee

The structural spares option under contract NAS9-17800 with Rockwell International is not functioning as intended and, if structural spares continue to be built, should be converted to a CPAF type contract. The structural spares contract option was negotiated as a cost-plus-incentive-fee (CPIF) type contract and was exercised in November 1989. The contract option provided for a predetermined formula where fee increases if the total allowable cost is less than the negotiated target cost and fee decreases when total allowable cost exceeds the negotiated amount. A CPIF contract is designed to motivate a contractor to control contract costs. However, three NASA funding constraints have impacted the contractor's ability to manage contract costs and contributed to cost growth and schedule stretch-outs. As of April 1992, NASA had not negotiated revised targets for assessing contractor performance. Since target costs were not established, the contractor was automatically receiving the originally negotiated target fee of nine percent. Consequently, performance had no impact on fee, and although the structural spares option was negotiated as a CPIF type contract, it is not working as intended to control costs. We believe that NASA should convert the structural spares contract option to a CPAF contract. An award fee contract is appropriate when the

funding profile is not stable. Further, this type of contract would use periodic evaluations to foster effective communications and measure the contractor's performance. We recommended the Contracting Officer convert the option for structural spares on contract NAS9-17800 from CPIF to CPAF when the contract is modified to account for the impact of the funding constraints. JSC concurred with the recommendation and plans to enter into negotiations to effect the recommended changes when the technical content for continuation of the structural spares program is more precisely defined. (Page 11)

3. Develop Program for Orbiter Post Production
Support to Maintain Critical Skills

NASA has not developed a program for Orbiter post production support to maintain the critical skills and staffing needed to support the Orbiter fleet through the year 2020. At the direction of the JSC Orbiter and GFE Projects Office, Rockwell performed a study and, in August 1991, reported a need for 19 functions staffed with 373 equivalent personnel in manufacturing. After Rockwell's presentation, the JSC Orbiter and GFE Projects Office accepted the contractor's plan. Although funding was not provided to directly support the critical skills identified in this study, current production activity is being used to retain these skills. We recommended the Associate Administrator for Space Flight identify minimum Orbiter production requirements and develop a plan for post production support of the Orbiter fleet. The assessment of critical skills and staffing should be performed by NASA, or if assistance is required from Rockwell, the contractor's data should be adequately reviewed and evaluated. The Office of Space Flight agreed with the recommendation. (Page 15)

INTRODUCTION

The Office of Inspector General has completed an audit of the Orbiter production phasedown activities. This audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions 9910.1A and 1103.27B, dated June 16, 1989, and January 31, 1990, respectively.

In July 1991, the National Space Council announced a new National Space Launch Strategy where NASA will not build any additional Orbiters but will maintain the existing fleet. According to the JSC Center Director:

"The Space Shuttle will remain operational well into the next century and the present four-shuttle fleet can serve all of our plans for the next decade and beyond including those for the Space Station Freedom program. The new space strategy supports extending the lifespan of the shuttle fleet, the production of spare parts and maintaining the inherent capability for Shuttle support or production in the event of an orbiter loss. The development of other vehicles to supplement our national launch capability has long been contemplated, but the Shuttle and our mission operations based on it will remain central to the manned space program for many years to come."

The final Orbiter (OV-105) has been delivered to NASA, and only structural spares remain to be completed. In November 1989, NASA exercised modification number 33 to contract NAS9-17800 for the production of Orbiter structural spares. The structural spares option was negotiated as a cost-plus-incentive-fee (CPIF) contract where fee was calculated by a predetermined formula. The contract established a \$344 million target cost and \$31 million target fee. NASA is committed to flying the Shuttle through year 2020. After production ceases, NASA will have to rely on some minimum skill level for post production support.

A discussion draft report was provided to NASA management on July 27, 1992, and an exit conference with Office of Space Flight and JSC officials was held on August 12, 1992. Necessary report changes resulting from the exit conference were included in the draft report, dated August 21, 1992. The NASA Headquarters and JSC responses are included as Appendices B and C, respectively, in this final report.

OBJECTIVES AND SCOPE

The objectives of the audit were to evaluate: (1) the adequacy and effectiveness of JSC's management of Orbiter production activity; (2) decisions for identifying the critical skills and level of effort needed to support minimum Orbiter production requirements; (3) Government property accountability, storage, shipment, and/or release; and (4) management actions to determine whether or not Orbiter property and facilities could be utilized in the Space Station Freedom program. The scope of the audit included NASA, as well as contractor, planning for Orbiter production phasedown. Field work was performed at Rockwell International, Downey, California; Air Force Plant No. 42, Site 1, Palmdale, California; and Johnson Space Center during August 1991 through April 1992.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances.

Our audit was limited to an examination of NASA, as well as contractor, planning for Orbiter production phasedown activities. Accordingly, we express no opinion on NASA's system of internal controls taken as a whole.

As part of this audit, a final interim report concerning facility issues was issued to NASA Headquarters on April 10, 1992. Recommendations 1, 2, and 3 are included in the interim report. The final interim report and related NASA Headquarters' comments are presented in Appendix A.

OBSERVATIONS AND RECOMMENDATIONS

NASA has initiated some Orbiter production phasedown activities. The Director, Space Shuttle and Director, Space Station Freedom have led an effort to examine the feasibility of establishing common design and developmental efforts for planned similar program flight hardware between Space Shuttle Program and Space Station Freedom Program. Additionally, the Agency has taken actions to identify and evaluate facilities and equipment used during Orbiter production. Rockwell International has been tasked with long-term planning for Orbiter production property disposition. The effort includes simultaneous assessment of property and equipment, facilities, and documentation. NASA approval of the results of each stage is required. The status of NASA's and Rockwell's progress in each area of their assessment through April 3, 1992, is presented below.

<u>DESCRIPTION</u>	<u>PERCENT COMPLETE</u>
<u>Property and Equipment</u>	
-- Identify Property	52
-- Retention Analysis	50
-- Decide What NASA Keeps	0
-- Assess Storage Requirements	15
-- Implement Storage Plan	0
<u>Facilities:</u>	
-- Identify Facilities	55
-- Assess Maintenance Requirements- Routine and Special	50
-- Disposition-Keep, Standdown, Abandon	12
<u>Documentation:</u>	
-- Identify Documents	79
-- Storage Plan	68

Completion of this effort is scheduled for September 1992. Although some actions may be taken during the planning effort, the actual performance of disposition and closeout will be directed upon conclusion of the planning effort.

However, we noted that NASA management actions are needed to ensure the Government does not incur unnecessary costs during Orbiter production phasedown activities. On February 7, 1992, we issued a draft interim report that disclosed: (1) NASA can save \$50 million annually in occupancy costs and avoid approximately \$55.5 million for planned facility improvements by closing the Downey, California plant; and

(2) eight Fiscal Year (FY) 1991 facility projects valued at \$5.3 million were not necessary. The Office of Space Flight expressed general agreement with the three report recommendations in our draft interim report. The final interim report, dated April 10, 1992, and related NASA Headquarters' comments are presented as Appendix A.

Additionally, we noted that management actions are needed to: (1) reassess the need for an entire set of structural spares; (2) convert the option for structural spares to a cost-plus-award-fee (CPAF) contract; and (3) develop a program for Orbiter post production support to maintain critical skills. These areas are discussed in the following paragraphs.

1. Reevaluate Need for Entire Set of Structural Spares

There is not a mission requirement for an entire set of structural spares. Historically, structural spares have only been used to build an Orbiter. Currently, there are no plans to build an additional Orbiter. Due to funding constraints, the original negotiated target price of \$375 million and delivery date of June 1994 is no longer realistic. Based on current estimates, the cost to NASA at completion will be between \$619 million and \$766 million depending upon which funding profile is used. The estimated delivery date is between 1998 and 2000. This represents a \$244 million to \$391 million increase in cost and an additional four to six years to complete structural spares. We estimate that by cancelling structural spares contract option, NASA can avoid between \$471 and \$618 million of planned costs to complete spares production.

The National Space Council, chaired by the Vice President, developed and released the National Space Launch Strategy dated July 24, 1991. It states:

"...As the nation is moving toward development of a new space launch system, the production of additional Space Shuttle orbiters is not planned. The production of spare parts should continue in the near term to support the existing Shuttle fleet and to preserve an option to acquire a replacement orbiter in the event of an orbiter loss or other demonstrable need...."

It further states:

"...The Department of Defense and the National Aeronautics and Space Administration will undertake the joint development of a new space launch system to meet civil and national security needs.... While initially unmanned, the new launch system will be designed to be "man-rateable" in the future.... The development program will be structured in the near

term toward the goal of a first flight in 1999.... Final decisions on the program schedule, including the date of the first flight, will be made during fiscal year 1993, based on updated requirements and technical and budgetary considerations at that time...."

NASA has established a goal to cut the Space Shuttle Program's budget by 15 percent. The target is to reduce the budget by three percent each year over the next five years.

An entire set of structural spares may not be useful as replacement parts for the Orbiter fleet. According to the Orbiter and GFE Projects Office, structural spares have never been used to correct a problem on an Orbiter. They stated, "...We have used detailed parts (e.g., tubes, wire harnesses, ducts, etc.), but nothing like a wing or a payload door...." Some of the structural spares, such as the wings and the fore, mid, and aft fuselages, are only needed if NASA builds another Orbiter.

According to the Orbiter and GFE Projects Office, there are a number of primary purposes and benefits associated with the Structural Spares Program. In their opinion, production of structural spares is a good idea because: (1) it reduces the lead-time to build an Orbiter vehicle; (2) there is a reasonable probability that a component of structural spares will be needed before Space Station is completed; and (3) it preserves the capability to build upgrades and to perform structural repairs.

Structural spares manufactured under contract NAS9-14000 were used on OV-105. However, NASA does not plan to build any additional Orbiters. The structural spares contract option to NAS9-17800 was exercised in November 1989 prior to the decision in 1991 not to produce an additional Orbiter. However, the Orbiter Projects Office has not received any direction from the Office of Space Flight that funds for an additional Orbiter will not be requested at some future date.

Conclusion

NASA will incur unnecessary costs for the production of structural spares that are not needed by the Agency. Due to funding constraints, the cost of structural spares has significantly increased from the amount originally negotiated and the delivery schedule will be extended. The current impact of the funding constraints has not been proposed and negotiated; therefore, we do not know the exact cost impact. However, based on current estimates, the cost to NASA at completion will be between \$619 and \$766 million depending upon

which funding profile is used. Estimated delivery date is between 1998 and 2000. This represents a \$244 million to \$391 million increase in cost and additional three to five years to complete structural spares.

We estimate NASA could save between \$471 and \$618 million by cancelling the structural spares contract option. As of June 1992, NASA had incurred approximately \$148 million for the cost and fee associated with the production of structural spares. Based on the current estimates for completion between \$619 and \$766 million, NASA will save between \$471 and \$618 million if no additional costs are incurred. This estimated cost savings did not include consideration of termination costs, which were not known at the time of our review. Since there is no mission requirement for the entire set of structural spares and the cost has significantly increased, NASA should reevaluate the need for structural spares.

RECOMMENDATION 4

We recommended the Associate Administrator for Space Flight reassess the need for the entire set of structural spares due to the increased cost, delivery schedule stretch-out, and lack of mission requirement.

MANAGEMENT RESPONSE

The Office of Space Flight has reassessed the content of structural spares. This was performed during the FY 1994 budget process. Significant reductions were achieved by revising the content to include only major components susceptible to damage, i.e.; Landing Gear doors, External Tank disconnect doors, Payload Bay doors, and Orbiter control surfaces. At the same time, some fleet improvements will be produced. The three major goals of the structural spares program are:

1. Augment production skills to keep fleet flying.
2. Acquire major replaceable structure components.
3. Maintain minimum manufacturing capability to produce another Orbiter.

EVALUATION OF MANAGEMENT RESPONSE

The Office of Space Flight's comments are responsive to the report recommendation. Significant components, such as the fuselages and crew module, have been deleted from the revised structural spares content. Since the structural spares content was recently revised, NASA has not developed an estimated cost at completion for the revised content. However, we determined from discussions with JSC Orbiter and GFE Projects Office officials that NASA plans to spend \$35 million per year for revised structural spares for FYs 1993 through 1996. By

comparing the current funding profile of \$35 million per year with the funding profiles required to produce the originally planned set of structural spares, we determined that NASA will save \$220 to \$325 million by revising the content of the structural spares program. This estimate does not include termination costs, if any, associated with revising the content of the structural spares program.

2. Convert Structural Spares Contract Option to Award Fee

The structural spares option under contract NAS9-17800 with Rockwell International is not functioning as intended and, if structural spares continue to be built, should be converted to a CPAF type contract. The structural spares contract option was negotiated as a CPIF type contract and was exercised in November 1989. The contract option provided for a predetermined formula where fee increases if the total allowable cost is less than the negotiated target cost and fee decreases when total allowable cost exceeds the negotiated amount. A CPIF contract is designed to motivate a contractor to control contract costs. However, three NASA funding constraints have impacted the contractor's ability to manage contract costs and contributed to cost growth and schedule stretch-outs. As of April 1992, NASA had not negotiated revised targets for assessing contractor performance. Since target costs were not established, the contractor was automatically receiving the originally negotiated target fee of nine percent. Consequently, performance had no impact on fee, and although the structural spares option was negotiated as a CPIF type contract, it is not working as intended to control costs. We believe that NASA should convert the structural spares contract option to a CPAF contract. An award fee contract is appropriate when the funding profile is not stable and would use periodic evaluations to foster effective communications and measure the contractor's performance.

The option for structural spares was exercised as modification number 33 to contract NAS9-17800. Rockwell International was to manufacture, test, and deliver structural spares (see Exhibit I) which consisted of:

- upper forward fuselage;
- crew module;
- airlock;
- forward RCS module;
- lower forward fuselage;
- mid fuselage;
- payload bay doors;
- vertical stabilizer;
- OMS pods;
- body flap;
- aft fuselage;
- wings;
- feedlines (MPS); and
- mating hardware.

NASA and Rockwell agreed the target price for providing structural spares would be \$375 million. Target price consisted of \$344 million target cost plus \$31 million target fee at nine percent of cost. Fee was to increase by 20 cents for every dollar that total allowable cost was under the target cost and decrease 20 cents for every dollar that

total allowable cost was above \$365 million. Minimum fee was \$14.62 million at 4.25 percent and maximum fee was \$41.28 million at 12 percent. The completion date was June 30, 1994. While a specific funding profile was not negotiated, approximate funding requirements were:

<u>FISCAL YEAR</u>	<u>FUNDING REQUIREMENTS</u>
1989	\$ 2 Million
1990	34 Million
1991	69 Million
1992	129 Million
1993	95 Million
1994	<u>15 Million</u>
 TOTAL	 <u>\$344 Million</u>

A CPIF contract is a cost-reimbursement contract with fee that is adjusted by a formula in accordance with the relationship between total allowable cost and target cost. Initially, there is negotiated a target cost, target fee, minimum and maximum fee, and fee adjustment formula. Final fee is determined in accordance with the formula after completion of the contract. Final fee will exceed target fee when total allowable cost is less than target cost and, conversely, final fee will be less than target fee when total allowable cost exceeds a negotiated amount.

The contract is operating as a fixed-fee type contract because the negotiated target cost is no longer realistic due to funding constraints. To date, there have been three funding constraints as summarized below.

February 4, 1991	FY 1991	\$70.5 million
	FY 1992	\$78.3 million
October 28, 1991	FY 1992	
	1st quarter	\$15.0 million
December 24, 1991	FY 1992	\$44.7 million

According to the Contracting Officer, incentive-fee type contracts do not benefit the Government when there are funding constraints because targets keep changing. Incentive-fee type contracts should be used when there is a clearly defined statement of work and stable funding profile. However, FY 1992 funding for structural spares is about \$84 million less than funding requirements for the negotiated contract and future funding is uncertain.

An award-fee type contract requires NASA to evaluate various aspects of contractor performance to arrive at an appropriate fee. Federal Acquisition Regulation 16.404-2, CPAF contracts, states:

"A cost-plus-award-fee contract is a cost-reimbursement contract that provides for a fee consisting of (1) a base amount fixed at inception of the contract and (2) an award amount that the contractor may earn in whole or in part during performance and that is sufficient to provide motivation for excellence in such areas as quality, timeliness, technical ingenuity, and cost-effective management. The amount of the award fee to be paid is determined by the Government's judgmental evaluation of the contractor's performance in terms of the criteria stated in the contract.... Cost-plus-award-fee contracts shall provide for evaluation at stated intervals during performance, so that the contractor will periodically be informed of the quality of its performance and the areas in which improvement is expected. Partial payment of fee shall generally correspond to the evaluation periods. This makes effective the incentive which the award fee can create by inducing the contractor to improve poor performance or to continue good performance...."

According to the Contracting Officer, award-fee type contracts should be used when changes are anticipated, funding profile is not stable, and active communications between contractor and NASA management are desired.

Conclusion

Since there are funding constraints on the contract, the incentive-fee is not serving its intended purpose. NASA has not been able to renegotiate the contract for structural spares; therefore, NASA has no way to measure performance on the contract. In the meantime, Rockwell is being paid the target fee of nine percent without any adjustments for performance. Since funding is constrained by NASA, Rockwell is unable to earn incentive-fee greater than target fee. Conversely, NASA cannot penalize Rockwell for cost growth because they have not negotiated realistic targets based on current funding constraints and schedule stretch-outs.

RECOMMENDATION 5

We recommended the Contracting Officer convert the option for structural spares on contract NAS9-17800 from CPIF to CPAF when the contract is modified to account for the impact of the funding constraints.

MANAGEMENT RESPONSE

We concur with the recommendation and plans are to enter into negotiations with the contractor to effect the suggested change from a cost-plus-incentive-fee (CPIF) to a cost-plus-

award-fee (CPAF) contract when the technical content for continuation of the structural spares program is more precisely defined by Shuttle Program management. While we are in agreement that this change in contract type would be more beneficial to the Government, please be aware that such a change cannot be made until the programmatic decisions regarding Orbiter structural spares as discussed in recommendation 4 are resolved. Therefore, it is anticipated that this contract type conversion will not be initiated until March 31, 1993.

EVALUATION OF MANAGEMENT RESPONSE

The Center's comments are responsive to the report recommendation.

3. Develop Program for Orbiter Post Production Support to Maintain Critical Skills

NASA has not developed a program for Orbiter post production support to maintain the critical skills and staffing needed to support the Orbiter fleet through the year 2020. At the direction of the JSC Orbiter and GFE Projects Office, Rockwell performed a study and, in August 1991, reported a need for 19 functions staffed with 373 equivalent personnel in manufacturing. After Rockwell's presentation, the JSC Orbiter and GFE Projects Office accepted the contractor's plan. Although funding was not provided to directly support the critical skills identified in this study, current production activity is being used to retain these skills. Since production activity is decreasing, NASA should identify minimum Orbiter production requirements and develop a plan for post production support of the Orbiter fleet.

NASA is committed to flying the Shuttle through the year 2020. The Orbiter fleet will require post production support. Examples of post production support programs are presented below:

- The B1-B program provides post production support through a long-term planned product improvement program.
- The SR-71 maintained critical capabilities by continually upgrading with new technology and systems to meet new mission requirements.
- The Concorde used logistics procurements and similar vehicle production lines to maintain critical capabilities.

In August 1991, Rockwell presented to the Space Shuttle Program a plan for post production support to maintain critical capabilities in manufacturing. The plan provided for 373 personnel at an estimated FY 1992 cost of \$204 million. Rockwell also recommended that the post production support program be periodically reassessed to adjust for: (1) changes in the environment, such as new mission requirements; and (2) the need to continually review logistics requirements against subcontractor capabilities. The Orbiter and GFE Projects Office accepted Rockwell's plan and included funding for 373 critical skill positions in its funding request.

According to Rockwell International, minimum skills and critical skills are distinctively different terms. The Rockwell presentation to the Space Shuttle Program stated:

"Critical skill is simply: a specific, identifiable capability to do a specific task (i.e., TPS stress analysis)

A minimum skill level is time-related: assuming you have the critical skills available, how many people do you need to execute the given task in a specific amount of time?

The terms are not interchangeable"

The critical skill requirements defined by Rockwell in the August 1991 study were not funded in the FY 1992 Space Shuttle Program budget. Since funding for critical skills was not received, the Orbiter and GFE Projects Office does not plan to submit future budget requests for critical skill retention, but plans to request funding for production items to keep some production lines open. NASA has not committed to, or developed a plan to, address post production support of the Orbiter fleet. Current funding is based on the production of hardware and spare parts. Eventually, production will cease and NASA will have to rely on some minimum skill level.

Conclusion

The Office of Space Flight has not identified the minimum Orbiter production requirements. Clear goals and guidelines must be established to efficiently accomplish Orbiter production phasedown. According to JSC officials, production requirements must be established in order to determine the level of critical skills needed to support the Orbiter fleet. Consequently, the capability to provide critical flight support functions is disappearing and there is a growing response time to develop major upgrades.

RECOMMENDATION 6

We recommended the Associate Administrator for Space Flight identify minimum Orbiter production requirements and develop a plan for post production support of the Orbiter fleet. The assessment of critical skills and staffing should be performed by NASA or if assistance is required from Rockwell, the contractor's data should be adequately reviewed and evaluated.

MANAGEMENT RESPONSE

The Office of Space Flight, in conjunction with the Orbiter Project Office at JSC, has thoroughly reviewed and identified the minimum Orbiter production requirements. A plan has been developed to maintain the skills and capability to provide critical flight support functions, while staying within the budget guidelines. The critical skills at Rockwell will be supported through structural spares, fleet improvements, payload integration hardware, and other new efforts associated with Extended Duration Orbiter, and the future Shuttle/Mir rendezvous mission.

EVALUATION OF MANAGEMENT RESPONSE

The Office of Space Flight's comments are responsive to the recommendation. We will review the critical skill retention plan during our normal audit follow-up process.

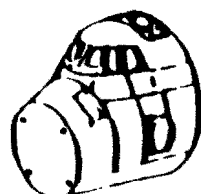
GENERAL COMMENTS

We appreciate the courtesy, assistance, and cooperation extended by JSC, NASA Headquarters, and contractor personnel contacted during this audit.

OV-106 — Structural Spares



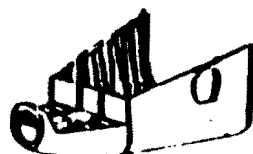
**UPPER FORWARD
FUSELAGE**
• SKIN STRINGER



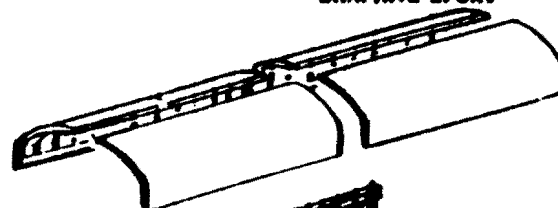
CREW COMPARTMENT
• FLOORING
• WELDED SKIN



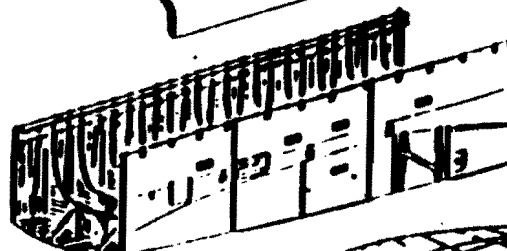
**FORWARD RCS
MODULE**
• SKIN STRINGER



**LOWER FORWARD
FUSELAGE**
• SKIN STRINGER



**PAYLOAD BAY
DOORS**
• 2 DOORS SPLIT
AT VERTICAL
• GRAPHITE EPOXY



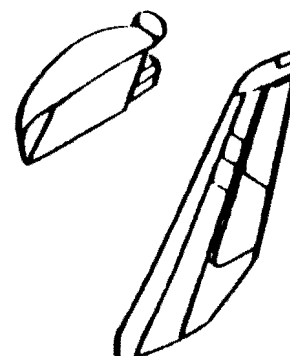
MID FUSELAGE
• SKIN STRINGER



ELEVONS

WING

- SKIN STRINGER COVERS
- WEB & TRUSS SPARS
- ELEVON HONEYCOMB COVERAGE
- CONVENTIONAL ALUMINUM STRUCTURE



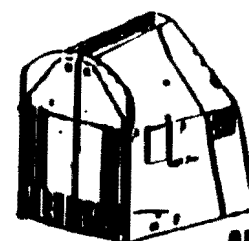
VERTICAL STABILIZER

- SKIN & STRINGER
- FIN COVERS
- HONEYCOMB RUDDER COVER
- MACHINED SPARS
- SHEET METAL RIBS



UMS / RCS

- SKIN-STRINGER
- GRAPHITE EPOXY & MILLED SKIN
- TITANIUM THERMAL BARRIER



AFT FUSELAGE

- INTEGRALLY MACHINED SKINS-SHELL
- TITANIUM / BORON EPOXY THRUST STRUCTURE
- ALUMINUM HONEYCOMB BASE HEAT SHIELD DOMES WITH THERMAL INSULATION
- INTEGRALLY MACHINED BASE HEAT SHIELD PANELS

BODY FLAP



I N T E R I M
**AUDIT
REPORT**

AUDIT OF ORBITER PRODUCTION PHASEDOWN ACTIVITIES

JOHNSON SPACE CENTER

April 10, 1992



OFFICE OF INSPECTOR GENERAL



National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Air of W

April 10, 1992

TO: M/Associate Administrator for Space Flight

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Interim Report on Audit of Orbiter Production
Phasedown Activities
A-JS-91-008

The Office of Inspector General is conducting an audit of Orbiter production phasedown activities at the Johnson Space Center (JSC). The purpose of the audit is to assess overall NASA, as well as contractor planning, and actions related to Orbiter production phasedown. The audit objectives are to evaluate: (1) the adequacy and effectiveness of JSC's management of Orbiter production activity; (2) decisions for identifying the critical skills and level of effort needed to support minimum Orbiter production requirements; (3) Government property accountability, storage, shipment, and/or release; and (4) management actions to determine whether or not Orbiter property and facilities could be utilized in the Space Station Freedom program. During our initial field work, the scope of work was limited to issues related to Government property and facilities utilization. Field work began on August 15, 1991, with detailed field work performed at Air Force Plant 42, Site 1, Palmdale, California, and Rockwell International, Downey, California.

Rockwell International, the Space Shuttle prime contractor, operates the NASA Industrial Plant (NIP) at Downey under JSC contract NAS7-300(F). This is a cost reimbursable contract for facilities in support of development and production of NASA vehicle and spacecraft systems. NIP facilities are a combination of 57 NASA-owned buildings, 28 Rockwell-owned buildings, and one leased building on a 211.5 acre site (see Exhibits I and II of the attached report). These buildings provide office, conference, computer, and technical facilities, as well as laboratories, manufacturing, and warehouse space.

The final Orbiter (OV-105) has been delivered to NASA, and only structural spares remain to be completed. In July 1991, the National Space Council announced a new National Space Launch Strategy which did not include production of any additional Orbiters. According to the JSC Center Director:

"The Space Shuttle will remain operational into the next century. The present four Shuttle fleet can serve all of our plans for the next decade and beyond, including those for the Space Station Freedom program. The new space strategy supports extending the life-span of the Shuttle fleet, the production of spare parts, and maintaining the inherent capability for Shuttle support or production in the event of an Orbiter loss. The development of other vehicles to supplement our national launch capability has long been contemplated, but the Shuttle and our mission operations based on it will remain central to the manned space program for many years to come."

Since there are no longer plans for producing any additional Orbiters, NASA should initiate production phasedown planning to ensure unnecessary program costs are prevented. Accordingly, management actions are needed to address the future status of Orbiter production facilities, and the storage or disposition of large amounts of Government-owned special test equipment and tooling used on the Shuttle program.

JSC is planning to conduct a study of Orbiter property disposition. However, we believe immediate actions are needed to reduce facility costs associated with the NIP at Downey. The audit results to date indicate that the Downey plant is no longer needed to support the Space Shuttle program. By closing the Downey facility, NASA could save \$50 million annually in occupancy costs and avoid approximately \$55.5 million for planned facility improvements in Fiscal Years 1992 through 1998. We also identified eight FY 1991 facility improvement projects valued at \$5.3 million which were not necessary. Specific conditions, their causes, and recommended actions are presented in the attached report and the accompanying exhibits.

A draft interim report was provided to your office on February 7, 1992. The Office of Space Flight expressed general agreement with the report recommendations. The Headquarters response, dated March 6, 1992, is summarized after each recommendation and is included in its entirety as Appendix A of this final interim report. This interim report will be incorporated into our overall report on Orbiter Production Phasedown.

for Richard J. Pellétier

Enclosures

cc:

NA-1/Troupe

JSC-AA/Cohen

JSC-BY/Sullivan

W/Smith

April 10, 1992

INTERIM REPORT ON
ORBITER PRODUCTION PHASEDOWN ACTIVITIES

Johnson Space Center

1. No Future Need for the NASA Industrial Plant at Downey

According to the National Launch Strategy developed by the National Space Council, no additional Orbiters are planned to be built. As a result, the NASA Industrial Plant at Downey, California, is no longer needed to support the Space Shuttle program. The Downey facility was needed during Orbiter production, but it is not required for the sustaining engineering activities associated with operating the existing Orbiter fleet. We estimate that by closing the Downey facility, NASA can reduce future occupancy costs by \$50 million annually, and avoid \$55.5 million of planned facility improvements in Fiscal Years (FYs) 1992 through 1998. We also noted that the Downey facility is not currently being fully utilized.

a. Occupancy Costs for the Downey Facility

Occupancy costs are defined by the Rockwell International Accounting Manual as: (1) purchased services for utilities and power; (2) depreciation and amortization of property, plant, and equipment; and (3) miscellaneous expenses. Examples include insurance, taxes, heat, light, guard services, and maintenance expenses.

During September 1991, we met with Rockwell officials from the Financial Accounting, Accounts Assignment, and Property Division to determine the occupancy costs associated with the Downey facility. According to these officials, Rockwell distributes total occupancy costs to various overhead pools for the Space Systems Division's Downey and Palmdale facilities based on square footage utilized. Subsequently, the occupancy costs in these overhead pools are allocated to Space Systems Division contracts based on direct labor hours.

We requested a listing of occupancy costs by contract for FY 1990 to determine the exact amount of occupancy costs charged to NASA contracts. The Manager, Financial Accounting, Accounts Assignment, and Property Division was unable to provide the requested information for the 24 General Support Services overhead pools. However, he provided an occupancy cost breakdown by contract for the Administrative, Manufacturing, Engineering, and Material overhead pools. Based on this data, we determined that \$34.58 million of the

\$35.83 million (approximately 97 percent) occupancy costs in those four overhead pools bases were charged to NASA contracts. Furthermore, since these four overhead pools comprise 79 percent of the total occupancy costs, we concluded that the remaining costs would be allocated in the same percentages. Accordingly, our analysis showed that \$43.8 million of the \$45.4 million total occupancy costs were charged to NASA contracts during FY 1990.

Occupancy costs for the Space Systems Division have increased progressively between FY 1986 and FY 1991. The following chart illustrates the significant growth in occupancy costs.

SCHEDULE OF SPACE SYSTEMS DIVISION OCCUPANCY COSTS
(Dollars in Millions)

<u>FISCAL YEAR</u>	<u>TOTAL OCCUPANCY COSTS</u>	<u>AMOUNT CHARGED TO NASA CONTRACTS*</u>
1986	\$31.8	\$30.7
1987	34.2	33.0
1988	39.6	38.2
1989	43.5	42.0
1990	45.4	43.8
1991	56.5**	54.5

* Based on our computation that approximately 97 percent of the FY 1990 occupancy costs were charged to NASA contracts.

** The total FY 1991 occupancy costs were not available when our field work was performed. The \$56.5 million amount was based on actual costs for the period October 1990 through August 1991 and an estimate of the September 1991 occupancy costs.

Exhibit III illustrates graphically how occupancy costs have increased during the last five years. The graph shows a steep increase in occupancy costs between 1990 and 1991; a period when OV-105 production was completed and the overall production effort was decreasing.

b. Planned Construction of Facility (Coff) Projects

In addition to the annual occupancy costs that NASA reimburses Rockwell through overhead charges, several Coff projects are planned at Downey. NASA has budgeted \$27.3 million for three projects during FY 1994. These projects are as follows:

<u>Description</u>	<u>FY 1994 Estimated Cost</u>
Earthquake Protection for Building 1	\$14.7 Million
Air Conditioning Upgrades for the Downey Site	\$10.6 Million
Roof Drains for Building 1	<u>\$ 2.0 Million</u>
Total Planned Projects	<u>\$27.3 Million</u>

As stated in our draft interim report, dated February 7, 1992, NASA could avoid the cost of the three Coff projects shown above. However, on March 13, 1992, we determined that several additional Coff projects were planned for the Downey facility. We found that 27 Coff projects were planned for FY 1992 through 1998. The total estimated cost for these projects is \$55.5 million (see Exhibit IV). Consequently, the potential cost avoidance associated with this audit observation is \$55.5 million. We believe NASA should evaluate the continued need for the Downey facility before allocating funds for any Coff projects.

c. Utilization of the Downey Facility

During September 24 through 26, 1991, we met with Rockwell Facilities and Industrial Resources Engineering officials and toured the Downey facility. Our purpose was to observe the uses and general condition of buildings and equipment, and to determine whether the facilities were being utilized efficiently. Our general observations were as follows:

- Building 1 was being used primarily for office space. However, we observed that large areas were used for temporary storage, and the Machine Shop, Special Projects Assembly Area, and Wire Harness Assembly Area had little or no activity. We also noted that a high percentage of desks were empty, equipment was idle, and personnel did not appear to be productively working. Overall, office space appeared significantly underutilized.
- Production type facilities, such as Building 10, Paint Services; Building 25, Chemicals; Building 41, Shops, Wood Mock-Up, Heat Treatment, and Paint; Building 61, Upholstery Shop; Building 287, Dip Tanks, Painting, and Honey Comb Bonding; and Building 277, Dip Tanks and Foam Operations appeared underutilized and very few employees were present. The majority of the equipment and buildings were observed to be idle.
- Building 750, Professional Development Facility, appeared underutilized with little or no activity.

- Pads 3 and 4 are outside storage areas. These pads are used to store large quantities of equipment and tooling. Items did not have property tags or the tags could not be seen. Grass was growing uncontrolled around certain items which, according to Rockwell officials, had been stored for as long as a year. Many of the equipment items were obsolete, showing virtually no signs of being productively used.
- Building 4, a Rockwell-owned building used for simulation and laboratory activities, appeared generally inactive. Many of the rooms were not occupied.
- In Building 290, personnel were working on Extended Duration Orbiter components. This high bay area contained a large amount of specialized tooling. Although some work was being performed, overall activity in the building was at a minimum level.
- For Building 288, which contained miscellaneous items of equipment, no activity was observed.
- Building 305, a Rockwell-owned building, appeared productively utilized. Major renovations for earthquake protection were recently made to this building.

Our overall observation was that most buildings were not being fully utilized, equipment was obsolete and idle, and personnel were not working at their full capacity.

d. Conclusion

Rockwell's major responsibility has shifted from Orbiter production to sustaining engineering. Generally, only office space and computer support are necessary for performing sustaining engineering activities. The production facilities at Downey are not necessary for sustaining engineering.

In our opinion, there are several alternative locations for conducting Orbiter sustaining engineering activities. Possible alternative locations include:

- (1) Palmdale, CA - Although Palmdale is an Air Force facility, it has been used to support Orbiter operations for many years. Also, NASA's Memorandum of Understanding with the Air Force requires that Palmdale be used as a production or operational facility. Furthermore, according to the NASA Resident Manager at Palmdale, office space for 1,200 to 1,500 employees could be made available for use.

- (2) Kennedy Space Center (KSC). - KSC is already responsible for Orbiter logistics and support. In addition, NASA recently announced that future Orbiter structural modifications and inspections will be performed at the Orbiter Processing Facility at KSC. NASA is also in the process of consolidating Space Shuttle management at KSC. In the "NASA Roles and Mission Report" issued during November 1991, the former NASA Deputy Administrator recommended that Shuttle management Levels I and II be consolidated at KSC and that the element prime contractors perform hands-on at KSC. On December 30, 1991, the NASA Administrator approved the recommended consolidation, and stated that the planned management transition will also include "...program engineering functions with an eye toward consolidation and cost-saving efficiencies. Both civil servant and contractor engineering functions will be addressed."
- (3) JSC - Johnson has primary responsibility for managing and operating the Orbiter fleet. The Orbiter and Government Furnished Equipment (GFE) Projects Office is located at JSC. In addition, the JSC Engineering Directorate and the Safety, Reliability, and Quality Assurance Office have major management and oversight responsibilities for the Orbiter. Locating Orbiter sustaining engineering with existing management organizations at JSC could have numerous advantages.
- (4) It may also be feasible to lease office space in the Downey, California, area. Although we have not assessed leasing costs in this area, we believe sufficient space could be acquired for much less than the current occupancy costs for the Downey facility.

We recognize that moving the sustaining engineering function would result in one-time costs for obtaining new offices and possibly relocating employees. Nevertheless, since NASA plans to operate the Orbiter fleet through the year 2020, sustaining engineering activities should be performed at the most efficient and economical location.

The Downey facility is very expensive to operate and maintain, and there is no programmatic requirement for performing Orbiter sustaining engineering at the Downey plant. Additionally, the Shuttle program is experiencing severe budget constraints. The FY 1992 NASA budget request submitted to Congress was reduced from \$15.7 billion to \$14.3 billion. Congress eliminated \$330 million from Space Shuttle operations

and informed NASA that future budget increases will only reflect adjustments for inflation. NASA has also been directed to reduce spending on the Space Shuttle program by three percent annually for the next five years. Ensuring Orbiter sustaining engineering is accomplished in the most economical manner would greatly help NASA meet current and future funding constraints.

We estimate NASA could save approximately \$50 million annually in occupancy costs and avoid \$55.5 million of planned Coff facility improvements by closing the Downey facility. During the production phase of the Shuttle program, it was reasonable to collocate sustaining engineering and production activities at the Downey facility. However, since Orbiter production is essentially complete, NASA should ensure sustaining engineering activities are conducted at the most economical location while providing adequate programmatic support.

RECOMMENDATION 1

We recommend the Associate Administrator for Space Flight evaluate the continued need for the NASA Industrial Plant at Downey, California. This evaluation should include current and planned occupancy and improvement costs, and consider alternative locations for sustaining engineering activities. The most cost effective location for future sustaining engineering functions should be selected.

MANAGEMENT RESPONSE TO RECOMMENDATION 1

Although we may not fully agree with the analysis and description of each issue contained in the draft interim report, we are in general agreement with the three report recommendations. We are currently assessing most, if not all, of the facts and circumstances leading up to your recommendations.

As you are aware, the National Space Launch strategy guidelines contain near- and far-term implications for Orbiter production. In the near term, the guidelines call for continuing production of spare parts to support the existing Shuttle fleet. For the far term, the guidelines require the preservation of "an option to acquire a replacement Orbiter in the event of an Orbiter loss or other demonstrable need." The management challenge is how to prudently comply with the guidelines to preserve the option by maintaining an inherent capability to resume orbiter production if necessary.

In our view, it would be premature to conclude at this time that the most prudent course of action requires closing the Downey facility. We are not presently prepared to reach such a conclusion. Clearly, as your report points out, savings would accrue should the facility be closed. However, the

analysis cannot end there because of the serious program implications of potentially foreclosing the option to resume production of either additional spare parts beyond those currently planned or additional Orbiters should circumstances warrant. We will continue our efforts to identify the appropriate balance between maintaining the program option and cost-effective implementation of the current policy of not planning for production of additional Orbiters.

NASA is planning to conduct a study of Orbiter property disposition as you noted. We will also be evaluating the continued need for the various facilities at the Downey plant. In the meantime, action has been taken to put all Rockwell-funded facility improvement and NASA FY 1992 and subsequent Coff projects on hold until they are further reviewed for absolute need.

EVALUATION OF MANAGEMENT RESPONSE TO RECOMMENDATION 1

NASA plans to evaluate the need for various Downey facilities, and to identify the appropriate balance between maintaining Shuttle production capabilities and the cost savings associated with ceasing Orbiter production activities. We recognize that these planned actions will require an extensive effort and many significant programmatic issues must be thoroughly evaluated before a final decision is reached. As a result, we will assess NASA's progress in this area as our review of Orbiter production phasedown activities continues. The results of the planned evaluations will be included in our final audit report.

2. Unneeded Facility Improvement Projects

We identified eight major FY 1991 JSC facility improvement projects valued at \$5.3 million that did not appear beneficial to NASA. The costs of these facility improvements were accumulated as a portion of occupancy costs and charged to NASA as overhead costs.

Rockwell's Space Systems Division uses its own capital to make severable and permanent improvements to Rockwell and NASA buildings at Downey and Palmdale. Most of these costs are capitalized and charged to NASA as amortization or depreciation costs. The following chart illustrates Rockwell's investment in capital facility improvement projects.

	<u>ROCKWELL CAPITAL EXPENDITURES</u>	<u>FACILITIES ORGANIZATION COST</u>	<u>OCCUPANCY COSTS</u>
FY 1986	\$1.5 Million	\$4.0 Million	\$31.8 Million
FY 1987	\$1.9 Million	\$4.3 Million	\$34.2 Million
FY 1988	\$2.7 Million	\$5.3 Million	\$39.6 Million
FY 1989	\$3.7 Million	\$5.5 Million	\$43.5 Million
FY 1990	\$5.4 Million	\$6.2 Million	\$45.4 Million

Rockwell submits Authorization Requests (ARs) for facility projects to the Administrative Contracting Officer (ACO) in Downey, California. Previously, the ACO reviewed and approved all facility improvement projects. However, during August 1990, the ACO was directed to adhere to procedures limiting his approval authority for permanent facility modifications in NASA-owned buildings to projects valued at \$25,000 or less. This direction was repeated in a letter to Rockwell International, dated February 11, 1991. The JSC Facility Planning Office is the approving authority for permanent improvements or modifications valued at more than \$25,000 to NASA buildings.

In order to assess the need and benefit of Rockwell-funded facility improvement projects at Downey and Palmdale, we obtained a listing of all approved projects for FY 1991. We then contacted the Orbiter and GFE Projects Office and requested an evaluation of the benefit to NASA for each project. The Orbiter and GFE Projects Office did not respond to our request, but directed the JSC Space Shuttle Procurement Division to provide a response. The information provided by the Space Shuttle Procurement Division was prepared by a Rockwell employee, and it did not include an assessment of NASA's programmatic need for the facility improvement projects. We repeated our request to the Orbiter and GFE Projects Office on November 8, 1991. However, as of January 1992, the Projects Office had not provided any information to our office.

We also requested the JSC Facility Planning Office to evaluate the benefit to NASA of the FY 1991 Rockwell-funded facility improvement projects. The Facility Planning Office identified eight major projects which, in their opinion, were not beneficial to NASA. These facility improvement projects and the associated costs are shown below.

<u>FACILITY IMPROVEMENT PROJECT</u>	<u>ESTIMATED COST</u>
Office Upgrade, Rockwell International Building 305	\$ 805,000
Earthquake Damage Repair, Rockwell International Building 305	2,796,000
Provide Advanced Systems Development Center, Downey	194,000
Establish New Business Acquisition Area, Government Building 1	353,430
Construct Secured Computing Facilities, Rockwell Building 742	220,000
Plaster Washout System, Government Building 287	231,000
Upgrade Facilities for NASP, Downey	218,000
3 Axis Tracer Mill, Government Building 1	<u>481,248</u>
TOTAL	<u>\$5,298,678</u>

In addition to these facility improvement projects, we also identified some additional projects that did not appear beneficial to NASA. For example, Rockwell constructed a \$1.8 million "training and professional development" facility which was to be used for mandatory training and management development. The AR for the training center stated that only professional courses supporting the Shuttle program would be offered. These courses were: (1) microprocessor applications training; (2) Artemis training; (3) Oracle training; (4) artificial intelligence/expert systems training; (5) executive overview and systems engineering workshops; (6) software process training; (7) secretarial skills development; and (8) engineering technology and professional engineer courses.

During our facility review at Downey, we observed that only a limited amount of professional training was being held in the Professional Development Center. The training center actually provides nonprofessional services, such as general assessments and testing, dyslexia screenings, and remedial skills training. The training center also offers general education courses, basic and advanced math and science courses, and "English as a Second Language" courses.

Rockwell also spent more than \$400,000 for improvements to executive office suites during the last four years. From FY 1988 through FY 1990, the contractor performed refurbishment projects on senior executive suites at the NASA Industrial Plant totaling \$399,198. In FY 1991, the cost of office upgrades for three Rockwell executives totaled \$48,000.

As previously stated, the cost of Rockwell-funded facility improvement projects are charged to NASA as overhead costs. Consequently, only projects beneficial to NASA should be authorized. Furthermore, since Orbiter production activities are essentially complete, the need for future facility improvements or upgrades should be thoroughly reviewed and evaluated by appropriate NASA management officials.

RECOMMENDATION 2

We recommend the Associate Administrator for Space Flight take appropriate actions to ensure the need for future Rockwell-funded facility improvements is thoroughly reviewed and evaluated. Facility improvement projects which are not beneficial to NASA should not be approved.

RECOMMENDATION 3

We recommend the Associate Administrator for Space Flight re-examine the FY 1991 Rockwell-funded facility improvement projects and identify all unnecessary projects in light of the National Space Council's new National Space Launch Strategy. If considered appropriate, the costs associated with unneeded facility costs should be recovered.

MANAGEMENT RESPONSE TO RECOMMENDATIONS 2 AND 3

Although we may not fully agree with the analysis and description of each issue contained in the draft interim report, we are in general agreement with the three report recommendations. We are currently assessing most, if not all, of the facts and circumstances leading up to your recommendations.

NASA is planning to conduct a study of Orbiter property disposition as you noted. We will also be evaluating the continued need for the various facilities at the Downey plant. In the meantime, action has been taken to put all Rockwell-funded facility improvement and NASA FY 1992 and subsequent CofF projects on hold until they are further reviewed for absolute need.

EVALUATION OF MANAGEMENT RESPONSE TO RECOMMENDATIONS 2 AND 3

NASA plans to evaluate the continued need for various facilities at the Downey plant. Furthermore, on March 5, 1992, the Chief, JSC Space Shuttle Procurement Division, issued formal directions to suspend all Rockwell-funded facility improvements and future Coff projects at the Downey facility (see Exhibit V). These actions are responsive to the intent of the recommendations.



National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX A

MAR 6 1992

Reply to Attn of ME

TO: W/Assistant Inspector General for Auditing
FROM: M/Associate Administrator for Space Flight
SUBJECT: Interim Audit Report on Orbiter Production
Phasedown Activities, A-JS-91-008

This is in response to your memorandum dated February 7, 1992, same subject.

Although we may not agree with the analysis and description of each issue contained in the interim report, we are in general agreement with the three recommendations, as discussed and amplified below. As your office is aware, we are currently assessing most, if not all, of the facts and circumstances leading up to your recommendations.

There is one aspect of the interim report which deserves additional dialogue between your office and agency management. That involves the appropriate interpretation of the National Space Launch strategy insofar as it applies to future orbiter production. The report correctly points out that the strategy does not contemplate the production of additional orbiters as a "planned" program activity; however, that does not necessarily support the indication in your cover letter accompanying the interim report "that the Downey plant is no longer needed to support the Space Shuttle program."

As you are aware, the strategy "Guidelines" contain near-and far-term implications for orbiter production. In the near term, the guidelines call for continuing production of spare parts to support the existing Shuttle fleet. For the far term, the guidelines require the preservation of "an option to acquire a replacement orbiter in the event of an orbiter loss or other demonstrable need." The management challenge is how to prudently comply with the guidelines to preserve the option by maintaining an inherent capability to resume orbiter production if necessary.

In our view, it would be premature to conclude at this time that the most prudent course of action requires closing the Downey facility. We are not presently prepared to reach such a conclusion. Clearly, as your interim report points out, savings would accrue should the facility be closed. However, the analysis cannot end there because of the serious program implications of potentially foreclosing the option to resume production of either additional spare parts beyond those currently planned or additional orbiters should circumstances warrant. We will continue our efforts to identify the appropriate balance between maintaining the program option and cost-effective implementation of the current policy of not planning for the production of additional orbiters.

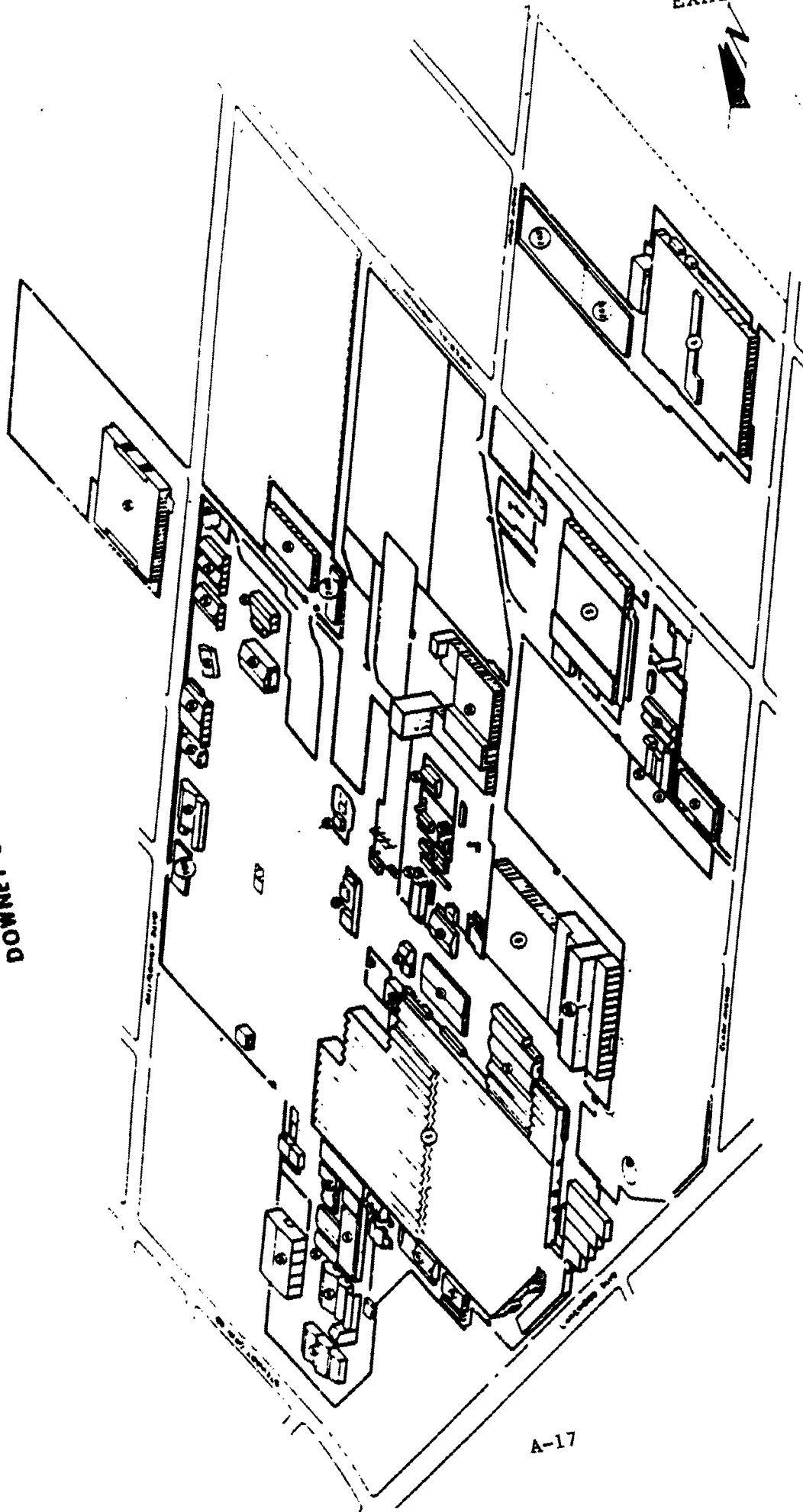
NASA is planning to conduct a study of orbiter property disposition as you noted in your cover letter. We will also be evaluating the continued need for the various facilities at the Downey plant. In the meantime, action has been taken to put all Rockwell-funded facility improvements and NASA FY 1992 and subsequent CoF projects on hold until they are further reviewed for absolute need.

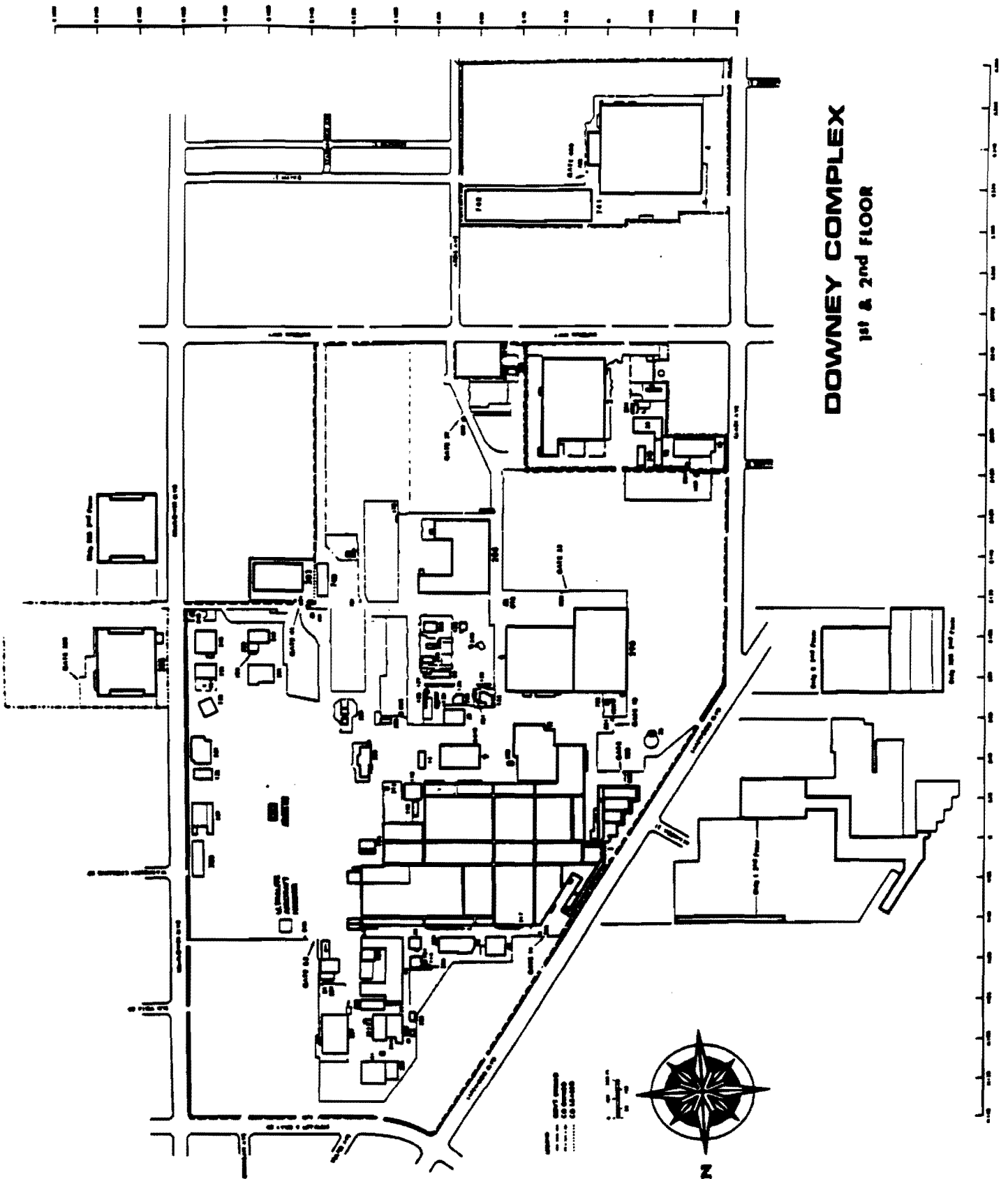
Your identification of these concerns is appreciated. Our intent is to make decisions that will maximize the long-term benefit to NASA and the country. If you have any questions, please contact ME/David Winterhalter at 453-1141.



William B. Lenoir

DOWNNEY COMPLEX





ROCKWELL INTERNATIONAL

SPACE SYSTEMS DIVISION

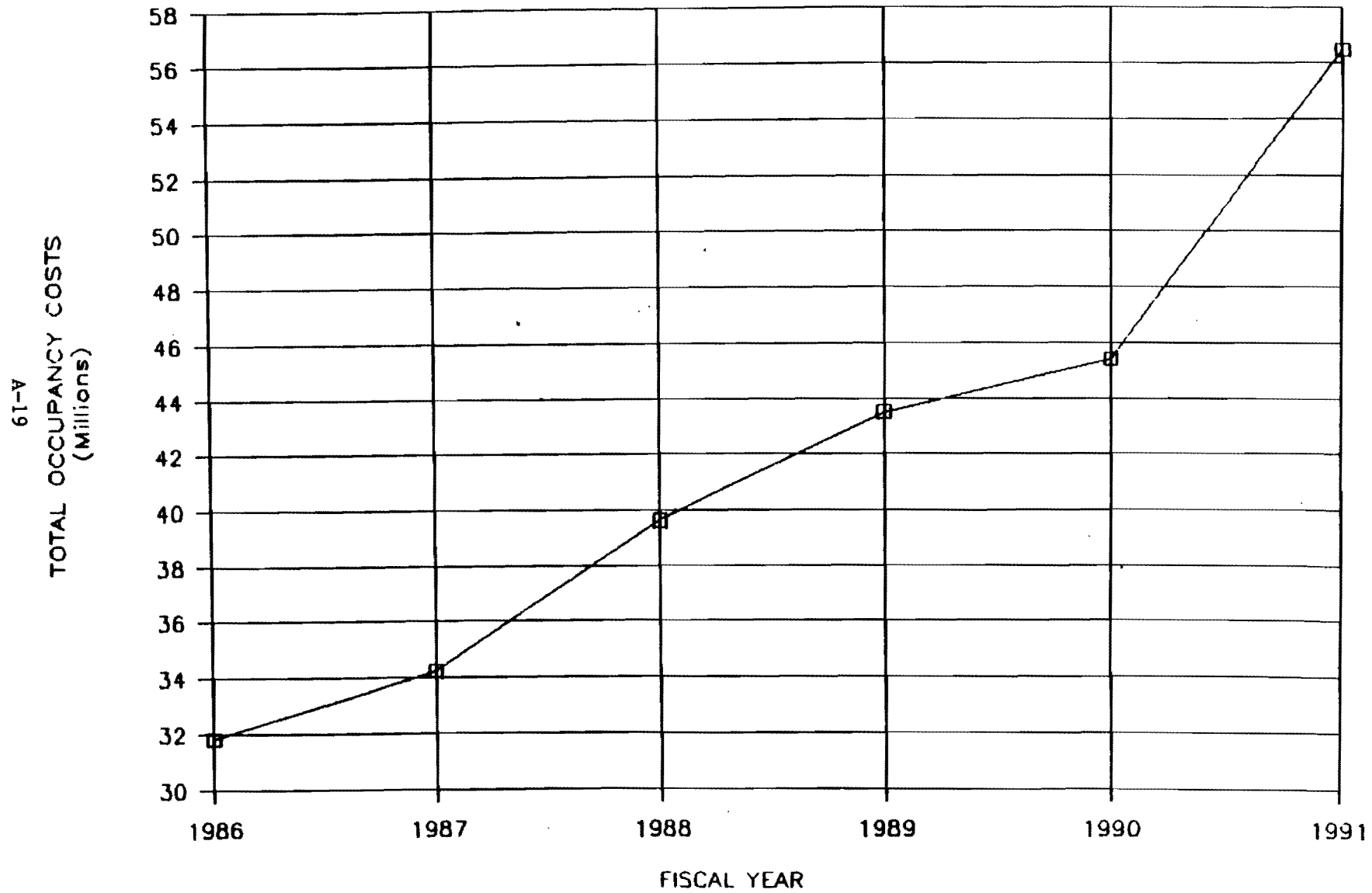


EXHIBIT III

AUDIT OF ORBITER PRODUCTION PHASEDOWN ACTIVITIES

EXHIBIT IV

Page 1 of 1

SCHEDULE OF C&F PROJECTS TO BE FUNDED

AT NIP, DOWNEY

Fiscal Years 1992 Through 1998

(000's)

Fiscal Year/Description	Cost
Fiscal Year 1992:	
Replace tanks 15 & 20	\$200
additional effort	
Modifications for earthquake protection	4,400
Replace 480V power panels, 001	235
Install NOX controls	430

Total for FY 1992	\$5,265
	=====
Fiscal Year 1993:	
Repair roofs, various buildings	\$900

Total for FY 1993	\$900
	=====
Fiscal Year 1994:	
Modifications for earthquake protection	\$14,700
A/C systems rehabilitation	10,600
Replace roof drains	2,000
Replace air compressors (119)	770
Replace secondary switchgear	920
Replace 120/480-V power panels	760
Replace underground gas lines	480
Repair roofs	290
Modify high bay lighting and floor (290)	370
Upgrade restrooms (006)	780
Rehabilitate restrooms (001)	750
Modifications for industrial gray water use	440

Total for FY 1994	\$32,960
	=====
Fiscal Years 1995 Through 1998:	
Replace secondary switchgear	\$900
Replace 120/480-V power panels	980
Install overflow detection system	425
(061, 276, 277, 287)	
Upgrade restrooms, various buildings	725
Upgrade lighting (244, 277, 287, 290)	625
Construct restrooms (006)	350
Replace boilers (290)	720
Remove asbestos, various buildings	6,000
Rehabilitate parking lots,	5,400
storage areas, and roadways	
Install suspended ceilings (001 and 134)	430

Total for FY's 1995 through 1998	\$16,455
	=====
Total for FY's 1992 through 1998	\$55,480
	=====

Lyndon B. Johnson Space Center
Houston, Texas
77058

EXHIBIT V

Reply to Attn of:

BC/92-20

March 5, 1992

TO: BC5/Carl Weber
FROM: BC/Chief, Space Shuttle Procurement Division
SUBJECT: Rockwell International (RI) Facility Projects for the NASA
Industrial Plant-Downey and Palmdale

Based upon a conversation with Mr. Easley (which was the result of a conversation he had with Mr. Tom Utsman), please inform RI immediately of the following NASA Positions:

1. Rockwell Capital Funded Facility Projects:

Beginning immediately, no NASA approvals shall be issued for RI funded facility projects at Downey or Palmdale. Such approvals shall be suspended until a NASA review team has an opportunity to review the plans for such projects. Projects previously approved and in work may be completed. Projects previously approved and not yet initiated are to be placed on hold for reassessment.

2. Maintenance:

RI shall continue, as appropriate, with the typical maintenance practices performed under their NASA facility contracts and in support of Downey and Palmdale.

3. NASA Funded Construction of Facility (CoF) Projects:

RI is to continue with approved and funded NASA Cof projects but is to suspend Cof new starts.

NOTE: JSC Facility Development Division concurrences for these new starts have not been issued according to the Office Chief, Grady Owens.

With regard to item 1, you have the authority to approve certain critical projects on an as needed basis, but an added emphasis must be placed criticality and immediacy. All such approvals should be coordinated with this office. Please inform me of any problems associated with implementation of the points above. The NASA review team and review schedule is yet to be established.

If you have any questions, please let me know as soon as possible.

Original Signed By
RANDY K. GISH

Randy K. Gish

BC/RKGish:nk:3/5/92:33556



National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX B

SEP 16 1992

Reply to Attn of

ME

TO: W/Assistant Inspector General for Auditing
FROM: M/Associate Administrator for Space Flight
SUBJECT: Draft Report on Audit of Orbiter Production Phasedown
Activities, Report No. A-JS-91-008

The Office of Space Flight response to the subject report
Recommendations 4 and 6 are addressed below. We are requesting
closure on these two recommendations. Recommendation 5 of the
subject report will be addressed by the JSC Procurement Office.

Further, we understand that our response to Recommendations 1,
2, and 3 from the Interim Audit Report dated April 10, 1992,
which relate to facility upgrades at Downey, were "responsive to
the intent of the recommendation" and we are requesting closure
on those recommendations as well.

RECOMMENDATION 4

We recommend the Associate Administrator for Space Flight
reassess the need for the entire set of structural spares due to
the increased cost, delivery schedule stretch-out, and lack of
mission requirement.

RESPONSE

The Office of Space Flight has reassessed the content of
structural spares. This was performed during the FY 1994 budget
process. Significant reductions were achieved by revising the
content to include only major components susceptible to damage,
i.e.; Landing Gear doors, External Tank disconnect doors,
Payload Bay doors, and Orbiter control surfaces. At the same
time, some fleet improvements will be produced. The three major
goals of the Structural Spares program are:

1. Augment production skills to keep fleet flying.
2. Acquire major replaceable structure components.
3. Maintain minimum manufacturing capability to produce
another Orbiter.

RECOMMENDATION 6

We recommend the Associate Administrator for Space Flight identify minimum Orbiter production requirements and develop a plan for post production support of the Orbiter fleet. The assessment of critical skills and staffing should be performed by NASA or if assistance is required from Rockwell, the contractor's data should be adequately reviewed and evaluated.

RESPONSE

The Office of Space Flight, in conjunction with the Orbiter Project Office at JSC, has thoroughly reviewed and identified the minimum Orbiter production requirements. A plan has been developed to maintain the skills and capability to provide critical flight support functions, while staying within the budget guidelines. The critical skills at Rockwell will be supported through structural spares, fleet improvements, payload integration hardware, and other new efforts associated with Extended Duration Orbiter, and the future Shuttle/Mir rendezvous mission.

If you have any questions, please contact ME/David Winterhalter at 453-1141.

Jeremiah W. Pearson

cc:

M-7/T. Utsman
ME/D. Winterhalter
MID/G. Gabourel
JM-1/J. Troupe
JSC/AA/A. Cohen
JSC/BY/L. Sullivan
JSC/W/W. Smith

Lyndon B. Johnson Space Center
Houston, Texas
77058

APPENDIX C

SEP 16 1992

Reply to Attn of BY/92-9-078

TO: W-JS/Director, Center Office of Inspector General
FROM: AB/Deputy Director
SUBJECT: Reply to Draft Report on Audit of Orbiter Production Phasedown
Activities, A-JS-91-008

We have reviewed the subject audit report which contained one recommendation (number 5) addressed to JSC, and two recommendations addressed to the Associate Administrator for Space Flight. We concur with recommendation 5; however, implementation of this recommendation is dependent on programmatic decisions regarding Orbiter structural spares as discussed in recommendation 4, which will be addressed by the Associate Administrator for Space Flight. If you have have any questions, please call Pat Ritterhouse at 483-4220.

Paul J. Weitz

Enclosure

cc:
NASA Hqs., M-1/T. E. Utsman
JSC, BB/R. E. Easley
GA/L. S. Nicholson
GA2/J. B. Costello
JA/K. B. Gilbreath
JD/G. E. Owens
VA/D. M. Germany

Reply to Draft Report on Audit of Orbiter Production
Phasedown Activities, A-JS-91-008,
dated August 21, 1992

Auditor's Findings

2. Convert Structural Spares Contract Option to Award Fee

"The structural spares option under contract NAS9-17800 with Rockwell International is not functioning as intended and, if structural spares continue to be built, should be converted to a CPAF-type contract. The structural spares contract option was negotiated as a CPIF-type contract and was exercised in November 1989. The contract option provided for a predetermined formula where fee increases if the total allowable cost is less than the negotiated target cost and fee decreases when total allowable cost exceeds the negotiated amount. A CPIF contract is designed to motivate a contractor to control contract costs. However, three NASA funding constraints have impacted the contractor's ability to manage contract costs and contributed to cost growth and schedule stretch-outs. As of April 1992, NASA had not negotiated revised targets for assessing contractor performance. Since target costs were not established, the contractor was automatically receiving the originally negotiated target fee of nine percent. Consequently, performance had no impact on fee, and although the structural spares option was negotiated as a CPIF-type contract, it is not working as intended to control costs.... An award fee contract is appropriate when the funding profile is not stable and would use periodic evaluations to foster effective communications and measure the contractor's performance."

Recommendation 5

"We recommend the Contracting Officer convert the option for structural spares on contract NAS9-17800 from CPIF to CPAF when the contract is modified to account for the impact of the funding constraints."

JSC Comments

We concur with the recommendation and plans are to enter into negotiations with the contractor to effect the suggested change from a cost-plus-incentive-fee (CPIF) to a cost-plus-award-fee (CPAF) contract when the technical content for continuation of the structural spares program is more precisely defined by Shuttle Program management. While we are in agreement that this change in contract type would be more beneficial to the Government, please be aware that such a change cannot be made until the programmatic decisions regarding Orbiter structural spares as discussed in recommendation 4 are resolved. Therefore, it is anticipated that this contract type conversion will not be initiated until March 31, 1993.

Enclosure



National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of: W

July 18, 1988

TO: M/Associate Administrator for
Office of Space Flight

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Report on Audit of Contingency Planning for Orbiter
Emergency Landings, Report No. A-KE-87-006

The NASA Office of Inspector General has completed a review of Contingency Planning for Orbiter Emergency Landings. The purpose of the audit was to evaluate NASA's planning for emergency landings of the orbiter with primary emphasis on landing sites controlled by foreign governments.

We identified a need for improved planning for emergency landings at foreign controlled airfields in order to enhance the safety and security of the orbiter, its crew, and ground personnel during an emergency landing.

The Office of Space Flight comments to the audit recommendations are considered responsive and are incorporated in this report with actions taken and planned to improve contingency planning for emergency landings.

I would like to thank you for the cooperation extended to my staff by the many personnel involved in this program.

Richard J. Pelletier

Enclosure

Report No. A-KE-87-006

CC:

N/M. Peralta

MOJ/J. Johnson

XIC/J. Sakss

JSC-PD/R. Thorson

KSC/Crippen

THIS PAGE LEFT
INTENTIONALLY BLANK

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
DIGEST	1
INTRODUCTION	3
OBJECTIVE AND SCOPE	7
OBSERVATIONS AND RECOMMENDATIONS	
1. Procedures to Notify Emergency Landing Sites	9
2. Orbiter/ELS Communications	13
3. Feedback from Diplomatic Posts on ELS Procedures	17
GENERAL COMMENTS	21
APPENDIX I -- NASA Headquarters Response to Report Recommendations	

THIS PAGE LEFT
INTENTIONALLY BLANK

ACRONYMS

ALS.....Augmented Landing Site
AOA.....Abort-Once-Around
ATCT.....Air Traffic Control Tower
DDMS.....Department of Defense
 Manager's Space Transportation
 System Contingency Support
 Office
DOD.....Department of Defense
ELS.....Emergency Landing Site
FAA.....Federal Aviation Administration
JSC.....Johnson Space Center
KSC.....Kennedy Space Center
NMI.....NASA Management Instruction
NSTS.....National Space Transportation
 System
OIG.....Office of Inspector General
TACAN.....Tactical Air Navigation
TAL.....Transoceanic Abort Landing
UHF.....Ultra High Frequency
VHF.....Very High Frequency

THIS PAGE LEFT
INTENTIONALLY BLANK

July 18, 1988

REPORT ON CONTINGENCY PLANNING
FOR ORBITER EMERGENCY LANDINGS

JOHN F. KENNEDY SPACE CENTER, FLORIDA

DIGEST

Introduction

The NASA Office of Inspector General (OIG) performed an audit of NASA's contingency planning for National Space Transportation System (NSTS) orbiter emergency landings.

Results of Audit

We found that improvements in planning are required to enhance the safety and security of the orbiter, its crew, and ground personnel during an orbiter emergency landing. Responsible NASA officials are aware of needed improvements and corrective efforts are underway. Specific observations and recommendations are summarized below:

1. Procedures to Notify Emergency Landing Sites

NASA needs to inform affected U.S. diplomatic posts concerning the selection of emergency landing sites (ELSs) for each NSTS mission. U.S. diplomatic posts should also be advised of the minimum time frames under which they will be required to notify host government officials regarding an impending emergency landing. The timely notification of host government officials is important to obtain required airspace and runway clearances at the emergency landing site. We recommended that NASA Headquarters inform affected diplomatic posts through the State Department of designated emergency landing sites in advance of each mission, and supply minimum time frames to notify the airfield of an emergency landing during each phase of the mission. NASA Headquarters has initiated actions to improve the notification process. (Page 9)

2. Orbiter/ELS Communications

The orbiter's crew cannot communicate with six non-Department of Defense (DOD) ELS Air Traffic Control Towers (ATCTs) and, therefore, would not have an alternative means to notify the ELS if, for unforeseen reasons, procedures described in Observation 1 were not successfully implemented. Further, the crew would be unable to obtain current landing conditions, weather data, or inform the ATCT

of required support, such as medical needs, etc. We recommended that NASA Headquarters perform an in-depth evaluation to resolve the communications incompatibility at the affected sites. NASA Headquarters has initiated actions to further reduce the probability of landing at sites with incompatible communications. (Page 13)

3. Feedback from Diplomatic Posts on ELS Procedures

NASA needs to determine if emergency landing procedures can be effectively implemented by affected diplomatic posts. No assurance could be provided by NASA that: diplomatic posts are properly staffed to implement emergency procedures; local communications would provide for timely communication to host government officials; and the local government is capable of responding to landing, security, and safety requirements. We recommended that NASA Headquarters conduct a review to determine if responsible diplomatic posts can effectively implement emergency landing notification procedures, safety and security measures, and if the site is diplomatically viable. Based on the results of the study, the desirability of designated emergency landing sites should be reevaluated. We also recommended that periodic follow-ups be made to ensure that emergency landing procedures remain effective. NASA Headquarters has initiated actions to perform reviews of each site and conduct periodic follow-up reviews. (Page 17)

INTRODUCTION

The Office of Inspector General (OIG), Kennedy Space Center (KSC), Florida, has completed a review of NASA's National Space Transportation System (NSTS) emergency landing plans. The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMIs) 9910.1 and 1103.27A, dated January 28, 1980, and August 5, 1986, respectively.

NASA designates an end-of-mission landing site, transoceanic abort landing (TAL) sites, abort-once-around (AOA) sites, and emergency landing sites (ELSS) for each NSTS mission. End-of-mission sites, TAL sites, and AOA sites, are also referred to as augmented landing sites because they are staffed with NASA technicians and equipped with landing aids to assist an orbiter landing. TAL site operations are conducted in accordance with formal agreements with applicable foreign governments. ELSS are not covered by government to government agreements, only meet minimal requirements for orbiter landings, and are not equipped with orbiter landing aids.

The launch phase of the mission is considered the most vulnerable to problems that may lead to an unscheduled landing. One of the most probable situations that could lead to an unscheduled landing would be a malfunction of the Space Shuttle's main engine during ascent, before the orbiter has enough momentum to achieve orbit. Accordingly, NASA deploys personnel and equipment to the following landing sites:

A team at Kennedy Space Center to assist in a landing if the shuttle system fails during the launch and the orbiter returns to land at the launch site. Upon a successful launch, this team will travel to Edwards Air Force Base to assist in end-of-mission landing efforts.

Teams at TAL sites in Europe and Africa during the launch phase of the mission in case the orbiter cannot achieve orbit. Current plans are to designate three TAL sites for each mission; primary, secondary, and a site to accommodate a two engine failure. TAL site teams start preparations for returning to the U.S. upon a successful launch.

AOA teams at Edwards Air Force Base and White Sands Space Harbor to assist an orbiter landing if the orbiter cannot achieve orbit but has too much energy to land at a TAL site. Current planning is to keep the White Sands team at the site for the duration of the mission. The Edwards Air Force Base team will be augmented by additional personnel from KSC upon a

successful launch to assist in the planned end-of-mission landing.

In addition to NASA manned sites in the U.S. and augmented landing sites, NASA identifies ELSs for each mission. ELSs are U.S. Department of Defense (DOD) bases or civilian airfields located either in the United States or in foreign countries. ELSs in foreign countries would only be used if an emergency occurs requiring the orbiter to descend before it is able to reach a TAL or U.S. landing site. These ELSs represent a last chance alternative to the newly developed crew bailout procedure. NASA Office of Space Flight personnel advised us that the probability for any emergency landing, although not quantifiable, is extremely low.

NASA's Flight Rules list landing site selection priorities for determining the most desirable landing sites. Critical factors considered are ability to reach site, weather conditions, length of runway, TACAN (Tactical Air Navigation) availability, adequate daylight, etc. General priorities for landing are (1) a U.S. site, (2) a TAL site, (3) a Department of Defense (DOD) ELS, and (4) a non-DOD ELS. Currently, NASA has designated 15 non-DOD ELSs in foreign countries.

Runway selection tables included in orbiter software contain information to guide the orbiter to possible ELSs for specific STS missions. These runway selection tables can record 30 different runway thresholds. Many times two thresholds are used for each ELS -- approaches to each end of the selected runway. At the time of our review, seven non-DOD ELSs had been identified in preliminary planning for inclusion in runway selection tables for STS 26.

The Operations Integration Office at JSC, which is organizationally under the Deputy Director-NSTS Operations, Office of Space Flight, is responsible for NSTS contingency operations plan development. Assisting in this function is the DOD Manager's Space Transportation System Contingency Support Office, referred to as DDMS. DDMS is responsible for STS contingency support operations. The DDMS Shuttle Landing Support Office is responsible for project management for Shuttle landing support-related items, represents NASA in mission planning and coordination of Shuttle landing support, and acts as the landing support operations focal point for the Mission Control Center at JSC.

Another key NASA organization is the International Relations Division, within the NASA Office of External Relations, which is responsible for (1) negotiating agreements with other countries or organizations, as required to support NASA's activities abroad, (2) providing a central point within NASA for information relating to NASA

international policies, activities and procedures, and (3) providing a point of contact between NASA and the Department of State and other U.S. Government entities regarding international affairs.

Since the Challenger accident, NASA, with DDMS and State Department assistance, has been reevaluating orbiter landing sites and the procedures used in the emergency landing notification process. Current plans are to formally update information provided to diplomatic posts regarding emergency landings.

The draft report was provided to NASA Headquarters for comment on April 25, 1988, a response was received on May 27, 1988, and a revised response was received on June 28, 1988. The comments were responsive to the intent of the observations/recommendations and identified positive actions completed or planned. The entire NASA Headquarters response is included as Appendix 1 to this report. We have also incorporated the responses following each report recommendation and provided any additional audit comments considered necessary.

THIS PAGE LEFT
INTENTIONALLY BLANK

OBJECTIVE AND SCOPE

The purpose of the audit was to evaluate NASA's planning for emergency landings of the STS orbiter. Primary emphasis was placed on the adequacy of communications with non-DOD emergency landing sites in the event of an emergency and planning for safety and security requirements.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation considered necessary under the circumstances. In this audit, we reviewed the adequacy of current emergency landing policies and procedures and interviewed selected personnel assigned to KSC, JSC, NASA Headquarters, the Department of Defense Contingency Support Office (DDMS), and the State Department.

THIS PAGE LEFT
INTENTIONALLY BLANK

OBSERVATIONS AND RECOMMENDATIONS

Current NASA planning for emergency landings at non-DOD ELSs needs to be improved. Our review disclosed that (1) U.S. diplomatic personnel in countries with ELSs are not informed of the ELS designation in advance of each mission or advised of the minimum time frames required to notify appropriate foreign officials; (2) six ELSs cannot communicate with the orbiter; and (3) neither NASA nor the State Department could provide assurances that diplomatic personnel can effectively implement established emergency landing procedures. This occurred because NASA believed that the current procedures for notifying an ELS of an impending emergency landing through the U.S. State Department would be effective and provide sufficient lead time to prepare for the landing. NASA considered these plans sufficient because of the low probability of landing at these sites. As a result, the safety and security of the orbiter and its crew during an emergency landing could be negatively effected.

1. Procedures to Notify Emergency Landing Sites

Should an orbiter emergency landing be required, the JSC Mission Control Center Landing Support Officer would notify the State Department's Operations Center, which would send a prepared Flash priority telegram and attempt to telephone the diplomatic post in the country where the landing would be attempted. The Flash priority is designed to get the message to responsible U.S. diplomatic personnel within 10 minutes. The post would notify the local government so that preparations can be made for the landing.

Current non-DOD ELS notification procedures are contained in a 1981 State Department document called an AirGram. The AirGram advised diplomatic posts world-wide of the Space Shuttle program, associated emergency landing possibilities, and their responsibilities during such a contingency. The AirGram advised that government channels to be used would be those that can authorize overflight, landing, support of rescue aircraft, assistance to U.S. units in locating astronauts or spacecraft, and help in securing the orbiter undisturbed on the ground. A Post Action Summary, incorporated at the end of the AirGram, listed actions to be taken in the event of an emergency landing. The first action listed is "Immediately advise host government, requesting urgent airspace/airfield clearance and emergency radio channel (243.0 MHz) monitoring."

Our review disclosed two weaknesses in the current plan as noted below.

a. The current AirGram was issued in 1981, seven years ago, to diplomatic posts worldwide. As previously noted, specific ELSs are established in advance for each mission, however, no process has been established to notify the cognizant U.S. diplomatic personnel of the pre-selected ELSs. As a result, the potential exists that diplomatic personnel would be unable to notify the proper host government officials to effect required air and ground clearances. We believe that prior to each mission the cognizant diplomatic posts should be informed that they are an ELS for the upcoming mission. This would provide the diplomatic personnel with sufficient time to ensure that appropriate plans are in place, and if there are problems preventing the site's use, responsible State and NASA officials could be notified so that other contingency plans could be made.

b. The AirGram only addressed emergencies encountered during orbit and did not address the more time critical emergency landing requirements during the launch and descent phases of the mission. These emergencies would only allow minimal time for notifying the ELS. If a mission were aborted during the launch phase only about 30 minutes would be available and during the descent phase something less than one hour. Diplomatic posts that may be required to respond to these shorter time frames should be advised so that notification procedures can be developed accordingly.

NASA and State Department personnel were working to update the AirGram before resumption of STS missions. Other actions were also being discussed to improve the channels of communication to potential emergency landing sites.

RECOMMENDATION 1 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division, should advise the State Department in advance of Emergency Landing Sites identified for each STS mission and request that affected diplomatic posts be notified of specific response times for orbiter emergency landings during launch, orbit, and descent.

MANAGEMENT RESPONSE

The Office of Space Flight, in coordination with the International Relations Division and the State Department, have written an Airgram for Space Shuttle Emergency Support Operations that has been distributed to the embassies in the countries where an Emergency Landing Site (ELS) exists. This Airgram provides basic guidance and information on the support which may be required in the unlikely event an Orbiter is forced to make an emergency return to a landing site outside the Continental United States.

The International Relations Division has in the past in advance of each Shuttle Mission, through the Department of State, notified the U.S. diplomatic posts in countries which contain Emergency Landing Sites designated by NASA for each mission. Such advance notification will continue, mission by mission, and will include specific response times for orbiter emergency landings during launch, orbit, and descent.

EVALUATION OF MANAGEMENT RESPONSE

The planned issuance of Department of State telegrams to all ELS diplomatic posts in advance of each mission, as noted in the management response to Recommendation 3, is responsive to the intent of this recommendation.

THIS PAGE LEFT
INTENTIONALLY BLANK

2. Orbiter/ELS Communications

The orbiter's crew cannot communicate with six non-DOD ELS Air Traffic Control Towers (ATCTs) and, therefore, would not have an alternative means to notify the ELS if, for unforeseen reasons, procedures described in Observation 1 were not successfully implemented. Further, the crew would be unable to obtain current landing conditions, weather data, or inform the ATCT of required support, such as medical needs, etc. We found that efforts have been undertaken to identify solutions to this problem, however, these efforts have been unsuccessful. Considering the importance of this issue, an in-depth evaluation should be made to identify and assess possible solutions.

The orbiter communicates on the UHF band. While this band is used by U.S. civilian airports and DOD bases, many foreign ATCTs utilize the VHF band, not UHF. In August 1986, DDMS personnel determined from the FAA that 6 of the 15 designated non-DOD ELS ATCTs have radio equipment that is incompatible with the orbiter's. It should be noted that the 1981 AirGram erroneously indicates that the orbiter can communicate with ELS air traffic control towers.

The Astronaut Office conducted a test to determine if a hand-held VHF radio, used by the crew for communication upon evacuation of the orbiter, could communicate with an ATCT during descent. The test showed that the radio had limited transmitting capability and could not effectively communicate with the ATCT. As a result, the Astronaut Office decided not to pursue VHF capability for the orbiter because (1) an improved radio would add weight to the orbiter, (2) it would probably require a large dollar investment and, (3) there is only a small probability that an emergency landing would ever have to be made at a non-DOD ELS. The Astronaut Office decided it would be better to reevaluate ELSs included in runway selection tables.

We discussed this issue with the Chief of JSC's Communication Development Office, who stated that other hand-held radios would probably not provide adequate capability to communicate from orbiter to ATCT in time to achieve clearances. Further, he felt the cost to develop VHF capability in the orbiter would be prohibitive. An antenna at least twice the size of the present UHF antenna would be required. However, no formal evaluation has been made to determine what alternatives are available to obtain VHF capability and the associated cost for development.

In our opinion, the inability of the orbiter to communicate with the responsible air traffic control tower during an emergency landing is a serious weakness. Most of the non-DOD ELSs are civilian airports which may not be able to clear their runways and airspace in an emergency

situation, creating a hazardous condition. Further, since weather conditions are volatile, it would be desirable to transmit updated information to the orbiter on a real time basis. Considering the value of communications between the orbiter and the ELS ATCT during an emergency landing, an in-depth evaluation should be made to identify and assess possible solutions.

RECOMMENDATION 2 (NASA HQ/M)

Office of Space Flight perform an in-depth evaluation to resolve the communications incompatibility between the orbiter and non-DOD ELSs and initiate appropriate action.

MANAGEMENT RESPONSE

Currently there are five ELS sites without UHF communications, which are included in the Orbiter software. Of these five, four are basically in place to provide a landing site in the event of a highly improbable contingency abort during ascent when a TAL site may not be available. It is planned to have selected embassies (whose ELS site is along the ascent ground path) on standby during the Shuttle ascent phase, should an ascent contingency abort occur to a specific ELS. If notified, the effected embassy would notify the appropriate country officials and the air field tower per pre-determined plans.

During the orbiter phase of the mission, the ELS sites without UHF are nominally redundant to other sites with UHF. For example, the four sites mentioned above are redundant to existing TAL sites with UHF on the same orbital revolution. The sole ELS site in the Pacific Ocean region without UHF is redundant to DOD sites on the same revolution.

To ensure maximum use of UHF sites for potential ELS usage, a flight rule has been written giving the following priority for an ELS situation.

1. TAL sites
2. DOD ELS sites
3. Non-DOD sites with UHF
4. Non-DOD sites without UHF

As stated above, sites without UHF located low in priority and nominally redundant with UHF sites would only be used for the highly improbable ascent contingency abort case or for a near-instantaneous abort from orbit (an extremely low probability) and as an option other than the bailout scenario.

Based on the very low probability of having to exercise a non-UHF site, current plans do not include either

modifying the Orbiter for VHF or for supplying non-UHF ELS sites with a UHF capability.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken and planned should further reduce the current low probability of an orbiter emergency landing at a site with incompatible communications. This alternative action is considered responsive to the intent of the recommendation.

THIS PAGE LEFT
INTENTIONALLY BLANK

3. Feedback from Diplomatic Posts on ELS Procedures

Since the 1981 AirGram was issued, NASA has not determined if the responsible diplomatic posts can effectively implement the required ELS procedures. Our review of procedures addressed in the AirGram showed that they were generally adequate, except as noted in Observations 1 and 2. However, because of the many different foreign governments involved, turnover at diplomatic posts and changing political conditions, it is important to obtain feedback from diplomatic posts regarding the status of their emergency landing procedures. Lacking such feedback, NASA officials were unable to provide assurances that:

- o The diplomatic post's on duty staff is aware of its responsibilities in the event of an emergency during a mission.
- o The action officer is on call in the diplomatic post at all times or can be contacted promptly.
- o The message center understands its role in this process and the need for timely notification of the action officer.
- o There is sufficient local communications capability to provide reliable and timely notification of local government officials by the diplomatic post.
- o Where existing local communications are poor, alternative lines of communication have been developed.
- o The local government is able to communicate with the responsible air traffic control tower on a timely basis to ensure that air and ground clearances can be effectively made. Failure to do so will negatively impact the safety of the orbiter, crew and ground personnel.
- o At those ELS ATCTs with incompatible communications, alternative communication channels have been established with the responsible ATCT to enable direct communication by either the diplomatic post or NASA.
- o The ELS can provide adequate security for the orbiter, payload and crew.
- o The ELS can implement the safety requirements outlined in the AirGram or that alternatives exist to address identified weaknesses.

- o The local reaction to an emergency landing would be favorable and provide a viable site. An indication of the cooperation that may be expected from a foreign government is its position on the United Nations (UN) Agreement on the Rescue of Astronauts, The Return of Astronauts and the Return of Objects Launched Into Outer Space. Four foreign governments with designated ELSs have not ratified this agreement. These governments may cooperate in an emergency landing situation. However, it is important to determine from cognizant U.S. diplomatic posts each government's position on emergency landings so that NASA can modify its planning accordingly.

In order to ensure that emergency landings will be handled as effectively as possible, we believe the above concerns must be addressed and plans adjusted accordingly. Due to personnel turnover at diplomatic posts, we believe periodic follow-ups should be made to ensure that local procedures are still effective and updates or modifications can be made as required.

RECOMMENDATION 3 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division and State Department, conduct a review of each identified emergency landing site to determine if:

1. Responsible diplomatic posts can effectively implement emergency landing procedures.
2. Safety and security measures can be effectively implemented.
3. The site is currently diplomatically viable.

MANAGEMENT RESPONSE

The Office of Space Flight and the International Relations Division, in coordination with the Department of State, have initiated specific actions and plan additional actions which, taken together, will provide the factual information and the evaluations and recommendations by the U.S. diplomatic posts and the Department of State to permit the review of each identified emergency landing site as described in this recommendation.

The following specific actions have been initiated or are planned:

1. Department of State Desk Officers notified of ELS status in their countries (completed on February 24 with NASA briefing at the State Department).

2. Department of State telegram to affected posts requests information on communications capability (sent January 88).

3. Updated Department of State Airgram sent to all posts outlining the procedures and circumstances of an Emergency Landing Site (sent on April 29).

4. State Department telegram to posts in countries with non-DOD ELSs will provide specific information pertaining to these ELSs, will request posts evaluations and recommendations of diplomatic viability, ability to implement emergency notification and communication procedures, and ability to implement safety, security, and recovery support procedures (to be sent approximately May 27; will request posts' response by approximately June 30).

5. Department of State telegrams to all appropriate ELS diplomatic posts in advance of each STS mission (to be sent approximately 30 days before each launch).

RECOMMENDATION 4 (NASA HQ/M)

Office of Space Flight, based on the results of evaluations and reviews in Recommendations 2 and 3 above, reevaluate the desirability of designated emergency landing sites.

MANAGEMENT RESPONSE

The Office of Space Flight is continuously assessing the desirability of ELS sites from the standpoint of safety of flight. This procedure is similar to that used for civilian and military aircraft under contingency conditions. For cases where the selected site becomes unusable for either diplomatic or physical reasons, alternative sites would be evaluated for potential use provided they met the minimum physical qualifications for a landing site.

RECOMMENDATION 5 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division and State Department, conduct periodic follow-ups to ensure that emergency landing procedures are effective. This should include input from cognizant diplomatic posts.

MANAGEMENT RESPONSE

The specific actions in coordination with the Department of State as outlined in the response to Recommendation 3 will re-establish NASA requirements, put into place effective channels of communication, and designate Space Shuttle control officers at U.S. diplomatic posts which together will support operation and maintenance of the ELS program. NASA will request the Department of State, in its planned telegram of instructions to ELS posts, to require each post to routinely notify the Department of any significant changes in the ability of each post, or the ability or willingness an ELS host country government, to meet the requirements of the NASA STS emergency landing site program. The Office of Space Flight will be informed promptly of any such significant changes at an ELS.

Assessments will occur on a periodic basis supplemented by standard verification procedures used by the Landing Support Officer in the Mission Control Center prior to each flight. In addition, crew visits to selected sites have provided first-hand assessments in the past. This policy of on-site visits will continue and be expanded on a site-by-site basis provided State Department concurrence is obtained.

EVALUATION OF MANAGEMENT RESPONSES

The actions taken and planned are considered responsive to Recommendations 3, 4, and 5.

GENERAL COMMENTS

The Office of Inspector General staff members express their appreciation for the courtesy and cooperation extended by NASA, DOD, and State Department personnel during this audit.

THIS PAGE LEFT
INTENTIONALLY BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

JUN 28 1988

Reply to Attn of: M-2

TO: W/Assistant Inspector General for Auditing

FROM: M-2/Director, Strategic Planning

SUBJECT: Draft Audit Report on Contingency Planning for Orbiter Emergency Landings,
Kennedy Space Center (KSC), Report No. A-KE-87-006

As requested in your memorandum of April 25, 1988, we have reviewed the draft audit report and are providing the following comments:

RECOMMENDATION 1 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division, should advise the State Department in advance of Emergency Landing Sites identified for each STS mission and request that affected diplomatic posts be notified of specific response times for orbiter emergency landings during launch, orbit, and descent.

RESPONSE TO RECOMMENDATION 1

The Office of Space Flight in coordination with the International Relations Division, and the State Department have written an Airgram for Space Shuttle Emergency Support Operations that has been distributed to the embassies in the countries where an Emergency Landing Site (ELS) exists. This Airgram provides basic guidance and information on the support which may be required in the unlikely event an Orbiter is forced to make an emergency return to a landing site outside the Continental United States.

The International Relations Division has in the past in advance of each Shuttle Mission, through the Department of State, notified the U.S. diplomatic posts in countries which contain Emergency Landings Sites designated by NASA for each mission. Such advance notification will continue, mission by mission, and will include specific response times for orbiter emergency landings during launch, orbit, and descent.

RECOMMENDATION 2 (NASA HQ/M)

Office of Space Flight perform an in-depth evaluation to resolve the communications incompatibility between the orbiter and non-DOD ELSs and initiate appropriate action.

RESPONSE TO RECOMMENDATION 2

Currently there are five ELS sites without UHF communications, which are included in the Orbiter software. Of these five, four are basically in place to provide a landing site in the event of a highly improbable contingency abort during ascent when a TAL site may not be available. It is planned to have selected embassies (whose ELS site is along the ascent ground path) on standby during the Shuttle ascent phase, should an ascent

contingency abort occur to a specific ELS. If notified, the effected embassy would notify the appropriate country officials and the air field tower per pre-determined plans.

During the orbit phase of the mission, the ELS sites without UHF are nominally redundant to other sites with UHF. For example, the four sites mentioned above are redundant to existing TAL sites with UHF on the same orbital revolution. The sole ELS site in the Pacific Ocean region without UHF is redundant to DOD sites on the same revolution.

To ensure maximum use of UHF sites for potential ELS usage, a flight rule has been written giving the following priority for an ELS situation:

1. TAL sites
2. DOD ELS sites
3. Non-DOD sites with UHF
4. Non-DOD sites without UHF

As stated above, sites without UHF located low in priority and nominally redundant with UHF sites would only be used for the highly improbable ascent contingency abort case or for a near-instantaneous abort from orbit (an extremely low probability) and as an option other than the bailout scenario.

Based on the very low probability of having to exercise a non-UHF site, current plans do not include either modifying the Orbiter for VHF or for supplying non-UHF ELS sites with a UHF capability.

RECOMMENDATION 3 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division and State Department, conduct a review of each identified emergency landing site to determine if:

1. Responsible diplomatic posts can effectively implement emergency landing procedures.
2. Safety and security measures can be effectively implemented.
3. The site is currently diplomatically viable.

RESPONSE TO RECOMMENDATION 3

The Office of Space Flight and the International Relations Division, in coordination with the Department of State, have initiated specific actions and plan additional actions which, taken together, will provide the factual information and the evaluations and recommendations by the U.S. diplomatic posts and the Department of State to permit the review of each identified emergency landing site as described in this recommendation.

The following specific actions have been initiated or are planned:

1. Department of State Desk Officers notified of ELS status in their countries (completed on February 24 with NASA briefing at the State Department).
2. Department of State telegram to affected posts requests information on communications capability (sent January 88).
3. Updated Department of State Airgram sent to all posts outlining the procedures and circumstances of an Emergency Landing Site (sent on April 29).
4. State Department telegram to posts in countries with ELS identified above will provide specific information pertaining to these ELS, will request posts evaluations and recommendations of diplomatic viability, ability to implement emergency notification and communication procedures, and ability to implement safety, security, and recovery support procedures (to be sent approximately May 27; will request posts' response by approximately June 30).
5. Department of State telegrams to all appropriate ELS diplomatic posts in advance of each STS mission (to be sent approximately 30 days before each launch).

RECOMMENDATION 4 (NASA HQ/M)

Office of Space Flight, based on the results of evaluations and reviews in Recommendations 2 and 3 above, reevaluate the desirability of designated emergency landing sites.

RESPONSE TO RECOMMENDATION 4

The Office of Space Flight is continuously assessing the desirability of ELS sites from the standpoint of safety of flight. This procedure is similar to that used for civilian and military aircraft under contingency conditions. For cases where the selected site becomes unusable for either diplomatic or physical reasons, alternative sites would be evaluated for potential use provided they met the minimum physical qualifications for a landing site.

RECOMMENDATION 5 (NASA HQ/M & XI)

Office of Space Flight, in coordination with the International Relations Division and State Department, conduct periodic follow-ups to ensure that emergency landing procedures are effective. This should include input from cognizant diplomatic posts.

RESPONSE TO RECOMMENDATION 5

The specific actions in coordination with the Department of State as outlined above will re-establish NASA requirements, put into place effective channels of communication, and designate Space Shuttle control officers at U.S. diplomatic posts which together will support operation and maintenance of the ELS program. NASA will request the Department of State, in its planned telegram of instructions to ELS posts, to require each post to routinely notify the Department of any significant changes in the ability of each post, or the ability or willingness an ELS host country government, to meet the requirements of the NASA STS emergency landing site program. The Office of Space Flight will be informed promptly of any such significant changes at an ELS.

Assessments will occur on a periodic basis supplemented by standard verification procedures used by the Landing Support Officer in the Mission Control Center prior to each flight. In addition, crew visits to selected sites have provided first-hand assessments in the past. This policy of on-site visits will continue and be expanded on a site-by-site basis provided State Department concurrence is obtained.

If you have any questions, please call me (453-1128) or Jim Johnson (453-2574).

✓ Lawrence H. Stern

cc:

M/Adm. Truly

Mr. Abbey

Mr. Aldrich

MO/Mr. Krier

Mr. Watkins

Mr. Johnson

N/Mr. Peralta

XIC/Mr. Sakes

JSC/Mr. Thorson

KSC/Mr. Crippen

KSC/Mr. McCartney

Langley FY85

A-LA-84-302

AUDIT REPORT

MANAGEMENT AND UTILIZATION OF WIND TUNNELS

LANGLEY RESEARCH CENTER

A-LA-84-302

OCTOBER 25, 1985



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Reply to Attn of

181

October 25, 1985

TO: 111/Director for Management Operations
FROM: 181/Director, Center OIG
SUBJECT: Report on Management and Utilization
of Wind Tunnels
Langley Research Center
(A-LA-84-302)

We have completed an audit of the management and use of wind tunnels at Langley Research Center (LaRC).

The purpose of the audit was to evaluate the effectiveness of management and utilization of major wind tunnels at LaRC and related policies, procedures, practices, and internal controls. The results of audit showed management and utilization of the wind tunnels is generally satisfactory and in compliance with existing statutes and regulations, but could benefit from improvements in some areas. We recommended LaRC execute written agreements for certain cooperative tests with industry, establish a policy for handling of test data when no fee is charged, develop written guidelines for processing tests, and NASA Headquarters revise NMI 1300.1 to reflect current practices. Appropriate corrective actions are planned.

A discussion draft was submitted to LaRC on January 8, 1985, and an exit conference held on July 24, 1985. Results of the conference were considered and included in the draft report dated August 5, 1985. The Center's written comments, dated August 21, 1985, and Headquarter's written comments, dated October 7, 1985, are summarized after each recommendation and are included in their entirety in Appendix A and Appendix B of this report.

Lee T. Ball

Enclosures

cc: W/AIGA

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	DIGEST	1
II	INTRODUCTION	3
III	OBJECTIVE AND SCOPE	5
IV	OBSERVATIONS AND RECOMMENDATIONS	7
	1. Agreements with Industry for Wind Tunnel Tests	8
	2. Wind Tunnel Utilization Controls	12
V	GENERAL COMMENTS	16
EXHIBIT I		
EXHIBIT II		
EXHIBIT III		
APPENDIX A - LANGLEY'S WRITTEN COMMENTS		
APPENDIX B - NASA HEADQUARTER'S WRITTEN COMMENTS		

MANAGEMENT AND UTILIZATION OF WIND TUNNELS
LANGLEY RESEARCH CENTER

DIGEST

Introduction

The purpose of the audit was to evaluate the effectiveness of management and utilization of major wind tunnels at Langley Research Center (LaRC) and related policies, procedures, and practices. LaRC has 23 wind tunnels with a total replacement cost conservatively estimated at more than \$700 million. These tunnels are used for a variety of tests primarily in the performance of research and technology on aeronautical and space systems.

Results of Audit

The results of audit showed that management and utilization of wind tunnels at LaRC is generally satisfactory and the policies, procedures, and practices are reasonably effective. However, we made the following observations and recommendations in areas which we believe require additional management attention:

1. Agreements with Industry for Wind Tunnel Tests

LaRC wind tunnel managers frequently negotiate informal agreements with companies to perform wind tunnel tests. Since written agreements to set forth the responsibilities and requirements of each party are usually not executed, the Government may be exposed to unnecessary risks. Also, tunnel managers' opinions regarding the length of time the resulting test data can be considered proprietary data (not available to the public) vary considerably. This may cause some managers to reject as improper some tests proposed by companies which other managers would accept. This practice may also create the appearance of favored treatment for certain companies. We recommended LaRC execute written agreements where necessary to protect the Government's interests and establish a policy regarding the time test results can be held propriety without a fee. LaRC concurred with the recommendation and will require written agreements where necessary and will clarify the policy regarding the disposition of test data (page 8).

2. Wind Tunnel Utilization Controls

Controls and procedures regarding wind tunnel utilization should be improved. LaRC does not have written policies and procedures for processing all types of wind tunnel tests. NMI 1300.1 provides instructions for processing development tests for industry but needs to be revised to reflect the current practices. The lack of written guidelines may have contributed to the inconsistent treatment of test data discussed in Condition 1. We recommended LaRC develop written guidelines for wind tunnel utilization and NASA Headquarters revise NMI 1300.1 to reflect current practices. LaRC concurred with the recommendation and will develop written guidelines. NASA Headquarters also concurred and will revise the NMI (page 12).

INTRODUCTION

The Office of Inspector General has completed an audit of the management and use of wind tunnels at LaRC. The review was performed in accordance with the authority and responsibility contained in NASA Management Instruction (NMI) 9910.1, "The NASA Audit Program," dated January 28, 1980.

NASA Special Publication, SP-440, Wind Tunnels of NASA, describes an early wind tunnel as follows: "This utterly simple device consists of an enclosed passage through which air is driven by a fan or any appropriate drive system. The heart of the wind tunnel is the test section, in which a scale model is supported in a carefully controlled airstream, which produces a flow of air about the model, duplicating that of the full-scale aircraft. The aerodynamic characteristics of the model and its flow field are directly measured by appropriate balances and test instrumentation." Modern wind tunnels have evolved to highly complex systems requiring computers for operational control and data acquisition. Some tunnels use helium, freon, or liquid nitrogen as a test medium. However, the basic purpose and characteristics remain unchanged.

LaRC has 23 wind tunnels with a total replacement cost conservatively estimated at more than \$700 million. These test facilities are used for a wide variety of tests primarily in the performance of research and technology on aeronautical and space systems. At LaRC, wind tunnels are considered research tools and are assigned to organizations that conduct the type of research which the tunnel was constructed or modified to perform. The heads of these organizations are referred to as tunnel managers in this report.

The age of LaRC tunnels vary, but most are over 25 years old. The oldest is the 30 x 60-foot tunnel which was constructed in 1930; the newest is the National Transonic Facility (NTF) which was dedicated in December 1983 and is not yet fully operational. The tunnels have been rehabilitated and modified to incorporate technological advances within the constraints of funding limitations.

A discussion draft of this report was provided to LaRC management on January 8, 1985. An exit conference was held on July 24, 1985. Necessary report changes resulting from the exit conference were incorporated in a draft report provided to LaRC on August 6, 1985. The Center's written comments, dated August 21, 1985, and Headquarter's written comments, dated October 7, 1985, are summarized after each recommendation and are included in their entirety in

Appendices A and B respectively. The planned actions will be evaluated during our normal follow-up.

OBJECTIVE AND SCOPE

The objectives of the audit were to determine:

- . The adequacy of compliance with the Unitary Wind Tunnel Plan Act; NMI 1300.1, "Development Work for Industry in NASA Wind Tunnels"; NMI 9080.1B, "Review, Approval, and Imposition of User Charges"; and other applicable laws and regulations.

- . If utilization is consistent with established utilization plans and goals.

- . If LaRC is meeting its objectives used to justify upgrading/modernizing facilities.

- . Whether preventive maintenance is adequate to control tunnel downtime.

The scope of our review was limited to seven major wind tunnels with the highest replacement cost at March 1984 as shown below. (NTF was excluded because it was not yet operational.)

- . 8-foot Transonic Pressure Tunnel (\$44.2 million) - a closed circuit, continuous flow tunnel with a speed range from Mach 0.2 to 1.3. Since 1981 this tunnel has been dedicated to laminar flow research. The tunnel is managed and used primarily by the Airfoil Aerodynamics Branch, Aeronautics Directorate.

- . Full Scale Tunnel (\$20.5 million) - a 30- x 60-foot closed circuit, continuous flow atmospheric tunnel with a speed range from 26 to 90 miles per hour. The tunnel is managed and used primarily by the Flight Dynamics Branch, Aeronautics Directorate.

- . Transonic Dynamics Tunnel (\$64.2 million) - a 16- x 16-foot closed circuit, continuous flow tunnel with a speed range from Mach 0 to 1.2. Freon is an alternative test medium. The tunnel is managed and used by the Configuration Aeroelasticity Branch, Structures Directorate.

- . 16-foot Transonic Tunnel (\$91.9 million) - a continuous flow atmospheric tunnel with a speed range from Mach 0.2 to 1.3. The tunnel is managed and used by the Propulsion Aerodynamics Branch, Aeronautics Directorate.

- . V/STOL (4- x 7-meter) Tunnel (\$19.5 million) - a continuous flow tunnel with a speed range from 0 to 200 knots. The tunnel is managed and used by the Subsonic Aerodynamics Branch, Aeronautics Directorate.

. Unitary Plan Wind Tunnel (\$104 million) - a closed circuit, continuous flow, variable pressure wind tunnel with two test sections. Speed ranges from Mach 1.47 to 2.86 in Test Section 1 and from Mach 2.29 to 4.63 in Test Section 2. The tunnel is managed by the Unitary Operations Office and is used primarily by various branches in the High-Speed Aerodynamics Division, Aeronautics Directorate.

. 8-foot High Temperature Structures Tunnel (\$44.6 million) - an open jet blowdown tunnel which achieves the required energy level by burning methane and using the resulting combustion products as the test medium. Speed ranges from Mach 5.8 to 7.2. The tunnel is managed and used by the Aerothermal Loads Branch, Structures Directorate.

Our review included discussions with Center personnel involved with requesting, approving, scheduling, and performing wind tunnel tests. In addition, our review included discussions with tunnel maintenance and safety personnel to determine applicable procedures and controls and identify the problems and concerns which hamper the operations. We examined the organizational structure and staffing of units responsible for the management and operation of the wind tunnels as well as power usage (Exhibit 2) and maintenance costs (Exhibit 3) for the last 3 years. We reviewed the justifications for wind tunnel modifications. We also examined the final report of the OAST reimbursable policy study team, dated August 1982, entitled "Study of NASA's Reimbursement Policy for Work Performed in NASA Wind Tunnels" and avoided duplication of their efforts to the extent possible.

Our review of compliance with the Unitary Wind Tunnel Plan Act and NMI's 1300.1 and 9080.1B was limited to the Unitary Plan Wind Tunnel. It was the only LaRC tunnel constructed under the Unitary Wind Tunnel Plan Act and the only one of the above tunnels where company projects were tested and billed as specified in the NMI's in the past 5 years. However, the scope of the review did not include an evaluation of the billing rate structure for compliance with requirements of the NMI. Since no company reimbursable fee tests have been conducted since June 1980, billing rates were not used to compute fees during the period covered by our review.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documents as were considered necessary in the circumstances. The audit included a review of applicable internal controls. Except as noted in the "Observations and Recommendations" section, these controls were considered satisfactory.

OBSERVATIONS AND RECOMMENDATIONS

Management and utilization of wind tunnels at LaRC is generally satisfactory and in compliance with existing statutes and regulations. Efforts are continually being made to improve the wind tunnel productivity and capability with both Construction of Facilities (C of F) and Research and Development (R & D) funds. Modifications to enhance researcher capabilities to solve problems or make advancements in aerospace technology have also been made. A good preventive maintenance program exists, and annually each tunnel is shutdown for several days in accordance with a facility maintenance schedule to perform needed repairs. These actions minimize maintenance costs by reducing high cost emergency repairs and limit test schedule disruptions. Some facilities have controlled or reduced energy use by facility modifications and improvements in operational efficiency (fewer research investigations being conducted in some tunnels has also contributed). Examples of actions taken or planned include the following:

a. The Unitary Tunnel is currently undergoing a \$4.5-million facility and building rehabilitation. The building and tunnel circuit portion of this FY-79 C of F project was completed in 1980. The installation of a new computer-controlled model support system and a new pressure instrumentation system was still in process at the time of our review. Time savings of at least 25 percent for given test runs and high energy cost savings are anticipated. As shown in Exhibit 1, various other improvements made over many years, coupled with a reduction in the number of tests conducted, also have significantly reduced the electrical power needed to operate the Unitary Tunnel. A new \$600-thousand data acquisition system to replace the existing outdated Xerox Sigma III is planned.

b. A \$13.8-million planned modification to the 8-foot High Temperature Tunnel is included in the FY-85 budget. The modification will provide testing capability for high altitude aircraft and missiles and research capability for ramjets and scramjets. These capabilities are not available at any other facility in the United States.

c. A \$7.2-million modification of the 4 x 7-meter Low-Speed Tunnel is underway to increase the operational efficiency and productivity of the tunnel. Gains of at least 17 percent in useful test time are anticipated.

d. A \$4.4-million modification to the 30 x 60-foot Tunnel will be made to improve the model support system and upgrade other components of the facility. A 15-percent reduction in overall manhours is anticipated.

e. A \$9-million modification to the Transonic Dynamics Tunnel is in process. The project will increase the test medium density by 50 percent and repair critical systems.

f. The Operations Support Division (OSD) has cross-trained tunnel technicians on operations of multiple tunnels and multiple functions in order to maximize the utilization of personnel. OSD works closely with tunnel managers in developing run schedules; further, OSD shifts technicians freely between tunnels to provide the necessary test support.

g. Tests in tunnels requiring high power loads are conducted primarily at night to take advantage of off-peak (10 p.m. to 7 a.m.) electrical power costs.

LaRC upper management has granted individual tunnel managers some latitude to develop procedures and controls for management and operation of the wind tunnels assigned to their organizations. This approach has, for the most part, worked well. We noted the following areas, however, where upper management's attention could improve operations or controls:

1. Agreements with Industry for Wind Tunnel Tests

LaRC wind tunnel managers frequently negotiate informal agreements with companies to perform wind tunnel tests. Since written agreements to set forth the responsibilities and requirements of each party are usually not executed, the Government may be exposed to unnecessary risks. Also, tunnel managers' opinions regarding the length of time the resulting test data can be considered proprietary data (not available to the public) vary considerably. This may cause some managers to reject as improper some tests proposed by companies which other managers would accept. This practice may also create the appearance of favored treatment for certain companies.

Wind tunnel tests in cooperation with industry are essential to NASA's research objectives. They permit NASA researchers to exchange ideas with industry counterparts and keep in touch with ongoing projects and problems; they often give NASA personnel the opportunity to apply their knowledge and experience; and they utilize NASA facilities to solve current aerospace problems. Under these arrangements, companies often provide models in exchange for wind tunnel time and assistance with data analysis. This, in turn, enables NASA to perform tests and obtain data in areas of interest which could not be done as expeditiously if NASA had to fund the costly model fabrication.

Tests in cooperation with industry serve to supplement current research projects. Requests for cooperative tests are usually accepted only if NASA is performing research in an area closely related to the proposed test. No transfer of funds occurs because both parties contribute to and benefit from these tests.

Discussions with various tunnel managers indicated that cooperative arrangements are usually not set forth in writing. Instead, the agreements are usually verbal arrangements sometimes supported by correspondence which describe the test parameters and the processing of test results. Consequently, written agreements usually do not exist to ensure that both parties clearly understand their responsibilities under the terms of the agreement. Although we did not identify any serious problems that may have occurred in the past, we believe the lack of a written agreement signed by both parties exposes the Government to unnecessary risk. For example, the Government could be subjected to claims for damage to company models, for injuries to company representatives on site during the test, for dissemination of proprietary data or for other reasons because of misunderstandings that occurred because the terms of the agreement were not written. Also, if either Government or company representatives involved in establishing the agreement departed before the test was completed, their replacements may not honor the terms of the agreement.

We discussed the need for written agreements with the LaRC Chief Counsel. He concurred with our position that these arrangements for wind tunnel tests should normally be in writing. We believe these agreements should be set forth in writing and reviewed by the Office of Chief Counsel before they are executed to ensure the Government's interests are protected.

Discussions with tunnel managers also indicated that varying views exist as to the length of time that NASA can agree to withhold test results from dissemination. For example, Unitary Tunnel management refuses any proposed arrangement where the company requires test data not be released immediately. Company proprietary tests are performed on a cost-reimbursable basis only. Some other managers will agree to treat data from cooperative tests as proprietary for a year or more because they believe it will take that long to get the results published and ready for dissemination.

NMI 1300.1 incorporates 14 CFR 1210 as published in the Federal Register on October 4, 1978. Part 1210.1(d) specifies all NASA wind tunnels "may be used for industry work when it is in the public interest either in joint programs with NASA or on a fee basis." NMI 9080.1B 4a specifies that Office of Management and Budget Circular A-25 requires "when

a Government service (or privilege) provides special benefits to an identifiable recipient above and beyond those which accrue to the public at large, a charge should be imposed to recover full cost...." Therefore, while the performance of tests of company models is permissible without fee when the test supplements a NASA research project and the results are readily available to any interested party, we believe a fee for wind tunnel tests must be charged when the company accrues benefits greater than other companies or the public.

Since 1981, the percentage of tunnel occupancy time expended on cooperative tests with industry ranged from 0 to 29 percent in the tunnels examined. During this period, LaRC made the determination that all the cooperative tests were joint programs that supplemented NASA research. None of the tests were considered company developmental tests for which a fee must be charged. The last "fee" test was performed in the Unitary Tunnel in June 1980.

In regard to the results from tests done in cooperation with a company, we believe an agreement not to release the data to others for an extended period of time appears to provide greater benefits to that company. For example, the company could gain lead time to develop or improve a product which may be the subject of a future Government or commercial procurement where they are in competition with companies who could not immediately obtain the test data. In these cases a fee should be charged. We believe clear guidelines for tunnel managers are needed to ensure all companies which request test arrangements are treated equally. These guidelines should address whether a company accrues a greater benefit when NASA agrees to withhold the test data for a short period, and whether data can be withheld for any period without providing a company with a potentially greater benefit than is provided to others.

LaRC management should confer with legal counsel to develop guidelines as to the length of time, if any, test data can be held from release to ensure compliance with OMB Circular A-25 and avoid potential claims from other companies that NASA is providing an advantage to their competitors.

RECOMMENDATION 1

EXECUTE WRITTEN AGREEMENTS FOR COOPERATIVE TESTS

LaRC should execute written agreements to set forth each party's responsibilities when wind tunnel tests are performed in certain cooperative arrangements with industry. The agreements should be signed by an authorized representative of each party. The agreements should cite the authority for NASA to execute the agreement and include,

among other things, the property and services that each party will provide, a designation of responsibility in the event of damage to property or injury to personnel, and any restrictions on the use or dissemination of the test results. The Office of Chief Counsel should approve all agreements prior to execution.

MANAGEMENT RESPONSE

LaRC will require written agreements for certain cooperative efforts as required by the new NMI's 1050.6 and 1050.7. As in the past, however, many, if not most, of our efforts will continue to be "NASA tests" run in consultation with industry but which are consistent with our RTOP objectives. In these cases, there could be extensive joint discussion and planning for the tests, but the judgment is made that the tests are of general interest. The decision is made then that the tests will be carried out as part of the NASA research mission. Under this arrangement, written agreements would not be required, but no special benefits or data rights can be promised or given.

ADDITIONAL COMMENTS

The planned actions are responsive to the recommendation.

RECOMMENDATION 2

ESTABLISH POLICY REGARDING TIME PERIOD THAT TEST DATA CAN BE HELD PROPRIETARY WITHOUT A FEE

LaRC management should establish a policy regarding the length of time that test data can be withheld from dissemination or publication when no fee is charged. To prevent the granting or appearance of granting a competitive advantage to any company, tunnel managers should apply the policy when negotiating all test agreements regardless of the tunnel or company involved.

MANAGEMENT RESPONSE

We agree that data cannot be held proprietary without a fee being charged. In fact, the Freedom of Information Act (FOIA) requires the release of test data in our files unless such data falls within one of the exceptions to the Act. This policy will be made clear in the guidelines discussed under Recommendation 3.

ADDITIONAL COMMENTS

The planned actions are responsive to the recommendation.

2. Wind Tunnel Utilization Controls

Controls and procedures regarding the utilization of wind tunnels could be improved to ensure that wind tunnels are used to the fullest extent and in the most cost-effective manner.

a. Procedures and controls for requesting, approving, scheduling, and reporting in-house tests and tests under cooperative agreements with industry, Government agencies, other NASA Centers, etc., have not been fully developed and documented in management instructions. The lack of these procedures may have contributed to the inconsistent treatment of test results discussed in Condition 1. We believe LaRC should consider developing written procedures which describe the processing of all types of wind tunnel tests. The procedures could address the information that should be provided to permit an evaluation of the request and provide for documentation of all test requests and the results of evaluation. The procedures could also address the safeguards to protect test data which are classified or proprietary to a company. Separate procedures would probably be needed for each type or category of test. The establishment of consistent procedures which require requestors to submit a brief written description of the desired test to tunnel managers could permit routine or selective examination or approval by upper management and/or peer groups which could identify more efficient test methods or alternatives, such as computational analyses which could save time and money. This may help ensure wind tunnel tests are run as efficiently as possible.

Periodically, LaRC management or NASA Headquarters requires the tests performed in various wind tunnels to be categorized for evaluation of utilization or to respond to inquiries from Congress, DOD officials, or others. Since current procedures do not require tunnel managers to categorize tests, they must do this retroactively to satisfy these inquiries. This is a time-consuming effort and can produce inconsistent results if the categories to be used are not clearly defined. If tunnel managers, in conjunction with requestors, placed requested tests into clearly defined categories prior to approval, it would both simplify response to these requests and improve the test controls. Categories could include NASA tests, DOD/Demand tests, DOD/Joint tests, Industry/Fee tests, Industry/Joint tests, and Foreign Industry/Country tests, among others. Improvements in controls would result because a manager's designation would cause a particular request to be processed in accordance with the procedures established for that category of test. A determination could be made at the outset if fees and/or written agreements are required using the guidance provided for that test category. The required documentation would support the determination. Foreign

Industry/Country test requests would be submitted for special review to ensure the test would not provide the requestor a competitive advantage in the civil or military aviation market.

b. NMI 1300.1 (Part 1210.5) describes the procedure for initiating, approving, and scheduling of development work for industry in NASA wind tunnels, including Government projects (work for industry on projects which are under contract or supported by a letter of intent from a Government agency). Several procedures in the request/approval/schedule process for these tests have been changed with the concurrence of NASA Headquarters. For example, the sponsoring Government agency is no longer required to submit a letter of request to NASA Headquarters for approval. Instead, the letter is submitted directly to LaRC. Also, the projects allocation and priority group does not establish priorities for scheduling Government projects. Discussions with the representatives from the Office of the Director For Aeronautics (Code RJ) at NASA Headquarters indicated that the projects allocation and priority group has not functioned as intended since its inception. DOD has been unable to establish a workable policy for resolving priority conflicts. As a result, the establishment of priorities has been unofficially delegated to the Center to work out with the requestors from other agencies. An ad hoc group of the Aeronautics Panel of the Aeronautics and Astronautics Coordinating Board recommended in 1981 that procedural documentation be revised to reflect these changes. The NMI, however, has not been revised. Also, Code RJ stated that the NMI requirement for submission of schedules for the unitary and other major wind tunnels to NASA Headquarters on a monthly basis does not serve a useful purpose. Quarterly or other less frequent submissions would satisfy Headquarter's requirements.

We believe 14 CFR 1210 as set forth in the NMI should be revised and published in the Federal Register to advise interested Government agencies and companies of the current procedures. This action could also serve to remind companies that the NASA wind tunnels are available for their use on a fee basis, which could increase tunnel utilization. This applies especially to the Unitary Tunnel. The Unitary Wind Tunnel Plan Act specifies that unitary tunnels ". . . shall be available primarily to industry for testing experimental models in connection with the development of aircraft and missiles." Unitary utilization has declined significantly over the past 15 years (refer to Exhibit 1) for a variety of reasons. Failure to encourage use for development projects by sources outside NASA may have been a contributing factor. As stated above, no fee tests have been conducted since June 1980 in the tunnels examined. Since fees paid by companies are remitted directly to the United States Treasury, NASA has little direct incentive to

encourage companies to use its tunnels for developmental tests. However, to comply with the intent of the Act and contribute to this Country's maintenance of superiority in military and civil aircraft designs, we believe NASA should publicize the availability of their tunnels for use by others under certain conditions. The intent is not to limit NASA research, but to fully utilize these valuable assets to attain the best products this Country can produce.

RECOMMENDATION 3

DEVELOP WRITTEN GUIDELINES

LaRC should develop written guidelines/procedures for processing all types of wind tunnel tests to improve internal controls and ensure consistent treatment of all requests. These guidelines should include a statement of the Center's policy regarding the holding of test data proprietary.

MANAGEMENT RESPONSE

LaRC does intend to issue guidelines to clarify the general area of wind-tunnel utilization policies and procedures. This effort had been started but has been delayed by the revision discussions and decisions on related NMI's.

In this effort to clarify, we do not believe that additional documentation and reporting requirements will be necessary or desirable on all test requests as suggested in paragraph 2.a of the draft report. Present requirements give adequate internal controls and review of wind-tunnel utilization.

As pointed out previously, one of the goals of the current Administration (and of a recent Agency initiative) is to reduce paperwork, not to increase it, and to enhance our productivity. In this regard, wind-tunnel utilization reporting was reviewed during the recent Agency paperwork reduction effort and no further requirement was found desirable either at the Center or at Headquarters.

It is true that, periodically, information is required by LaRC management, or by NASA Headquarters, on wind-tunnel utilization that has to be assembled retroactively. Experience has shown, however, that this relatively infrequent requirement, the attendant required accuracy, and the ever-changing format or data elements are such as to render the present system very cost effective relative to a new or additional accounting and reporting system.

ADDITIONAL COMMENTS

The planned actions above supplemented by the plans to categorize tests as discussed at the exit conference are responsive to the recommendation.

RECOMMENDATION 4

REVISE NMI 1300.1

NASA Headquarters Office of Aeronautics and Space Technology (Code R) should revise 14 CFR 1210 as set forth in NMI 1300.1 to reflect the current procedures for requesting, approving, and scheduling development work for industry in NASA wind tunnels. The revised policies and procedures should be published in the Federal Register to notify potential requestors of the current procedures and remind interested parties that under prescribed conditions all NASA wind tunnels are available for their use and that the Unitary Tunnels shall be available primarily to industry as specified by the Unitary Wind Tunnel Plan Act.

MANAGEMENT RESPONSE

We will request that Headquarters revise the NMI to reflect the current procedures for development work for industry in NASA wind tunnels.

HEADQUARTERS RESPONSE

Response of the Associate Administrator for Aeronautics and Space Technology: I concur in the recommendation that NASA Headquarters revise NMI 1300.1 to reflect current practices. I have assigned responsibility for the revision to OAST's Director for Institutions.

ADDITIONAL COMMENTS

The planned action is responsive to the recommendation.

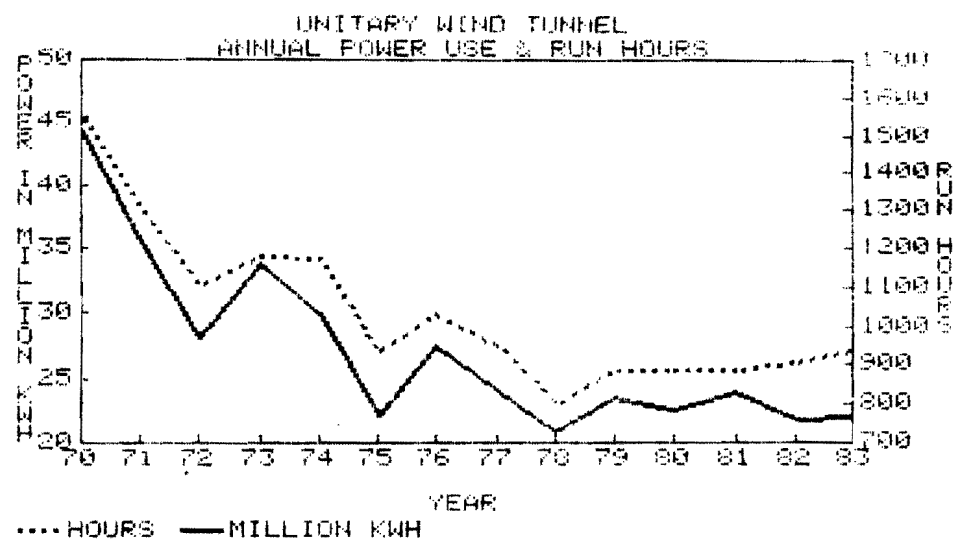
General Comments

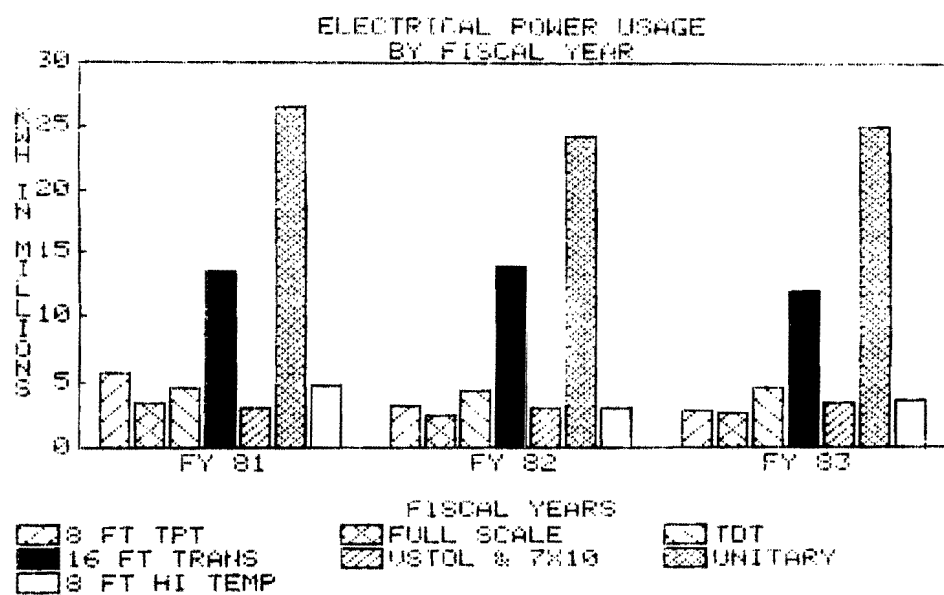
During our review, we identified a condition which warrants management consideration but was not significant enough to require a formal recommendation. We found the staffing levels needed to operate the facilities may not be fully considered during the project approval process. For example, no documentation exists to show that an evaluation was made to determine the manpower needed to operate the 4 x 7 Meter Tunnel after the ongoing modification is complete. This modification will permit one model to be prepared for testing outside the tunnel, while a second model is being tested in the tunnel. Prior to this modification, the same technicians both prepared the model, and operated the tunnel during the test. After the modification, additional technicians will be needed because the preparation and operation functions will be done concurrently. Tunnel managers expressed concern that technician staffing may not be adequate to perform both functions at the same time. If not, the projected increase in tunnel productivity cited in the project justification may not be attained.

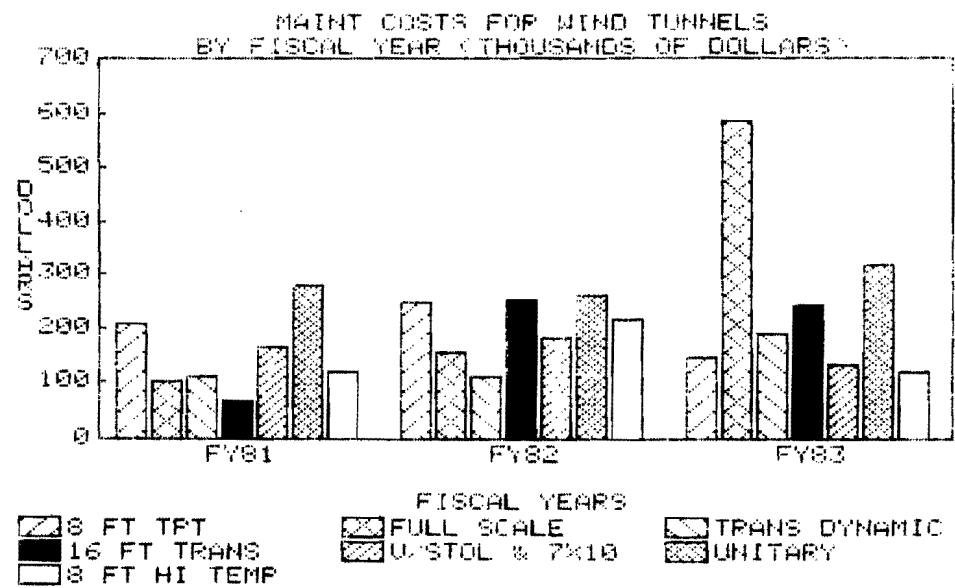
A review of the areas that requestors of facility projects are required to address showed that the impact on staffing levels is not included. We were informed that changes in staffing levels caused by facility projects had previously been documented during the approval process, but that this requirement was deleted in recent years. Currently, the impact on staffing is sometimes, but not always, addressed during presentations to Center management. However, no requirement to document the impact of the facility project on staffing levels currently exists.

In our opinion, the impact of a proposed facility project on staffing requirements is an important consideration in the approval process and sources for any additional personnel requirements should be fully examined and documented. We believe management should consider reinstituting the requirement to document the sources for additional personnel who will be needed to operate facilities after construction or modification.

This audit was performed by Mr. Richard Hess, who is available to provide additional information on the results. We extend our appreciation to the tunnel managers, OSD personnel, and others contacted during this review for their cooperation and assistance.







Reply to Attn of 111

August 21, 1985

TO: 181/Director, Center OIG, LaRC

FROM: 111/Assistant Director for Management Operations

SUBJECT: Draft Report on Review of Management and Utilization
of Wind Tunnels
(A-LA-84-302)

As pointed out in your draft report, LaRC has a policy of decentralized facility utilization management by the research program management. In addition, our management "style" has been "informal" to a great extent. This has resulted in excellent industry and university relations over the years. Cooperative discussions and research efforts have been the hallmark of NACA/NASA aeronautics research with outside groups. This policy and style have been highly praised and have significantly contributed to the Nation's objectives in aeronautics. As stated in page 6 of your draft report, your audit "did not identify any serious problems that may have occurred in the past . . ." under this management style and policy.

LaRC management is hesitant, therefore, to significantly modify this policy without clear and compelling reasons or payoff as long as we are in compliance with NASA Management Issuances (NMI's) and have reasonable and adequate internal controls in place. We believe this attitude is in line with recent efforts to reduce paperwork in Government and to uphold or increase our productivity.

The following comments are provided in response to the recommendations in the subject report:

RECOMMENDATION 1: EXECUTE WRITTEN AGREEMENTS FOR COOPERATIVE TESTS

LaRC will require written agreements for certain cooperative efforts as required by the new NMI's 1050.6 and 1050.7. As in the past, however, many, if not most, of our efforts will continue to be "NASA tests" run in consultation with industry but which are consistent with our RTOP objectives. In these cases, there could be extensive joint discussion and planning for the tests, but the judgment is made that the tests are of general interest. The decision is made then that the tests will be

carried out as part of the NASA research mission. Under this arrangement, written agreements would not be required, but no special benefits or data rights can be promised or given.

The subject NMI's are presently undergoing revision. When the revised versions are issued, LaRC will issue policy and procedure guidelines to the Center for the written formal agreements required.

RECOMMENDATION 2: ESTABLISH POLICY REGARDING TIME PERIOD THAT TEST DATA CAN BE HELD PROPRIETARY WITHOUT A FEE

We agree that data cannot be held proprietary without a fee being charged. In fact, the Freedom of Information Act (FOIA) requires the release of test data in our files unless such data falls within one of the exceptions to the Act. This policy will be made clear in the guidelines discussed under Recommendation 3.

RECOMMENDATION 3: DEVELOP WRITTEN GUIDELINES

LaRC does intend to issue guidelines to clarify the general area of wind-tunnel utilization policies and procedures. This effort had been started but has been delayed by the revision discussions and decisions on related NMI's.

In this effort to clarify, we do not believe that additional documentation and reporting requirements will be necessary or desirable on all test requests as suggested in paragraph 2.a of the draft report. Present requirements give adequate internal controls and review of wind-tunnel utilization.

As pointed out previously, one of the goals of the current Administration (and of a recent Agency initiative) is to reduce paperwork, not to increase it, and to enhance our productivity. In this regard, wind-tunnel utilization reporting was reviewed during the recent Agency paperwork reduction effort and no further requirement was found desirable either at the Center or at Headquarters.

It is true that, periodically, information is required by LaRC management, or by NASA Headquarters, on wind-tunnel utilization that has to be assembled retroactively. Experience has shown, however, that this relatively infrequent requirement, the attendant required accuracy, and the ever-changing format or data elements are such as to render the present system very cost effective relative to a new or additional accounting and reporting system.

RECOMMENDATION 4: REVISE NMI 1300.1

We will request that Headquarters revise the NMI to reflect the current procedures for development work for industry in NASA wind tunnels.

RESPONSE TO GENERAL COMMENT:

We agree that the impact of a proposed facility project on staffing requirements is an important consideration in the approval process. Actually, LaRC management has continued to request and discuss this information during our reviews of Coff projects during the approval process. OAST has also stated that they have required this information from each of the Centers during the submittal process. It is therefore clear that the impact on staffing is considered, but there is a lack of formal documentation. LaRC will consider how to formally introduce this information as a matter of record in the Coff approval process.

Robert H. Kirby /



National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Att of:

RI

OCT - 7 1985

TO: W/Acting Assistant Inspector General for Auditing
FROM: R/Associate Administrator for
Aeronautics and Space Technology
SUBJECT: Draft Report on Review of Management Utilization of
Wind Tunnel, Langley Research Center, Report No.
A-LA-84-302, dated August 6, 1985

I concur in the recommendation that NASA Headquarters revise NMI 1300.1 to reflect current practices. I have assigned responsibility for the revision to OAST's Director for Institutions.

Raymond S. Colladay

*Rec'd
10/1*

AUDIT REPORT

AIRCRAFT LANDING DYNAMICS FACILITY

LANGLEY RESEARCH CENTER

A-LA-85-004

July 25, 1986



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General

LaRC Field Office
Langley Research Center
Hampton, VA 23665



Reply to Attn of

181

July 25, 1986

TO: 111/Director for Management Operations
FROM: 181/Director, Center OIG
SUBJECT: Report on Modifications to the
Aircraft Landing Dynamics Facility
Langley Research Center
A-LA-85-004

We have completed an audit of the facility project for modification of the Aircraft Landing Dynamics Facility (ALDF) at Langley Research Center (LaRC).

A discussion draft was submitted to LaRC on December 31, 1985 and an exit conference was held on March 25, 1986. Results of the conference were considered and included in the draft report dated May 5, 1986. The Center's written comments, dated July 16, 1986, are included in their entirety in Appendix A of the report.

We will evaluate the status of corrective actions during a follow-up review in approximately 120 days and during future audits of construction projects.

Lee T. Ball

Enclosure

cc: W/AIGA

TABLE OF CONTENTS

Section		Page
I	DIGEST	1
II	INTRODUCTION	4
III	OBJECTIVE AND SCOPE	6
IV	OBSERVATIONS AND RECOMMENDATIONS	7
	1. Award and Administration of NAS1-17009	7
	2. Use of Change Orders	10
	3. Documentation of Inspections	15
	4. Contract Files Maintained by Facilities Engineering Division	18
	5. Enforcing Compliance with Contract Terms	21
V	GENERAL COMMENTS	25

EXHIBIT 1

July 25, 1986

MODIFICATIONS TO AIRCRAFT LANDING DYNAMICS FACILITY
LANGLEY RESEARCH CENTER

DIGEST

Introduction

The purpose of the audit was to evaluate management of this project by Langley Research Center (LaRC) to ensure the project resources were used effectively and efficiently to meet the established goals. The existing Aircraft Landing Dynamics Facility (ALDF) was modified to increase the test speed from 110 to 220 knots to provide a facility capable of meeting current and anticipated needs for aircraft landing gear research. Congress appropriated \$15 million for this project.

Results of Audit

The results of audit indicate the project was generally well managed and was completed within the appropriated funding level without any significant changes in scope. However, the following areas were identified where actions were needed to improve the management of future facility projects and overall contract administration.

1. Award and Administration of NAS1-17009

Contract NAS1-17009 was awarded for a fixed price to design and fabricate a new large-diameter, quick-acting propulsion control valve for the ALDF facility. Subsequent modifications of the contract were not made in strict compliance with the requirements of various procurement regulations. The original fixed-price contract for \$1,056,900 escalated to \$2,800,000. NASA unofficially assumed selected design responsibilities. The contractor was paid incurred costs plus a profit of about \$103,000. NASA engineers and technicians also incurred more than 27,000 hours assisting the contractor in design and analysis after contract award. The delivery date under the contract slipped from October 1983 to March 1985. We recommended LaRC management work with appropriate Headquarters personnel to obtain sufficient funds and resources to perform necessary preliminary design and analysis prior to award of future contracts for research facilities and ensure all negotiated agreements are executed by formal modifications to contracts. Center management concurred with the recommendations.

2. Use of Change Orders

ALDF project and procurement officials restricted competition by issuing unilateral change orders in lieu of competing new work. These changes added more than \$2 million to several ALDF contracts and potentially increased costs through lack of competition. We recommended the Aquisition Division take action to ensure the authority provided by the "changes" clause is properly applied. Center management concurred with the recommendation.

3. Documentation of Inspections

Inspection on ALDF contracts was performed by inspectors assigned to the project office in lieu of inspectors assigned to the Construction Management Unit (CMU) who inspect other construction contracts. The inspections of work performed on-site by ALDF contractors were not adequately documented to ensure the contractors complied with the contract terms and specifications. Without proper documentation of progress made by the contractor, compliance with specifications, problems incurred, and materials used on a daily basis as the work is performed, the Government may not be able to establish that a contractor defaulted on performance or caused delays or other problems that may arise at a later time. We recommended LaRC improve the documentation requirements used by CMU inspectors by documenting checks of material compliance and use CMU documentation requirements on future facility projects. Center management concurred with the recommendation.

4. Contract Files Maintained by Facilities Engineering Division

The official contract files for contracts administered by the Facilities Engineering Division (FENGd) sometimes did not contain the documents needed to support and explain various contractual actions. No standards were used for file maintenance of certain documents. As a result, it was often difficult to locate needed documents or determine the status of a contractual action or contract requirement at any point in time. We recommended LaRC establish and implement guidelines for maintaining files for contracts administered by FENGd. Center management concurred with the recommendation.

5. Enforcing Compliance with Contract Terms

Events that occurred on several ALDF contracts indicated LaRC was reluctant or unable to enforce contract terms and conditions. This reluctance increases the likelihood of future awards to contractors which are not fully qualified to perform the work. This could result in

performance delays and in possible overall cost increases. We recommended LaRC increase the assurance that specifications are reasonable and attainable; we also recommended LaRC more strictly enforce contract provisions and terminate contracts when contractors fail to comply. Center management concurred with the recommendations.

INTRODUCTION

The Office of Inspector General has completed an audit of the management of the facility project for modification of the Aircraft Landing Dynamics Facility (ALDF) at Langley Research Center (LaRC). The review was performed in accordance with the authority and responsibility contained in NASA Management Instruction (NMI) 9910.1, "The NASA Audit Program," dated January 28, 1980.

Modifications to the Aircraft Landing Facility was a major Construction of Facilities (C of F) at LaRC for which Congress appropriated \$15 million of fiscal year (FY) 1981 funds. The purpose of the project was to increase the test speed capability of the existing facility from 110 to 220 knots to provide a facility capable of meeting current and anticipated needs for aircraft landing gear research. The carriage propulsion system was modified to provide the increased thrust necessary to achieve the higher test speed; the test track was extended by approximately 600 feet to increase the length of the test section; an improved carriage arrestment system was installed; an improved, higher capacity carriage was procured to withstand the higher catapult and arrestment loads and to accommodate larger landing gear test specimens; and necessary service and storage areas were provided. The project was completed in August 1985. Exhibit 1 shows the major aspects of the facility project.

Construction management for this project was provided by the ALDF Project Office. The project was divided into workpackages which were managed by LaRC engineers. Work was accomplished by the award of construction and supply contracts and purchase orders. Construction inspection was provided by NASA inspectors assigned full time to the project with assistance provided part time by NASA and support contract inspectors assigned to the Construction Management Unit (CMU).

Changes to the project design, drawings, specifications, budget, master schedule, documentation, and construction were processed and controlled in accordance with the "Management Plan for Projects Assigned to Facilities Engineering Division."

The audit results indicate the project was generally well managed. The project was completed within the original \$15 million C of F funds appropriated by Congress without any significant changes to the project scope. Changes in the configuration of the project were documented and controlled. Project funds were accounted for accurately.

An exit conference was held on March 25, 1986 and conference results were included in the draft report forwarded to the Center on May 5, 1986. Center managements' response, dated July 16, 1986 concurred with all recommendations. The responses are summarized within the Observations and Recommendations section of the report and are included in their entirety in Appendix A.

OBJECTIVE AND SCOPE

The objective of the audit was to evaluate LaRC's management of this major C of F project to ensure the project resources were used effectively and efficiently to meet the established goals.

The scope of the audit included a review and evaluation of:

1. The internal controls established to ensure project funds were used for the intended purpose and were accounted for properly.

2. Major supply and construction contracts and a sample of minor contracts and purchase orders to ensure awards and subsequent modifications were properly made, payments were made as specified in the contract, required contractor submittals were obtained, required tests were performed, and inspections were made and documented to verify compliance with the contract terms and conditions.

3. The extent of compliance with the goals and objectives of the project.

The audit was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documents as were considered necessary in the circumstances. Nothing came to our attention to indicate untested items were not in compliance with applicable regulations.

The primary internal controls used to account for project funds included the standard controls for authorization and allotment of funds, purchase request approvals, and the evaluation of cost impact required by the management plan. In conjunction with these controls, an automated system was used to track the allocation of project funds to workpackages and identify incurred and pending obligations to contract awards and modifications.

Except as noted in the Observations and Recommendations section, the controls were considered satisfactory.

OBSERVATIONS AND RECOMMENDATIONS

1. Award and Administration of NAS1-17009

Contract NAS1-17009 was awarded for a fixed price to design and fabricate a new large-diameter quick-acting propulsion control valve for the ALDF facility. Subsequent modifications of the contract were not made in strict compliance with the requirements of various procurement regulations. The original fixed-price contract for \$1,056,900 escalated to \$2,800,000. NASA unofficially assumed selected design responsibilities. The contractor was paid incurred costs plus a profit of about \$103,000. NASA engineers and technicians also incurred more than 27,000 hours assisting the contractor in design and analysis after contract award. The delivery date under the contract slipped from October 1983 to February 1985.

Contract NAS1-17009 was awarded on April 23, 1982 to S&Q Corporation (S&Q), a small business located in San Francisco, CA. The contract was a negotiated fixed-price supply type for \$1,056,900. S&Q was the lowest of three offerors on a competitive solicitation which was subjected to review by a source evaluation panel. S&Q proposed a novel shutter valve concept that met the performance specifications. This concept appeared feasible and very attractive but had not been previously considered during the planning phase of the project. The other offerors were large businesses which specialized in the manufacture of valves.

During 1983 it became apparent that the contractor would not be able to produce a valve within an acceptable time frame without substantial assistance. For several months LaRC technical and procurement management considered various alternatives, including termination or conversion to a cost-type contract, but decided the contractor would be allowed to continue the existing contract. In December 1983, an informal agreement was entered into with the contractor. LaRC assumed selected design and analysis responsibilities and agreed "the contractor would not suffer financial loss." The contractor agreed to provide weekly technical activity and cost reports. The Government also issued a change order to incorporate a modular design feature and redesign of the safety shutter. The estimated cost of the change order was about \$110,000. The terms of the arrangement were not incorporated into the contract. A price for the change order was not definitized until after the valve was delivered in February 1985. In April 1985 a final price of \$2.8 million was negotiated. The delivered valve was not significantly different in concept from the valve proposed for \$1.1 million.

Without modifying the written fixed-price contract, the contracting officer verbally made a constructive change in the contract and committed the Government to payment of contract costs plus a profit of \$100,000. We believe this action exposed the Government to substantial financial risk and potential claims. The oral contract did not include a cost ceiling to limit the Government's risk, a reference to the cost principles to be used as a basis for determining the allowability of incurred costs on the prime and cost-type subcontracts or an agreement on the treatment of cost of money. The contractor orally agreed to permit an audit of incurred costs. LaRC became directly involved in the contractor's management of the contract and influenced decisions which impacted the contract costs. For example, in mid 1984 LaRC suggested the contractor award a sole source time and materials subcontract to Craft Machine Works, Incorporated, a machine shop located near LaRC, for assembly of the valve components. Although LaRC technical personnel closely monitored the subcontractor's performance, the subcontract cost increased from the estimate of about \$100,000 to \$318,000 at completion.

The formal written contract was also not modified to show NASA's assumption of responsibility for design and analyses, the increased involvement by NASA in other phases of the valve project, and the significant increase in contractor reporting requirements. The contracting officer subsequently modified the fixed-price contract four times to provisionally increase the contract price by \$1,298,671 to provide for payment of incurred costs in excess of the fixed-price. The justification used to support these increases was the undefinitized change order to provide a modular valve. As stated earlier, the estimated cost for this change was only \$110,000.

In our opinion, one factor that contributed to the problems with this contract was insufficient design and engineering analysis prior to the award. Neither project management nor the Architect/Engineer (A/E) had envisioned a shutter valve when the performance specifications were prepared. The limited funds and in-house resources provided for preliminary analysis prior to issuance of the solicitation were concentrated on other components (e.g., the carriage) thought to have higher risk. After the proposal for the unique and desirable shutter valve was received, the lack of time and available funding prevented extensive analysis prior to award.

LaRC management told us at the exit conference that funding is often inadequate for preliminary analyses involving construction or modification of unique research facilities. They have been working with Headquarters to obtain more funding for "up front" analyses. We support this action and believe efforts to increase the resources

applied to preliminary analysis should continue. Headquarters strongly encourages the use of firm fixed-price contracts for C of F projects. More preliminary study and analysis will help to ensure that designs and specifications are adequate and attainable under fixed-price contracts.

The cost impact of these actions cannot be determined. However, the total cost to the Government to procure the valve under this contract was about \$3.3 million (\$2.8 million for the contract plus \$.5 million for in-house effort). This exceeded the highest offer on the original solicitation by more than \$850 thousand. Only with an extraordinary involvement in the management of the contractor's operations was LaRC able to hold the cost to that level.

RECOMMENDATIONS

We recommend that:

1. LaRC management continue to work with Headquarters to ensure adequate funds and resources are provided for preliminary design and analyses on C of F projects for construction and modification of research facilities.
2. AD management ensure that any agreements negotiated with contractors are executed by formal modifications to the contracts.

MANAGEMENT RESPONSE

We concur with the recommendations.

ADDITIONAL COMMENTS

The Center has agreed to seek additional funding for preliminary design and analysis. This action is responsive to recommendation 1.

AD management has agreed that in the future all negotiated agreements with contractors will be executed by formal contract modifications. This action is responsive to recommendation 2.

2. Use of Change Orders

ALDF project and procurement officials restricted competition in contracting and potentially increased contract costs by issuing unilateral change orders to add new work to several ALDF contracts.

NPR 7.103-2, "Changes," clause specifies that "The Contracting Officer may at any time, by written order, and without notice to the sureties, make changes, within the general scope of this contract" Identical or similar wording is included in FAR 52.243-1 and FAR 52.243-4. These provisions were included in the contracts reviewed and authorized the contracting officer to make unilateral changes, but only within the general scope of the contract. In our opinion, the clause does not authorize the contracting officer to add new work which is not within the general scope of the contract such as is described in the following examples.

We reviewed the award and subsequent modifications of eight ALDF construction and supply contracts over \$100,000 and one contract under \$100,000 for compliance with procurement regulations including the change clause. We identified 11 change orders issued under five contracts which added new work outside the scope of the original contract as follow:

a. Contract NAS1-17095. This was a negotiated fixed-price supply contract awarded on July 30, 1982 to design, fabricate, and deliver a high pressure L-shaped vessel for ALDF. The contract price of \$1,489,073 was based on competition and was significantly less than the Government estimate of \$2,700,000. This work was one part of a prior solicitation package that was cancelled because all offers greatly exceeded the Government estimate. Some of the work added by change orders and discussed below was also included in the cancelled solicitation; however, none, in our opinion, was within the general scope of Contract NAS1-17095. The following change orders were issued to add new work which increased the contract price by \$1,350,000:

(1) Change order 5 was issued to make several changes within the contract scope and add design and fabrication of an air manifold to the work scope. The air manifold was a component separated from the L-shaped vessel by several feet of air piping for which the installation was added to this contract later by change order 8. A Justification for Noncompetitive Procurement was prepared on October 1, 1982 to recommend the air manifold work be awarded to the contractor without competition, indicating LaRC determined initially this effort was new work. However, procurement officials subsequently determined that this effort could be added as a change order. The contract

price was increased by \$361,000 as a result of this change. About \$230,000 related to the new work.

(2) Change order 8 was issued to add field fabrication and erection of the air piping system to the contract. The contract price was increased by \$224,439 for the new work.

(3) Change order 22 was issued to add design, fabrication, delivery, and testing of a compatibility nozzle to permit testing with an existing carriage and existing propulsion control valve. At the time the change was issued it was uncertain when the new valve would be completed. Therefore, expedited procurement of the compatibility nozzle was desired to permit the resumption of limited research testing on schedule. A separate delivery schedule of 270 days (about November 13, 1984) was established for this component and the fabrication was done by a subcontractor. After the main valve was delivered, project management's attention was directed elsewhere and the nozzle was not delivered until November 1985. The separate delivery schedule, fabrication by a subcontractor, and late delivery all lend support to this item being new work that should have been obtained by a new procurement. The contract price was increased by \$402,540 as a result of this change.

(4) Change order 25 was issued to add relocation and modification of the existing air bottles to the scope of work. The air bottles contain the pressurized air which causes the water to be expelled from the L-shaped vessel when the propulsion valve is opened. Work on the air bottles was not included in the contract work scope. The contract price was increased by \$125,305 as a result of this change.

(5) Change order 26 was issued to add fabrication and delivery of a flow straightener to the scope of work. The flow straightener directs the flow of water released by the propulsion valve against the test carriage. The flow straightener is on the opposite side of the valve from the L-shaped vessel. Specifications related to the flow straightener were not included in the original scope of work. The contract price was increased by \$89,072 as a result of this change.

(6) Change order 27 was issued to add installation and alignment of the rails on the new track extension. This work was originally awarded under separate contract which was descope and cancelled when the contractor failed to perform. The rails form the track on which the carriage travels and have no relationship to the L-shaped vessel. The contract price was increased by \$239,482 as a result of this change.

(7) Change order 30 was issued to modify the existing transfer dolly. The transfer dolly is used to move the test carriage to another building for repair and storage. The dolly is located at the other end of the test track from the L-shaped vessel. The contract price was increased by \$29,000.

The effect of adding new work by change order is that competition is restricted, controls including written justifications and approvals for noncompetitive procurements are bypassed, and costs are potentially increased. On NAS1-17095 the potential for increased cost is shown by comparing the relationship between the Government estimate and the negotiated price for the initial competitive award with the same relationship for the compatibility nozzle added by change order 22. The original contract price of \$1,489,073 was significantly less than the Government estimate of \$2,700,000. The \$402,540 negotiated in March 1985 to definitize change order 22, however, was significantly more than the Government estimate in May 1983 of \$279,000. Other change prices were negotiated much closer to the estimates, but, as expected without competition, none were significantly below.

In another example, the contractor on NAS1-17095 submitted a budgetary estimate of \$108,000 for installing rails in Buildings 1261 and 1262. Another contractor proposed \$80,000 for the same work. Both contractors were already on site and submitted their estimates in expectation of a change order on a noncompetitive basis. Although the award was made to the second contractor at a 26 percent lower price, competition may have reduced the price even more.

b. Our review found new work was also added by change order to several other contracts. Some of the more significant examples follow:

(1) Contract NAS1-17354. This contract was awarded for fabrication, testing and delivery of a main carriage for ALDF. Change order 7 was issued to add repair of the existing carriage which had been damaged in an accident in January 1982. This work was outside the scope of the original contract and resulted in a price increase of \$194,845.

2) Contract NAS1-17059. This contract was awarded for delivery of the carriage arrestment system. Change order 9 added installation of the system to the scope of work and resulted in an increased price of \$111,826.

(3) Contract NAS1-17834(c). This contract was awarded for constructing an addition to Building 1262 and a transfer track between Buildings 1261 and 1262 (Exhibit 1).

Change order 4 was issued to add installation of rails and rail supports inside both buildings. The work added by this change was also considered for addition by change order to Contract NAS1-17095 as discussed above. Initially, the work inside Building 1261 was included in Contract NAS1-17646(c) which was closed before significant work was performed as discussed in Condition 5b. The various options considered for performance of the work show it was new work outside the general scope of NAS1-17834(c). The contract price was increased by \$80,000 as a result of the change.

(4) Contract NAS1-17164(c). This contract was awarded for construction of a 300-foot extension to the ALDF track foundation. Change order 7 was issued to add an additional 313 feet to the track foundation. This additional footage was included in the approved project but had been postponed until the availability of sufficient funding was assured. The additional work was outside the scope of the original contract and could not properly be added by change order. A sole-source award to the on-site contractor may have been justified but required documentation and approval of the reasons involved. The contract price was increased by \$321,840 as a result of this change.

The Comptroller General (CG) has ruled on several cases where new work was added by modification similar to the ALDF cases discussed above. In Procurement Decision B207389 the CG concluded ". . . that the contracting parties may not change the terms of a contract to interfere with or defeat the purposes of competitive procurement." In regard to adding work under the changes clause, the CG commented, "In our view, the clause permits extra or changed work only in connection with work contemplated or specified in the contract" and ". . . the purposes of competitive procurement were defeated by the improper . . . contract modification incorporating the new work." In 41 Comp. Gen. 484 (1962), the CG was not persuaded that the agency's explanation that the contractor was already on-site, knew the existing conditions and offered the greatest assurance of satisfying the agency's needs justified the modification. We believe the CG rulings in B207389 (1982) and several other decisions support our position.

On Contract NAS1-17524(c) and other construction contracts, the contracting officer designated certain responsibilities for contract administration to a technical representative. The associated instructions stated in part, "No new work outside the scope of the contract specifications shall be directed or implied. Such efforts shall be treated as new procurements and submitted to the Acquisition Division in accordance with applicable procedures." We believe this further supports our position that it is not proper to add new work by change order.

In summary, we believe LaRC contracting officers improperly applied the authority provided by the "changes" clause by citing it as the basis for adding new work to existing contracts. As a result, the purposes of competitive procurement were defeated and excess costs were possibly incurred. Sole-source procurement of some of the efforts described above may have been justified, but, when that occurs, the procurement regulations require the reasons and appropriate approvals to be documented.

We believe the basic cause of this condition was a lack of clear guidance regarding the circumstances when the use of the change order is appropriate. The relatively short time and administrative effort involved in adding work by change order versus processing a new procurement was also a contributing factor. LaRC procurement officials need to develop guidelines or establish procedures to ensure change orders are properly used.

RECOMMENDATION

3. We recommend that AD management take action to ensure the authority to alter the scope of the contract provided by the "changes" clause is properly applied.

MANAGEMENT RESPONSE

We concur with the recommendation; however, in most cases we could have used the negotiation authority found in U.S. Code 2304(a)(10)(xvii) to accomplish the same results except we saved some time by using the change orders. We feel that the changes issued to contracts on this project were in the best interest of the Government, minimized overall cost to the Government by keeping the number of contractors on site at any given time to a minimum, and by processing the change requests at the earliest possible time.

ADDITIONAL COMMENT

We do not believe a conclusion that overall cost was minimized can be drawn without knowledge of the impact of competitive market forces. However, we plan to evaluate the actions taken to ensure proper application of the authority to modify the contract scope provided by the "changes" clause during our follow-up review.

3. Documentation of Inspections

The inspections work performed on-site by ALDF contractors was not adequately documented to ensure the contractors complied with the contract terms and specifications. Without proper documentation of progress made by the contractor, compliance with specifications, problems incurred, and materials used on a daily basis as the work is performed, the Government may not be able establish that a contractor defaulted on performance or caused delays or other problems that may arise at a later time.

Construction inspectors were assigned full time to the project to monitor contractor performance. The inspectors were required to complete daily reports to document the contractor's progress, compliance with specifications, problems incurred, etc.

We reviewed the construction inspection records on two major contracts and found inadequate documentation as follows:

a. Contract NAS1-17164(c) was awarded to provide the extension to the test track foundation and required numerous pours of concrete. A cursory review of construction inspection reports showed no reports existed for various periods during the performance period. Subsequently, we reviewed the inspection reports for dates when significant concrete pours were made as indicated by the existence of test reports from a testing laboratory. We found 19 of the 36 tests, for which test reports had been submitted to NASA, were not documented in inspection reports. In 16 of the 19 cases no inspection reports were on file. As a result of inadequate documentation, we were unable to determine whether all tests were performed and if they were conducted in accordance with contract specifications.

b. Contract NAS1-17524(c) was awarded to provide services and materials for the transfer station, impact barrier and re-erection of Building 1261. We reviewed the construction inspection reports and found the following examples of deficiencies in documentation:

(1) Daily inspection reports were not on file for the periods November 3, 1983 through January 2, 1984 and March 6, 1984 through April 20, 1984 as well as several other dates during the performance period.

(2) Although CMU inspectors initiated the use of a new inspection log book in mid-1982 to provide better documentation of inspection functions performed on formal contracts, the ALDF inspectors did not begin to use the log book until May 1984. The new log book provided sections for

recording critical data, but the ALDF inspectors made no entries in the several sections as follows:

(a) A schedule of noncompliance items was not completed.

(b) The record of contractor submittals was not completed.

(c) The record of Government-furnished materials was not completed.

(3) Before the contractor comes on-site, the CMU prepares a list of critical specifications that must be checked. The ALDF inspectors did not use a similar procedure to ensure critical specifications were monitored.

(4) Paint was applied on several days when the temperatures exceeded the maximum specified in the contract. The inspection records did not comment on the circumstance that permitted this to be done.

(5) The records did not document whether preservation was applied to cut portions of treated lumber as specified.

(6) The records did not show whether any check made to ensure materials such as paint or plywood complied with specifications.

Without adequate documentation by construction inspectors, it is not possible to determine whether contractors complied with critical contract specifications.

Several causes of the inadequate documentation exist. Firstly, the ALDF inspectors did not use procedures and controls developed for the CMU inspectors because they were under the organizational control of the project office. The periodic reviews of inspection logs which were done routinely by CMU management were not performed by ALDF project management. Project officials may have been less aware of the necessity for thorough documentation than CMU management.

A lack of manpower was also a contributing factor. Several major contracts were being performed concurrently and the ALDF inspectors had the responsibility for monitoring each one. Assistance from CMU inspectors was not obtained until the latter stages of the project.

We were informed during the review that the inspection function on future projects might be provided and organizationally controlled by CMU. We believe this plan should be implemented because CMU has several inspectors and has

more flexibility to move them to critical jobs on a daily basis. CMU also has established more stringent procedures and requirements for documenting inspections.

We reviewed inspection records prepared by CMU only where they assisted the ALDF inspectors on the contracts examined. However, we found their records often did not document that checks were made to ensure materials used by contractors complied with specifications and approved submittals. We believe such checks should be performed and documented to reduce the risk to the Government in the event of future claims.

RECOMMENDATIONS

We recommend that:

4. Systems Engineering and Operations (SE&O) management implement a plan to perform the inspection function on future facility projects with CMU inspectors and/or use the procedures and controls that have been established by that group for documenting the inspection results.

5. CMU revise inspection procedures to include documentation of checks made to ensure the materials delivered to the site and used on the contracts comply with contract specifications and/or approved contractor submittals.

MANAGEMENT RESPONSE

We concur with the recommendations.

ADDITIONAL COMMENT

SE&O management has agreed to use CMU inspectors on future facility projects. This action is responsive to recommendation 4.

CMU has begun documenting the checks made to ensure materials delivered to the construction site comply with specifications. This action is responsive to recommendation 5.

4. Contract Files Maintained by Facilities Engineering Division

The official contract files for contracts administered by the Facilities Engineering Division (FENGd) sometimes did not contain the documents needed to support and explain various contractual actions. No standards were used for file maintenance of certain documents. As a result, it was often difficult to locate needed documents or determine the status of a contractual action or contract requirement at any point in time. The problems we identified, however, related only to the documentation of certain actions and do not reflect on the performance of the overall administration functions.

Except for inspection records, the official contract files for contracts administered by FENGd, including the ALDF contracts, were maintained by a single NASA employee assigned to the Technical Management Control (TMC) Section. The files were kept in a trailer located behind Building 1209. Inspection records were kept by the construction inspectors and sent to (TMC) files sometime after the contract is completed. For the ALDF project, the inspection records for all contracts were retained by the inspection office awaiting completion of the entire project.

During our review, we examined several contracts administered by FENGd and noted deficiencies in file maintenance as follow:

a. On Contract NAS1-17354 the official contract files did not contain some or all of the required documentation including cost proposals, technical evaluations, audit reports, and negotiation memoranda for Modifications 10, 11 and 12. These documents were located in the work file maintained by the contract specialist.

b. On Contract NAS1-17524(c) the official file for Modification 9 did not contain a proposal from the contractor supporting part of a claim for equitable adjustment. The proposal was located in the specialist's work file.

c. Change order 26 on Contract NAS1-17095 and all supporting documentation was not contained in the official contract files.

d. On Contract NAS1-17834(c) the official contract file did not contain negotiation memoranda to document the results of negotiations for Modifications 4 and 7. The file also did not contain a list of subcontractors and the certification by the contractor that required clauses were included in subcontracts.

e. On Contract NAS1-17164(c) a portion of the contract file had been microfilmed and another portion was still maintained in hard copy. The Contract Specialist had documents pertinent to several modifications filed in a work file which had not been microfilmed. Construction inspection records were retained in the inspector's trailer in hard copy. In addition the microfilmed files contained more than one copy of several documents including bid submittals and contract specifications making it difficult and time consuming to locate desired documents.

Several factors were responsible for the problems found. Contributing factors included the contracting officers being outside the organization structure; maintenance of unofficial files by contract specialists, workpackage managers, and the project office; the type of contracts administered and limited manpower.

FENG D contract specialists were not supervised by contracting officers. This influenced the control the contracting officer had to ensure the contract files were properly maintained and the contract specialists were aware of the required documentation. Management attempted to improve this condition by relocating a contracting officer to the TMC area to permit more direct involvement with the contractual actions performed in FENG D.

In addition to the official contract files, unofficial files of ALDF contract documents were kept in several locations. The contract specialist kept a work file of documents related to each contract modification. The work package managers kept files of required submittals, certifications, test reports, and other correspondence related to the contracts included in their workpackages. The ALDF Project Office maintained correspondence files containing submittal data, drawing files, and other documents related to all ALDF contracts. The project construction manager kept files which included documents related to contracts. Construction inspectors kept files of some contractor submittals in addition to the inspection records. With several files containing duplicate documents, original documents occasionally were filed in unofficial files without distribution to the official files. Some documents which were routed to official files could not be filed because they did not contain sufficient information to identify the proper file.

Most of the contracts maintained in FENG D are construction contracts which include documents such as drawings, contractor submittals, certifications, test reports, and progress reports which are not a part of supply contracts. No specific guidelines have been developed to provide consistent filing of these documents. Other documents unique to construction contracts include bonds,

cost breakdowns, subcontract listings and certifications, and progress schedules. A consistent file structure for these documents has been established, but controls do not exist to ensure the documents are placed in the official file. After completion, contract files are microfilmed to provide a permanent record. No guidelines or controls exist to ensure the microfilm file contains all pertinent documents and extraneous and duplicate documents are removed.

We believe FENG D and AD management should develop guidelines for the maintenance of contract files administered by FENG D to ensure the inclusion of all pertinent documents and the exclusion of extraneous and duplicate documents. Consideration should be given to maintaining only one set of contract files to be used by all parties. An alternative would be to assign the responsibility for various elements of the official files to groups or individuals most familiar with the documents involved. The file should be maintained or at least periodically reviewed by someone familiar with the contract and subjected to a final review to verify the inclusion of required documents and the elimination of duplicates prior to microfilming. A file structure should be developed to provide consistent filing on all contracts.

RECOMMENDATION

6. We recommend that FENG D and AD management develop and implement guidelines for the maintenance of contract files administered by FENG D.

MANAGEMENT RESPONSE

We concur with the recommendation. The official construction contract files have been transferred to Acquisition Division and will be maintained under the same guidelines as all other contracts at LaRC

ADDITIONAL COMMENT

The Center's action is responsive to recommendation 6.

5. Enforcing Compliance with Contract Terms

Events that occurred on several of the ALDF contracts examined indicate LaRC was reluctant or unable to enforce contract terms and conditions. This reluctance increases the likelihood of future awards to contractors which are not fully qualified to perform the work. This could result in performance delays and in possible overall cost increases.

Our review identified events that occurred on several contracts which indicate a reluctance or inability to enforce contract terms:

a. Contract NAS1-16240 was a fixed-price award on May 21, 1980 to an A/E firm in the amount of \$828,000 for preparation of final design, drawings, specifications, and estimates for modifications to ALDF. The contractor was unable to perform some requirements and experienced delays in others. In August 1981, LaRC verbally agreed to treat some of the more stringent design requirements as "goals." In November 1981, the contracting officer and a former Director, SE&O examined, without any detailed analysis or audit, an unsubmitted claim in the amount of \$354,000 and offered the contractor a settlement of \$82,000. The settlement offer included accepting an uncompleted design for the new ALDF carriage. Documentation for the settlement indicated the contracting officer estimated NASA had experienced damages of at least \$1,250,000 caused by the contractor. In February 1982, the contractor submitted a formal claim in the amount of \$82,000 which was accepted by NASA. The contract price was increased by modification dated May 10, 1982. The agreed-to lessening of specification requirements was not incorporated into the contract and no final report was ever received.

b. Contract NAS1-17646(c) was awarded on January 4, 1984 in the amount of \$269,125 for installation of rails for the 613 feet of test track and 107 feet of storage track. In April 1984 LaRC determined the contractor was making poor progress and probably would not be able to complete the contract successfully. In lieu of terminating the contract, LaRC negotiated a settlement agreement to accept the very limited progress made by the contractor for \$45,000 and closed the contract. The authority cited on the supplemental agreement was "Mutual Agreement." Since the contract was not terminated, no audit of the contractor's proposal was required. The installation of the 613 feet of test track rails was added to Contract NAS1-17095 by change order which was later definitized at \$239,482. The installation of the 107 feet of storage track was added as a part of a change order to Contract NAS1-17834(c) which was definitized at \$80,000.

c. Contract NAS1-17255(c) was awarded on December 17, 1982 in the amount of \$33,500 for modifying ALDF air bottles. The completion date was April 18, 1983. In early April 1983, LaRC determined the contractor would not be able to complete the job on time which would have a serious impact on the other contractors in the area. In lieu of termination, LaRC descoped the contract, citing authority pursuant to the "changes" clause, to specify performance of only the work that had been completed and negotiated a final contract price of \$26,646. Discussions indicated the contractor actually performed only a small part of the work originally specified. The remaining work was added by change order to NAS1-17095 in May 1984. The contract price was increased by approximately \$47,000 to complete the work.

d. As discussed in Condition 1, S&Q Corporation was relieved from compliance with various contract terms and conditions on Contract NAS1-17009 without consideration.

Several factors were cited as reasons why these contract specifications had to be relaxed or reduced. In two cases, overly stringent specifications for a fixed-price contract was a factor. On NAS1-16240, the contracting officer noted the technical specifications were "a commercial impossibility" under a fixed-price contract. On NAS1-17646(c), the contracting officer indicated "the Government would . . . examine the specification to make them more commercially feasible."

Another factor cited was the possibility for delays and the potential for high costs that could result from terminations for convenience. Although several contractors did not prosecute the work required by the contract with such diligence as would insure its completion within the time specified in the contract, which is the basis for termination for default, termination for default was usually not considered as an option. Instead, LaRC relieved the contractors of various performance requirements and negotiated agreements to pay the contractor's incurred costs plus profit, in some cases without audit, and without regard for the ratio of the cost of work completed to the total contract price.

LaRC's reluctance to enforce compliance with the terms and conditions of contracts could result in the award of future contracts to contractors without the resources or qualifications to perform the work. Based on experience, contractors know that there is little likelihood that they will suffer any harm or penalty for failure to comply with the contract specifications. They can bid on jobs beyond their capabilities, recover their costs and a profit, and be relieved from some or all performance requirements. As a result, bids may be received from and awards made to contractors with limited capabilities.

Another result may be that some contractors are encouraged to submit unrealistically low bids believing that LaRC will relax specifications if they are unable to perform at a profit.

We recognize an effective program to enforce compliance with contract terms requires a coordinated Center-wide effort involving technical, procurement, legal and other personnel. However, we believe stricter enforcement of contract terms would ultimately reduce problems and could result in lower costs. If LaRC developed a reputation for enforcing compliance, contractors would be reluctant to bid on jobs if they had reservations on their ability to perform. Also, they would be more likely to submit realistic bids. Consequently, the problems that occur after award should be significantly reduced. While the initial contract prices would likely increase, the overall cost including the in-house costs related to resolving problems and assisting contractors in performance of the contract could be reduced.

We believe LaRC should improve the reviews of technical specifications to increase the assurance that they are reasonable, attainable and consistent with the planned contract type before inclusion in the solicitation. Then, after award, LaRC should more strongly enforce compliance with the specifications, obtain equitable consideration if specifications must be relaxed, and exercise termination rights if the contractor cannot perform. Over a period of time, these actions, coupled with increased competition, should result in awards to responsible and qualified contractors, less problems and assistance after award, and potentially lower overall costs.

RECOMMENDATIONS

We recommend that:

7. SE&O management emphasize the importance of reviews of technical specifications to increase the assurance that they are reasonable, attainable, and consistent with the planned contract type.

8. LaRC management develop a Center-wide program involving technical, procurement and legal office personnel directed toward more strongly enforcing compliance with contract terms and conditions. Contracting officers obtain equitable consideration if specifications are relaxed or initiate terminations for default unless the causes were beyond control and without the fault or negligence of the contractor.

MANAGEMENT RESPONSE

We concur with recommendation 7. All program directors (including the Director for SE&O) have included in their performance plans a requirement to review all specifications to assure that they are complete, reasonable and attainable; set forth the Government minimum requirements; and do not restrict competition. Accordingly, every level of management has been instructed to review specifications and our goal is to produce the most accurate procurement package possible for each acquisition.

ADDITIONAL COMMENT

The Center's actions are responsive to recommendation 7.

MANAGEMENT RESPONSE

We concur with recommendation 8. It has been our goal to strongly enforce compliance with the contract terms and conditions, and we believe we do so to the best of our abilities with the resources available considering the "field environment" where projects of this magnitude are carried out.

ADDITIONAL COMMENT

This recommendation involves the entire Center's philosophy that has evolved over many years in dealing with contractors. We believe an increased emphasis on enforcing compliance is a positive step toward changing the philosophy and complies with the intent of recommendation 8.

GENERAL COMMENTS

During our review, we identified a condition which warrants management attention but was not significant enough to require a formal recommendation. LaRC procured a trailer with C of F funds appropriated for the ALDF project and used the trailer at another location on the Center. The result was an inappropriate expenditure of \$8,078 of project funds.

An addition to Building 1262 was included in the scope of the original ALDF project. Subsequently, this effort was deleted from the project to ensure the availability of funds for more critical work elements. Later, when several contracts were awarded below the estimated costs, funds became available and the addition to Building 1262 was reinstated to the project.

During the time the work was deleted, LaRC management selected an area adjacent to Building 1262 as the location for a trailer complex to house personnel temporarily displaced by the rehabilitation of Building 1297 (not part of ALDF). The location was selected because of its proximity to the research facilities used by the displaced personnel.

When the addition to Building 1262 was reinstated to the project, the trailer complex had to be relocated. The only location found suitable did not have access to restroom facilities, so a trailer containing restrooms had to be purchased. Since the purchase was at least indirectly related to the ALDF project and no other funds were available, LaRC management decided to use ALDF funds to buy the trailer. On July 26, 1984, purchase order L72920B was awarded for \$8,166.

The NASA Budget Administration Manual (NHB 7400.1C), paragraph 3402d, specifies, "The use of resources authorities by NASA officials shall be limited to approved projects and activities and within the terms of, and limited by, approved resources authority allocations" We believe the use of funds appropriated for the ALDF project to procure a trailer not intended for use on the project is not a proper expenditure. To rectify this matter, the ALDF project funds used to purchase the trailer should be reinstated to the project.

This audit was performed by Mr. Richard W. Hess, who is available to provide additional information on the results. We extend our appreciation to the ALDF project manager, project personnel, AD personnel and others contacted during this review for their cooperation and assistance.

Langley Research Center
Hampton, Virginia
23665

Reply to Attn of 111

July 16, 1986

TO: 181/Director, Center OIG, LaRC

FROM: 111/Assistant Director for Management Operations

SUBJECT: Draft Audit Report on Modifications to the Aircraft
Landing Dynamics Facility, Langley Research Center,
A-LA-85-004

The following comments are provided in response to the subject report:

General:

We appreciate the IG's overall comment that the project was well-managed and we recognize that a review of the many thousands of decisions that were made during the life of the project might raise some procedural questions. Project decisions were made keeping in mind the overall complexity of the job, the presence of many contractor personnel onsite at any given time, and the urgency of the project (i.e., shuttle tire testing requirements). We believe that the Government's interest was best served by the overall decisions that were made and that the project was successfully completed. In addition, all technical objectives were completed within the approved cost limits.

Observations and Recommendations

Recommendation 1.- LaRC management continue to work with Headquarters to ensure adequate funds and resources are provided for preliminary design and analyses on C of F projects for construction and modification of research facilities.

We concur with the recommendation.

Recommendation 2.- AD management ensure that any agreements negotiated with contractors are executed by formal modifications to the contracts.

We concur with the recommendation.

Recommendation 3.- We recommend that AD management take action to ensure the authority to alter the scope of the contract provided by the "changes" clause is properly applied.

We concur with the recommendation; however, in most cases, we could have used the negotiation authority found in U.S.

Code 2304(a)(10)(xvii) to accomplish the same results except we saved some time by using the change orders. We feel that the changes issued to contracts on this project were in the best interest of the Government, minimized overall cost to the Government by keeping the number of contractors onsite at any given time to a minimum, and by processing the change requests at the earliest possible time.

Recommendation 4.- Systems Engineering and Operations (SE&O) management implement a plan to perform the inspection function on future facility projects with CMU inspectors and/or use the procedures and controls that have been established by that group for documenting the inspection results.

We concur with the recommendation.

Recommendation 5.- CMU revise inspection procedures to include documentation of checks made to ensure the materials delivered to the site and used on the contracts comply with contract specifications and/or approved contractor submittals.

We concur with the recommendation.

Recommendation 6.- We recommend that FENG D and AD management develop and implement guidelines for the maintenance of contract files administered by FENG D.

We concur with the recommendation. The official construction contract files have been transferred to Acquisition Division and will be maintained under the same guidelines as all other contracts at LaRC.

Recommendation 7.- SE&O management emphasize the importance of reviews of technical specifications to increase the assurance that they are reasonable, attainable, and consistent with the planned contract type.

We concur with the recommendation. All Program Directors (including the Director for SE&O) have included in their performance plans a requirement to review all specifications to assure that they are complete, reasonable, and attainable; set forth the Government minimum requirements; and do not restrict competition. Accordingly, every level of management has been instructed to review specifications and our goal is to produce the most accurate procurement package possible for each acquisition.

Recommendation 8.- LaRC management develop a Center-wide program involving technical, procurement, and legal office personnel directed toward more strongly enforcing compliance with contract terms and conditions. Contracting officers obtain

equitable consideration if specifications are relaxed or initiate terminations for default unless the causes were beyond control and without the fault or negligence of the contractor.

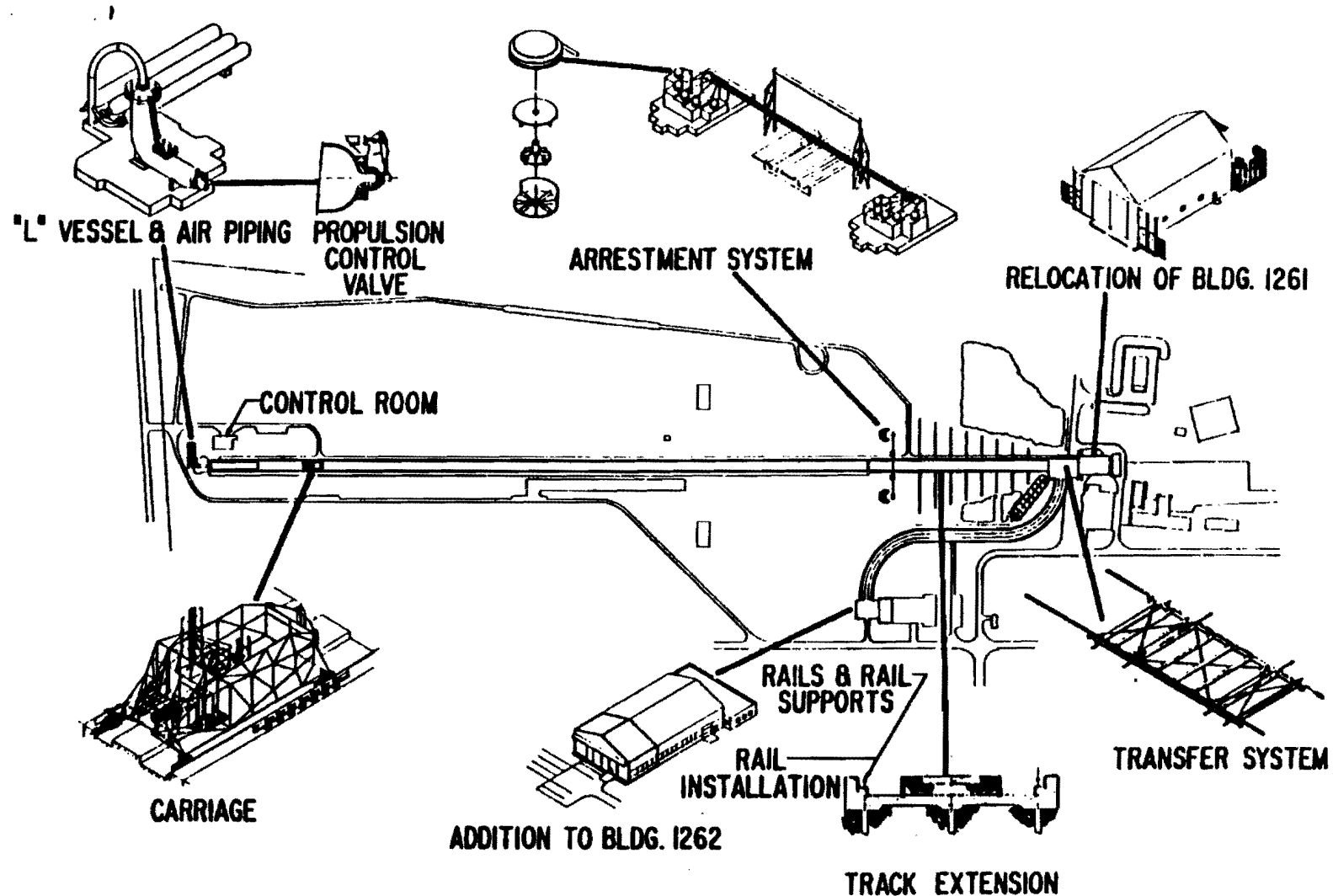
We concur with the recommendation. It has been our goal to strongly enforce compliance with the contract terms and conditions, and we believe we do so to the best of our abilities with the resources available considering the "field environment" where projects of this magnitude are carried out.

In summary, LaRC is very proud of its many experimental research facilities and especially the Aircraft Landing Dynamics Facility. The increased research capability of this facility can be attributed to the hard work of a dedicated team consisting of researchers, engineers, support personnel, and contractors and represents many man-years of effort and approximately \$15 million of construction funding. The results of their labor have already been utilized in the research conducted on the shuttle landing system. The many decisions made during the overall duration of the project resulted in a facility being completed within funding limits and in time to conduct needed research and at the lowest cost to the Government.

Sidney F. Pauls



AIRCRAFT LANDING DYNAMICS FACILITY



A-LE-88-002

AUDIT REPORT

REPORT ON AUDIT OF
THE DISPOSITION OF ATLAS AND CENTAUR PROPERTY

LEWIS RESEARCH CENTER

NOVEMBER 18, 1988



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Reply to Attn of: W/0160

November 18, 1988

TO: 0100/Director

FROM: 0160/Center OIG, LeRC

SUBJECT: Report on Audit of the Disposition of
Atlas and Centaur Property
A-LE-88-002

INTRODUCTION

The NASA Office of Inspector General (OIG) has completed an audit of the disposition of Atlas and Centaur property by the NASA Lewis Research Center (LeRC). The audit was conducted in accordance with the authority and responsibility contained in NASA Management Instructions 1103.27 and 9910.1, as amended.

Approximately fifty-nine (59) major contracts, valued in excess of \$1.5 billion, had been issued by LeRC to support NASA's Atlas and Centaur programs. As a result of the commercialization of the Atlas/Centaur (A/C) program in 1987 and the termination of the Shuttle/Centaur (S/C) program in 1986, NASA became accountable for the disposition of approximately \$360 million in residual Government-owned, contractor held, Atlas and Centaur property.

The residual property included flight and non-flight hardware such as vehicle components and parts, special test equipment, tooling, ground support equipment, raw materials and terminated work-in-process items.

The primary contractor for the A/C and S/C programs was the General Dynamics Corporation (GDC). The major associate contractors were Rocketdyne, Pratt & Whitney, Honeywell and Teledyne.

In a March 1987 agreement, NASA authorized GDC to manufacture and operate the A/C vehicle as a private sector venture. The agreement was made with the approvals of the cognizant House and Senate committees as provided by NASA Authorization Act of 1984 (42 USC 2465).

The initial property disposition mode included: the retention by NASA of a damaged A/C vehicle (A/C 68) for rehabilitation and launch; the retention by GDC of some flight property, at cost, with credits to the original contracts; the transfer to the Air Force of certain property needed for their Titan/Centaur program;

and the sale of surplus property through the Defense Contract Administration Services (DCAS).

Later, GDC proposed to provide NASA with commercial A/C launch services in exchange for certain Atlas and Centaur property. Some of the property would transfer to GDC at full book cost, some at fair market value and some at scrap value.

In September 1987, studies were requested by NASA Headquarters to evaluate the barter approach. A stated objective regarding the property was to support Presidential and Congressional policies by complete NASA withdrawal from the A/C program.

NASA believed that existing property not needed by the Air Force was sufficient to cover commercial services needed to launch at least two satellites without additional funding.

One satellite was the Fleet Satellite Communications (FLTSATCOM) for the U.S. Navy. This satellite was originally scheduled to be launched in July 1987 by NASA on A/C 68 before the vehicle was significantly damaged during launch preparation.

The other satellite to be launched was the Combined Release and Radiation Effects Satellite (CRRES), a joint NASA and Department of Defense project. The CRRES launch required a new A/C vehicle.

On July 29, 1988, the NASA Deputy Administrator authorized proceeding with the barter negotiations. LeRC was directed to develop and fully document the basis and rationale for trading any Atlas and Centaur property at less than the Government cost. LeRC was also required to obtain Air Force written concurrence to include S/C residual flight hardware and Atlas and Centaur non-flight property in the barter.

As a result of these requirements, all dollar assignments for property exchanged at less than book value were being justified and documented in the LeRC contract files. As of September 30, 1988, documentation to support the barter transaction was still being developed and finalized.

In July and August 1988, written concurrence was received from the Air Force to include certain property in the barter agreement as long as two conditions were met. These were:

" a. The agreement must stipulate that U. S. Government missions requiring use of the equipment shall be accorded priority in its use over commercial business.

b. The U. S. Government shall not be charged rent or use fees except for normal share of maintenance costs ..."

On August 30, 1988, LeRC received instructions from NASA Headquarters to include the conditions in the barter contracts.

AUDIT OBJECTIVES AND SCOPE

The purpose of the audit was to assess the management of the disposition of residual Atlas and Centaur property. Specific audit objectives were to evaluate: the planning process for asset disposition, coordination activity with the contractors, and compliance with applicable regulations and policies.

The audit was performed in accordance with generally accepted Government auditing standards and included such examination and tests of applicable records and documentation as was considered necessary in the circumstances.

The audit relied upon the independent review certification and oversight provided by DCAS to the effect that contractor reported quantity and cost of the residual Atlas and Centaur property was reasonably correct.

RESULTS OF AUDIT

The OIG found during the audit process that the proposed barter of Atlas and Centaur property for launch services was outside the scope of the agreement with GDC for commercializing the A/C vehicle for which formal Congressional notice was needed.

In substance, the barter arrangement would represent an estimated \$79.8 million NASA appropriation augmentation which could be considered improper unless the barter was sanctioned by the Congress as part of the commercialization of the A/C vehicle. Lacking such a sanction, NASA could be required to pay the U.S. Treasury an amount equal to the augmentation.

During June and July 1988, LeRC and NASA Headquarters project management personnel for the A/C and S/C programs were verbally notified of the OIG concern. By August 15, 1988, letter, the OIG Associate Attorney-Advisor cited legal rationale for the OIG concern. The letter was forwarded August 17, 1988, to NASA project personnel for consideration pending audit conclusion.

During August 1988, NASA project personnel verbally advised the OIG that NASA Headquarters was taking action to properly notify the cognizant Congressional committees about the barter. By letters dated September 14, 1988, the NASA Administrator formally notified the cognizant committees about the barter expected to be consummated in contracts awarded on or after October 15, 1988.

The September 14, 1988, notification resolved the OIG's major audit concern with the barter of Atlas and Centaur property.

By letter dated November 4, 1988, LeRC management provided to the OIG, in chronological sequence, all references of NASA's notification to Congress of the trade and barter. See Appendix A.

As of September 30, 1988, final Contractor inventory valuation and the resultant contractual settlement for the Atlas and Centaur property exchange had not occurred. Therefore, we were unable to render an opinion on this aspect of the Atlas and Centaur property disposition.

OTHER OBSERVATIONS

An analysis was performed to determine whether the barter of property would provide a return on the Government's investment which would not directly subsidize GDC pursuant to the intent of the Commercial Space Launch Act of 1984 (P.L. 98-575). The criteria used was the General Services Administration (GSA) 1987 experience in selling NASA property.

The analysis showed that the barter approach will likely result in an overall 29 percent return on the Government's investment. A 3 percent return would likely result through normal GSA sale.

The internal controls evaluated were adequate to protect against material loss to the Government. Nothing came to our attention to indicate that any untested areas were in noncompliance with applicable laws and regulations. Also, no new investigative referrals came to our attention to indicate that there were any instances of illegal acts that could result in criminal prosecution.

The procedures and internal controls over the planning process for property disposition were generally satisfactory as evidenced by: written action plans, meeting notes/agendas, and screening activities for excess and surplus property.

The coordination with contractor activity was generally effective as evidenced by documentation of: procurement negotiations; meetings between NASA, contractor, DCAS and Defense Contract Audit Agency (DCAA) personnel; various memoranda for the record; contract records; project office records, and interim property storage controls.

We found that controls were sufficient to ensure that LeRC personnel reviewed, analyzed, and planned the disposition in accordance with applicable policies and regulations.

While the termination of the S/C contracts had extended beyond the one year Federal Acquisition Regulations (FAR) guideline, documentation supported this extension. NASA property disposal regulations were followed as were procedures for delegating certain administration and audit functions to DCAS and DCAA.

We extend our appreciation to the LeRC, NASA HQ, DCAA, and DCAS personnel contacted during this review for their cooperation.

Ralph D. Rhodes

Appendix A - LeRC Letter dated November 4, 1988

Subject: Congressional Notification of the Barter
Arrangement between NASA and General Dynamics Space
Systems Division w/enclosures (53 pages)

cc:

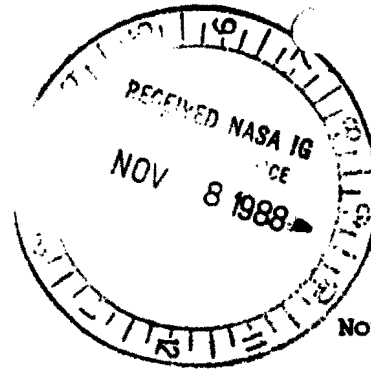
LeRC:

1000/F. Povinelli
1000/H. Wharton (ICO)
3000/J. Saggio
3300/B. Baker
6000/V. Weyers
6500/J. Gibb

NASA Headquarters:

W/R. Pelletier
W/F. LaRocca Jr.
W/OIG Center Directors

Lewis Research Center
Cleveland, Ohio
44135



November 4, 1988

Reply to Attn of: 6500

TO: 0160/Director, LeRC Office of Inspector General *E*
FROM: 0100/Deputy Director
SUBJECT: Congressional Notification of the Barter Arrangement between NASA and General Dynamics Space Systems Division
REF: (a) NASA Headquarters Memo to 6500/Manager, October 21, 1988, Congressional Notification of the Barter Arrangement between NASA and General Dynamics Space Systems Division
(b) Lewis Memo from 0160/Director, OIG, to 0100/Deputy Director, August 17, 1988, Audit of the Disposition of Atlas/Shuttle Centaur Assets A-LE-88-002

In order to complete the barter arrangement between NASA Headquarters, Lewis Research Center (LeRC) and General Dynamics Space Systems Division (GDSSD), the Office of Inspector General (OIG) at LeRC recommended (ref. b, encl. 2) that NASA seek full Congressional notice of the transaction to avoid any question of improper augmentation of appropriated funds.

First, let me state that both missions, the Navy Fleet Satellite Communications (FLTSATCOM) and the joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES) were missions approved by Congress with appropriated funding. The FLTSATCOM-8 was to have been launched in September 1987 by an Atlas/Centaur (A/C) launch vehicle and the CRRES was originally scheduled for launch on the STS in 1995. Because of a launch pad delay, the AC-68 FLTSATCOM launch is now scheduled for September 1989 and the CRRES mission was transferred from the STS to an Atlas/Centaur vehicle with a scheduled launch in June 1990.

We feel that allowing GDSSD to retain the assets in question (i.e., barter) is supportive of Congressional and Presidential initiatives to facilitate the commercialization of space launch services as embodied in the Commercial Space Launch Act (P.L. 98-575) and the revised National Space Policy approved by the President on January 5, 1988. These arrangements will provide the launch services contractor with production hardware needed for commercialization and the government with two launch services with the least impact on public funds.

In compliance with LeRC's OIG recommendation, listed below in chronological order (encls. 3-8) are all references of NASA's notification to Congress of the Trade and Barter. As you will note from the dates of the references, status was provided in parallel with the barter negotiations being conducted between LeRC and GDSSD for the two aforementioned launch services; AC-68 FLTSATCOM and CRRES.

1. September 17, 1987 Statement
by J. Mahon, page 3

Subcommittee on Space Science and
Applications

Committee on Science, Space and
Technology

House of Representatives
2. November 5, 1987 by
C. Gunn

Briefing to Senate Staffers
Mr. M. Cress/Mr. P. Perkins
3. November 9, 1987 by
C. Gunn

Briefing to House Staffers
Mr. D. Clements/Mr. L. Trippet
4. March 8, 1988 Statement
by Adm. Truly, page 11

Subcommittee on Space Science
and Applications

Committee on Science, Space and
Technology

House of Representatives
5. March 24, 1988

Letter from NASA Administrator with
enclosure to:
 - a) Honorable Robert A. Roe,
House of Representatives
 - b) Honorable Bill Nelson,
House of Representatives
 - c) Honorable Donald W. Riegle, Jr.
United States Senate
 - d) Honorable Ernest F. Hollings,
United States Senate
6. September 14, 1988

Letter from NASA Administrator to:
 - a) Honorable Robert A. Roe,
House of Representatives
 - b) Honorable Bill Nelson,
House of Representatives
 - c) Honorable Donald W. Riegle, Jr.
United States Senate
 - d) Honorable Ernest F. Hollings,
United States Senate

Reference (a) (encl. 1) states that no inquiry was made by the Congressional members as a result of the September 14, 1988, letters from the NASA Administrator. We, therefore, feel that the concern regarding full Congressional notice of the transaction has been alleviated.

It is our firm belief that NASA Headquarters, Codes ML and XC, have kept the Congress, the Department of Transportation and the USAF/Space Division fully informed about the barter.

✓ J. Ross

8 Enclosures

cc:

6000/V. J. Weyers

6500/J. W. Gibb

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

Ref. (w/o encls.

Encl. 1
OCT 24 1988

ST 21 603

Reply to Attn of: MLI

TO: Lewis Research Center
Attn: 6500/Manager, Launch Vehicle Project Office

FROM: ML/Director, Unmanned Launch Vehicles & Upper Stages

SUBJECT: Congressional Notification of the Barter Arrangement between
NASA and General Dynamics Space Systems Division

REFERENCE: (a) Chronological Listing of Congressional Notifications
dated September 19, 1988.

(b) Letter from LeRC OIG to 0100/Deputy Director dated
August 17, 1988.

Relative to the four letters included in the above reference (a), the NASA Administrator officially notified Congress of the intent to barter all NASA assets in exchange for two launch services; namely, the Navy Fleet Satellite-8 Communication (FLTSATCOM) and the Joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES). The letters sent to Congress for the requisite thirty (30) day review/comment cycle were dated September 14, 1988. As of October 18, 1988, NASA Headquarters did not receive any formal response from Congress, hence, the notification action is considered closed.

Accordingly, NASA has complied with LeRC's OIG recommendation of August 17, 1988, to ... "seek full Congressional notice of the barter transaction to avoid any question of improper augmentation of appropriated funds"... as stated in reference (b).

Enclosed for your files is a set of briefing charts that were prepared in anticipation of a Congressional request to review the barter conditions.

C. R. F. 
Enclosure

cc:
M/Mr. Mahon
ML/Mr. Cristofano
MLI/Mr. Castellano
LeRC/6500/Mr. Gibb
6510/Mr. Muckley

THIS PAGE
INTENTIONALLY
LEFT BLANK

Reply to Attn of: W/0160

August 17, 1988

TO: 0100/Deputy Director
FROM: 0160/Director, Center OIG, LeRC
SUBJ: Audit of the Disposition of Atlas/Shuttle Centaur Assets
A-LE-88-002

As you know, our office has been conducting the subject audit. An update of audit status follows.

During the course of our review work, we questioned whether the barter of Centaur assets for launch services would be an improper augmentation of NASA appropriations. After analysis of the situation, we requested the legal opinion of the Inspector General's Legal Staff (Code W).

The enclosure represents the summarization of their research. As a result of their opinion, we plan to prepare a brief letter report addressing the augmentation of appropriation issue. We plan to recommend that NASA seek full Congressional notice of the transaction in order to avoid any question of improper augmentation and possible significant loss of appropriated funds to offset the barter.

We have panafaxed a copy of the enclosure to Joseph Wikete of Code MLP, who has been the primary NASA contact point for this audit. During a telephone conversation on August 16, 1988, Mr. Wikete indicated preliminary acceptance of the audit recommendation, commenting that responsive corrective action is already underway.

We expect to release a Discussion Draft report after a review by our Headquarters office. If you have any questions, please do not hesitate to call me at extension 3-5412.

Ralph D. Rhodes

Enclosure

cc:
1000/J. Earls
6000/V. Weyers
6500/J. Gibb
MLP/J. Wikete
W/R. Raspen
W/E. Richardson (w/o encl.)

THIS PAGE
INTENTIONALLY
LEFT BLANK

September 17, 1987

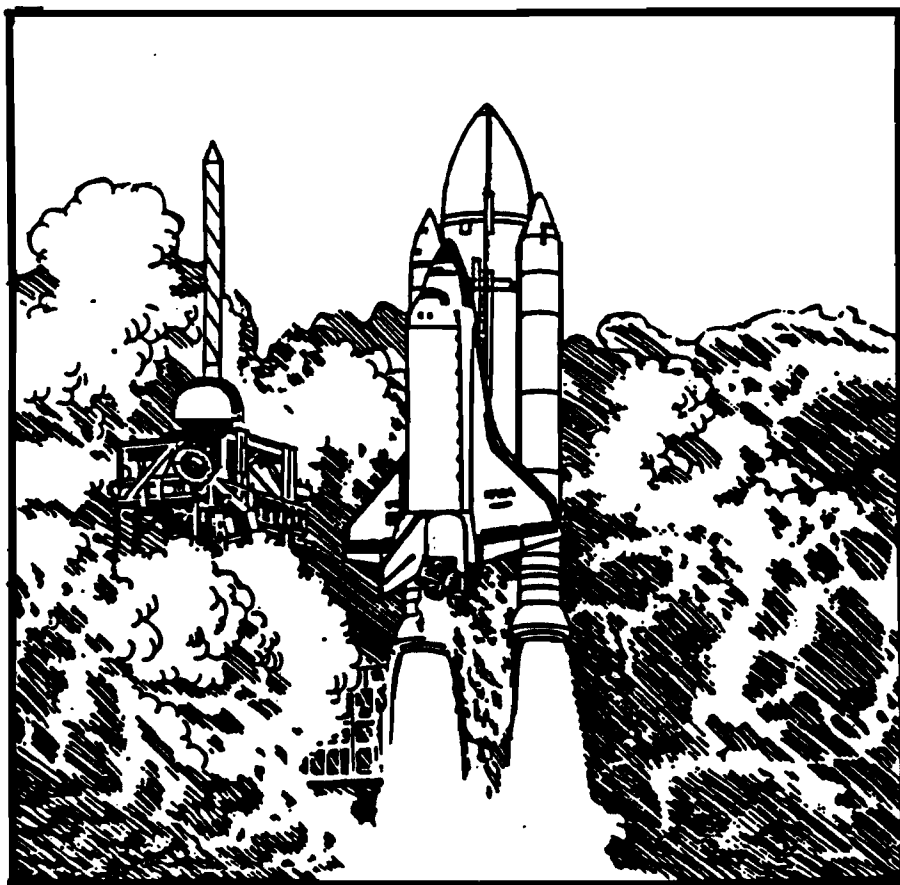
Subcommittee on Space Science and Applications

Committee on Science, Space, and Technology

House of Representatives

Statement by:

Joseph B. Mahon
Deputy Associate Administrator
for Space Flight
(Flight Systems)



100th Congress

**HOLD FOR RELEASE UNTIL
PRESENTED BY WITNESS**

Statement of

**Joseph B. Mahon
Deputy Associate Administrator
Office of Space Flight**

National Aeronautics and Space Administration

before the

**Subcommittee on Space Science and Applications
Committee on Science, Space, and Technology
House of Representatives**

Mr. Chairman and Distinguished Members of the Subcommittee:

I am pleased to appear before this committee today to share with you what NASA has been doing to facilitate the establishment of a commercial launch vehicle industry in this country, and how NASA's proposed three-phased plan for procuring commercial launch services will promote a U.S. expendable commercial launch vehicle industry.

NASA firmly endorses the development of a private sector (commercial) launch vehicle capability. Within six weeks after the 1983 National Security Decision Directive on Commercial Expendable Launch Vehicles was issued, NASA had published in the Commerce Business Daily requests for expression of interest for privatization of NASA's Delta and Atlas Centaur Expendable Launch Vehicles (ELV's).

Our efforts to privatize ELVs include intensive negotiation with ELV manufacturers to privatize NASA vehicles and to support industry with NASA capabilities and expertise. This support will include use of launch sites at the Kennedy Space Center and at the Wallops Flight Facility, production equipment, tooling and special test equipment. In addition, NASA will provide payload processing support, access to other facilities and launch support.

On March 24, 1987, NASA signed an agreement with the General Dynamics Corporation for private sector operations of Atlas/Centaur Expendable Launch Vehicles. This agreement, as you may remember, was reviewed by your Committee, and others last year. We are continuing negotiations with McDonnell Douglas on NASA's Delta Launch Vehicle and with the Ling Temco Vought (LTV) Corporation for the Scout launch vehicle. Further, NASA has agreed to support Space Services, Inc. a company that has developed, with private financing, its own vehicle, the Conestoga. NASA will provide, by agreement signed September 1986, payload processing support, facilities, equipment, and launch support operations at the Wallops Flight Facility in Virginia. In addition, the Martin Marietta company has signed an agreement with the United States Air Force to commercialize the Titan III launch vehicle. NASA is negotiating with the Martin Marietta Company to allow them access to payload processing at the Kennedy Space Center.

In recognition that the Department of Transportation's (DOT) Office of Commercial Transportation has the charter to facilitate and regulate development of the commercial ELV industry, NASA has and will continue to coordinate closely with DOT on commercial ELV matters. We have a good working relationship established with DOT and provide technical assistance and/or comments as requested on DOT drafts, such as commercial launch licensing regulations, evaluation of industry proposals, and applications for licenses.

NASA completed a study in December 1986, which identified several options for the use of a Mixed Fleet of vehicles for launching approved and planned NASA missions. The mixed fleet, as currently envisioned, is composed of the Space Shuttle and a family of U.S. private sector expendable launch vehicles capable of supporting NASA missions. The study recommends that an implementation plan be developed and that the program assure a safe and sustainable flight rate. A chronology of significant events related to this effort is included in enclosure I.

To help provide a stable business base for commercial enterprises and enhance NASA launch flexibility for launch services, we propose to enter into multi-year contracts. Services for these missions would be procured from the private sector, either directly or through Department of Defense. We are exploring approaches for implementing multi-year launch services contracts. Congress has recognized this and included such authority in the proposed FY 1988 NASA Authorization Act.

We have proposed a three-phased implementation plan for procuring expendable launch vehicle services for NASA's needs, (enclosure II).

Under phase I, (enclosure III) NASA proposes to procure Space Transportation services, to support critical NASA spacecraft launch needs through FY 1990/FY 1991. As in all phases of the ELV program, these service procurements will be performed in accordance with the requirements of the Competition in Contracting Act. The proposed missions for potential ELV support are ROSAT, EUVE, TDRS-E/F, CRRES and a planetary backup mission. These are mainly scientific missions whose spacecraft are in existence and can be transferred from the Shuttle to an ELV without undue penalty. We have requested funds in the FY 1988 Amendment to support two Delta-II class payloads (ROSAT and EUVE).

In addition, we are investigating and discussing the possibility of entering into a barter exchange agreement with the General Dynamics Corporation by which a portion of the cost for an Atlas Centaur launch would be offset by transfer of NASA-owned Centaur residual hardware and equipment to the contractor.

During Phase II, (Enclosure IV) NASA intends to compete its expendable launch vehicle transportation services requirements among commercial industry sources. We intend to solicit contractor proposals in 1988 for three classes of vehicles for small, medium, and intermediate launch vehicle performance capability, with procurements planned to begin in early FY 1989. We plan to procure large expendable vehicle services (Titan IV class) through the DOD as planned in Phase I, since there is no commercial alternative for this class vehicle. The contracts would run several years for stability, and are planned to be fixed price with a strong incentive for mission success.

We believe that our efforts to privatize NASA ELV's and encouraging the development of a U.S. private sector ELV Mixed Fleet which can operate along side the Space Shuttle, can be accomplished successfully. It will require commitments to effect actions for ELV launch services to support the Mixed-Fleet Expendable Launch Vehicle concept.

MAJOR EVENTS MIXED FLEET PLANNING

<u>DATE</u>	<u>EVENT</u>
16 SEPT 1986	DR. FLETCHER REQUESTED ADMIRAL TRULY TO CONDUCT A STUDY OF THE USE OF A MIXED FLEET OF VEHICLES FOR LAUNCHING APPROVED AND PLANNED NASA MISSIONS
15 DEC 1986	MIXED FLEET STUDY COMPLETED AND PRESENTED TO DR. FLETCHER <ul style="list-style-type: none">● RECOMMENDATIONS:<ul style="list-style-type: none">● IMPLEMENT A MIXED FLEET OPTION● FORMULATE MIXED FLEET IMPLEMENTATION PLAN● ASSURE SAFE SUSTAINABLE FLIGHT RATE
14 MAY 1987	DR. FLETCHER'S LETTER TO J. C. MILLER III (OMB) - TRANSMITTING PROPOSED ACQUISITION PLAN FOR LAUNCH SERVICES OF EXPENDABLE LAUNCH VEHICLES
15 MAY 1987	NASA RELEASES PROPOSED PLAN ON USE OF EXPENDABLE LAUNCH VEHICLES
25 MAY 1987	DR. FLETCHER'S LETTER TO J. C. MILLER III (OMB) REQUESTING AMENDMENT TO FY 1988 BUDGET FOR ACQUIRING EXPENDABLE LAUNCH VEHICLES FOR PRIORITY NASA SCIENCE MISSIONS
9 JUNE 1987	MIXED FLEET BRIEFING TO OMB BY J. B. MAHON
15 JULY 1987	NASA-SPONSORED SYMPOSIA WITH U.S. INDUSTRY LAUNCH VEHICLE PRODUCERS INVOLVED IN "COMMERCIAL" LAUNCH SERVICES INITIATIVES INCLUDED: <ul style="list-style-type: none">● MDAC/DELTA● GDC/ATLAS CENTAUR● MARTIN/TITAN● LTV/SCOUT● SPACE SERVICES, INC/CONASTOGA● AMERICAN ROCKET COMPANY
31 JULY 1987	ADMINISTRATION SUPPORT FY 1988 AMENDMENT FOR SERVICES IN SUPPORT OF TWO DELTA II CLASS MISSIONS (ROSAT, EUVE)

NASA MIXED FLEET EXPENDABLE LAUNCH VEHICLE PROPOSED PROGRAM PLAN

PHASE I - INITIAL NEAR TERM SPACE TRANSPORTATION SERVICES - FY 1990 & 1991

● NASA PROCURE LAUNCH SERVICES

- DELTA II CLASS - LAUNCHES THROUGH DOD CONTRACTS
 - ROSAT (2/90)
 - EUVE (8/91)
- ATLAS-CENTAUR - COMMERCIAL LAUNCH SERVICES/BARTER EXCHANGE
 - CRRES (6/90)
- TITAN III - COMMERCIAL LAUNCH SERVICES
 - TDRS-F (8/91)
- TITAN IV - LAUNCHES THROUGH DOD CONTRACT
 - PLANETARY BACK-UP (5/91)

● PREPARE FOR PHASE II LAUNCH SERVICES

NASA MIXED FLEET EXPENDABLE LAUNCH VEHICLE PROPOSED PROGRAM PLAN

PHASE II - SPACE TRANSPORTATION SERVICES CAPABILITY - FY 1992 & SUBSEQUENT

● COMMERCIAL INDUSTRY SOURCES - COMPETED

- THREE CLASSES OF CAPABILITY
 - SMALL LAUNCH VEHICLE CLASS - TWO FLIGHTS/YEAR
 - MEDIUM LAUNCH VEHICLE CLASS - THREE FLIGHTS/YEAR
 - INTERMEDIATE LAUNCH VEHICLE CLASS - ONE TO TWO FLIGHTS/YEAR
- MULTIYEAR SPAN - FIVE YEARS PLUS OPTIONS
- CONTRACT FOR DELIVERY TO ORBIT
- FIXED PRICE PLUS STRONG SUCCESS INCENTIVES
- SEPARATE MISSION PECULIAR INTEGRATION SCHEDULE - COST PLUS AWARD INCENTIVES

● DOD SOURCE

- ONE CLASS OF CAPABILITY
 - LARGE (TITAN IV) - ONE TO TWO FLIGHTS/YEAR

PHASE III - EXPAND CAPABILITY WHEN APPROPRIATE

ELV MIXED FLEET PROPOSED PROGRAM PLAN

PHASE I						PHASE II	
VEHICLE	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
MEDIUM CLASS (E.G. DELTA II)				ROSAT (10' FAIR) 2/90	EUVE 8/91	3 MISSIONS PER YEAR	
INTERMEDIATE CLASS (E.G. TITAN III/ATLAS CENTAUR)				CRRES 6/90	TDRS-F (IUS) 8/91	3 MISSIONS EVERY TWO YEARS	
LARGE CLASS (E.G. TITAN IV/HEAVY LIFT LAUNCH VEHICLE)					Planetary Backup 5/91 to 5/92	1 MISSION PER YEAR	
SMALL CLASS (E.G. SCOUT)						2 MISSIONS PER YEAR	

BRIEFED SENATE STAFFERS

NOV-5, 87

MR W. CRESS

MR P. PERKINS

BRIEFED HOUSE STAFFERS

NOV-9, 87

MR D. CLEMENTS

MS L. TRIPPE

ATLAS CENTAUR BARTER EXCHANGE

FOR

COMMERCIAL LAUNCH SERVICES

C. GUINN

NOVEMBER 1987

STRATEGY FOR BARTER

AGENDA

0 OBJECTIVES

0 STRATEGY

0 ACTION/STATUS

0 WORKING SCHEDULE

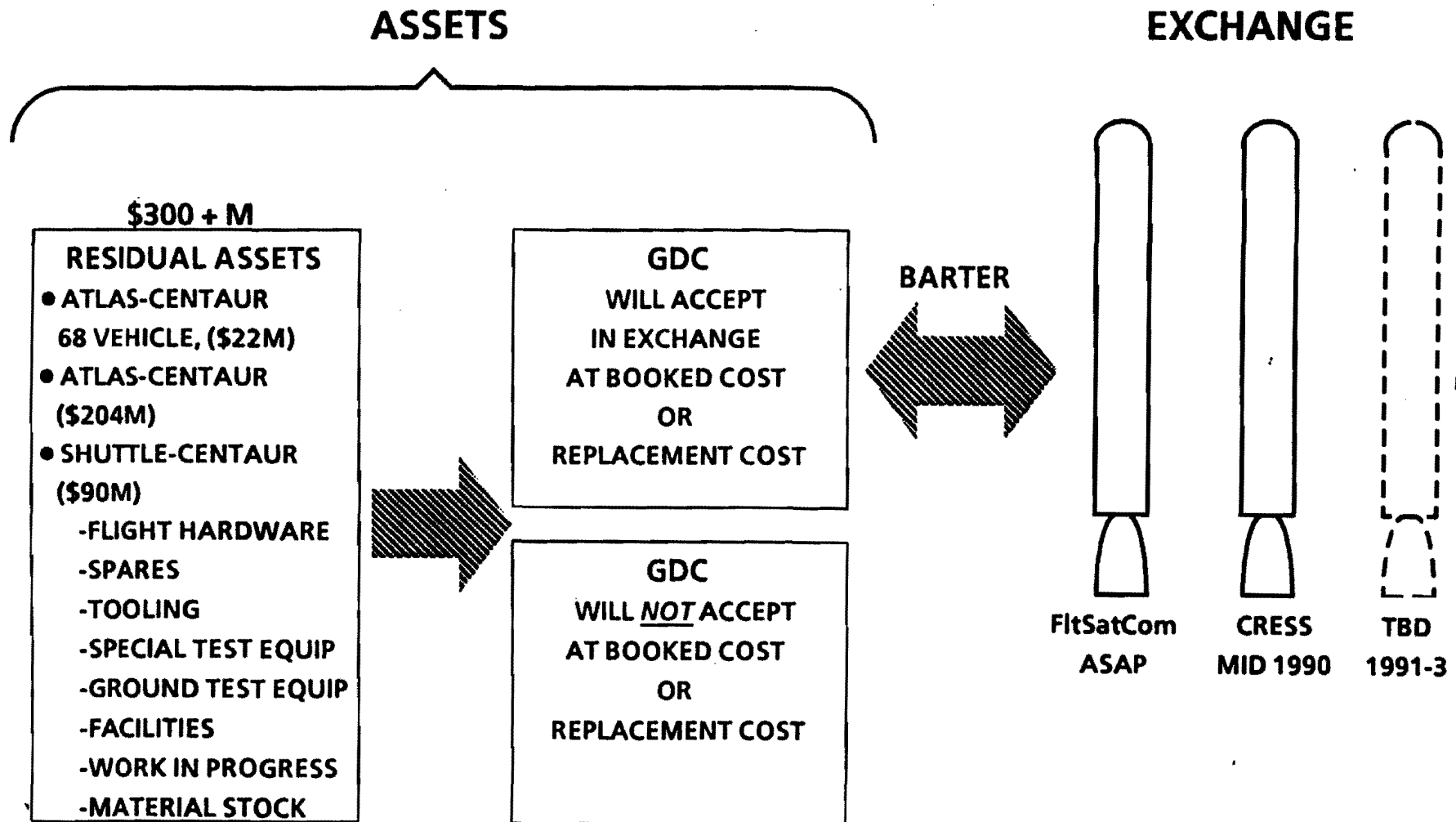
BARTER EXCHANGE OBJECTIVES

- O OBTAIN LAUNCH SERVICES FOR RESIDUAL ATLAS/CENTAUR AND SHUTTLE/CENTAUR ASSETS
 - o DAMAGED AC-68 VEHICLE
 - o ATLAS/CENTAUR - FLIGHT HARDWARE, LAUNCH SPARES, TOOLING, GSE, ETC.
 - o SHUTTLE/CENTAUR - FLIGHT HARDWARE, LAUNCH SPARES, TOOLING, GSE, ETC.
- O PROVIDE LAUNCH SERVICES FOR:
 - o FLTSATCOM F-8 - AS SOON AS POSSIBLE (JULY 1989)
 - o CRRES - BY JUNE 1990
 - o ADDITIONAL LAUNCH SERVICES - 1991
- O FOSTER EXPENDABLE LAUNCH VEHICLE COMMERCIALIZATION
 - o TOTAL NASA PHASEOUT OF PROGRAM
 - o TRANSFER FACILITY ACCOUNTABILITY TO U.S. AIR FORCE
 - o TRANSFER PRODUCTION TOOLING ACCOUNTABILITY TO GDC AND ASSOCIATE CONTRACTORS

STRATEGY

- 0 BARTER ARRANGEMENT PLANNED TO PROVIDE AS MANY LAUNCH SERVICES AS POSSIBLE FOR AGGREGATE ASSETS AVAILABLE
 - AGGREGATE ALTAS/CENTAUR AND SHUTTLE/CENTAUR ASSETS - INCLUDING AC-68 VEHICLE
 - ESTABLISH GOVERNMENT BOOKED COST/REPLACEMENT COST OF EACH ITEM
 - SEGREGATE ASSETS INTO TWO CATEGORIES:
 - (A) THOSE GDC WILL EXCHANGE FOR LAUNCH SERVICES AT GOVERNMENT BOOKED/REPLACEMENT COST
 - (B) THOSE GDC WILL NOT EXCHANGE FOR LAUNCH SERVICES AT GOVERNMENT BOOKED/REPLACEMENT COST
 - TRANSFER CATEGORY (B) ASSETS TO FACILITIES CONTRACTS WITH GDC AND ASSOCIATES
 - o NO COST TO GOVERNMENT - USE IN EXCHANGE FOR MAINTENANCE

STRATEGY BARTER EXCHANGE



STRATEGY

- O LAUNCH SEQUENCE "PRIORITY" TO SATISFY GOVERNMENT REQUIREMENTS
 - o PRIORITY 1 - FLTSATCOM-8 IN MID-1989
 - SOURCE OF FUNDS - CATEGORY (A) ASSETS
 - NO NEW APPROPRIATION
 - AC-68 CENTAUR TANK REBUILD AND LAUNCH CONDUCTED UNDER EXISTING LERC-GDC CONTRACT OR NEW LAUNCH SERVICES CONTRACT
 - o PRIORITY 2 - CRRES IN MID-1990
 - SOURCE OF FUNDS: - CATEGORY (A) ASSETS PLUS APPROPRIATIONS, IF REQUIRED - PLACE HOLDER IN FY 89 BUDGET SUBMIT
 - o PRIORITY 3 - ADDITIONAL LAUNCH SERVICES STARTING IN 1991
 - SOURCE OF FUNDS - ALL REMAINING CATEGORY (A) ASSETS
 - SEEKING METHOD TO BARTER CATEGORY (B) ASSETS AT LESS THAN BOOK VALUE

STRATEGY ACTION/STATUS

- 0 ACQUIRE REASONABLE OPTION FROM CONTRACTOR FOR AC-68 FLTSATCOM RECOVERY AND LAUNCH
 - GDSSD TO INCLUDE CONTRIBUTION TO AC-68 RECOVERY
 - OFFICIALLY INFORM DOD
- 0 NOTIFY CONGRESS OF BARTER STRATEGY/PLAN
- 0 PREPARE NECESSARY PROCUREMENT DOCUMENTATION
 - INCLUDE: JOFOC C-1 FOR AC-68
JOFOC C-7 FOR CRRES AS PART OF PHASE I MIXED FLEET PLAN
- 0 DIRECT LERC TO PROCEED WITH FACTFINDING LEADING TO PRENEGOTIATION POSITION WITH GDSSD
 - DUE LATE NOVEMBER
- 0 SET PROPOSED CONTRACT TARGET "GO-AHEAD" IN PLACE BY THE END OF CALENDAR YEAR

LAST A/C 68 PROPOSAL - LAUNCH JULY 1989

COSTS INCURRED TO DATE BY GDSS AND SUBCONTRACTORS	\$ 78,000,000 (ESTIMATE)
COSTS REMAINING FOR LAUNCH	<u>5,000,000</u>
TOTAL COST TO LAUNCH A/C 68	\$ 83,000,000

PRICE TO REPAIR AND LAUNCH A/C 68 (JULY 1989)	\$ 25,900,000
---	---------------

GDSS CONTRIBUTION:

LAUNCH CREW MAINTENANCE	(\$ 3,800,000)	
FOREGONE PROFIT	(1,800,000)	
SHARED MANAGEMENT AND ENGR. WITH COMMERCIAL PROGRAM	<u>(1,400,000)</u>	
<u>TOTAL GDSS CONTRIBUTION</u>		<u>(\$ 7,000,000)</u>
REMAINING COST		<u>(\$18,900,000)</u>

ASSETS REQUIREMENTS:

PRATT & WHITNEY	(\$ 5,000,000)	
TELEDYNE	(\$ 7,800,000)	
ROCKETDYNE	<u>(\$ 6,100,000)</u>	
TOTAL ASSETS REQUIREMENTS		<u>(\$18,900,000)</u>

RESULT	\$ 0
--------	------

PROGRAM PLAN WORKING SCHEDULE

AUGUST					SEPTEMBER					OCTOBER					NOVEMBER					DECEMBER					
	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27			

NASA HQ/GDC
MEETING



NASA HQ/DOD
MEETINGS



SCOPE/OPTIONS
DEFINED - L_oRC
ASSIGNED RESPONSIBILITY



POLICY/LEGAL PROC/
PROP COMPLETED



ASSET EVALUATION COMPLETE



PROCUREMENT
DOCUMENTATION



L_oRC/GDC NEGOTIATION



PRE-NEG



CONTRACT
SIGNATURE



CONGRESSIONAL
INTERACTIONS

AGENCY APPROVAL



INITIAL
NOTICE



JOFOC FORMAL
NOTICE



CONCUR



HOLIDAYS



CHRONOLOGY OF EVENTS
- ATLAS/CENTAUR BARTER -

APRIL 15, 1987 - INITIAL GDC OFFER FOR COMMERCIAL LAUNCH SERVICES. \$33M PLUS CERTAIN ASSETS OR \$0M PLUS ADDITIONAL ASSETS

JUNE 3, 1987 - GDC EXPANDED OFFER TO INCLUDE TWO MORE. \$102M PLUS CERTAIN ASSETS

JUNE 26, 1987 - LERC ASSESSMENT OF OFFER INDICATED A FAIR VALUE EXCHANGE

JULY 13, 1987 - ATLAS/CENTAUR 68 (FLTSATCOM) TANK DAMAGED AT KSC

AUGUST 6, 1987 - SEVERAL NEW OPTIONS DEVELOPED, INCLUDING LAUNCH OF FLTSATCOM IN 1990 AND CRRES IN 1991. \$0M PLUS ALL ATLAS/CENTAUR AND SHUTTLE/CENTAUR ASSETS

AUGUST 21, 1987 - OPTIONS EXPANDED OFFER TO INCLUDE ANOTHER LAUNCH IN 1991 FOR AN ADDITIONAL \$68M

AUGUST 28, 1987 - ADDITIONAL OPTION OFFERED TO ACCELERATE LAUNCH DATES. FLTSATCOM 4TH QUARTER 1989, CRRES 2ND QTR 1990, 3RD LAUNCH LATE 1990

SEPTEMBER 1, 1987 - LERC DIRECTED TO EVALUATE OPTIONS AND MAKE RECOMMENDATIONS

OCTOBER 15, 1987 - OPTION OFFERED FLTSATCOM IN MID-1989 AND CRRES IN MID-1990. \$OM PLUS CERTAIN (BOOK VALUE) ASSETS. INCLUDES GDC CONTRIBUTION

OCTOBER 27, 1987 - LERC DIRECTED TO PROCEED TOWARD PRENEGOTIATION POSITION. HQ APPROVAL END OF NOVEMBER, CONTRACT END OF DECEMBER. EXCHANGE ASSETS FOR LAUNCH SERVICES - NO FUNDS. PRIORITIES - FLTSATCOM, CRRES, ANOTHER

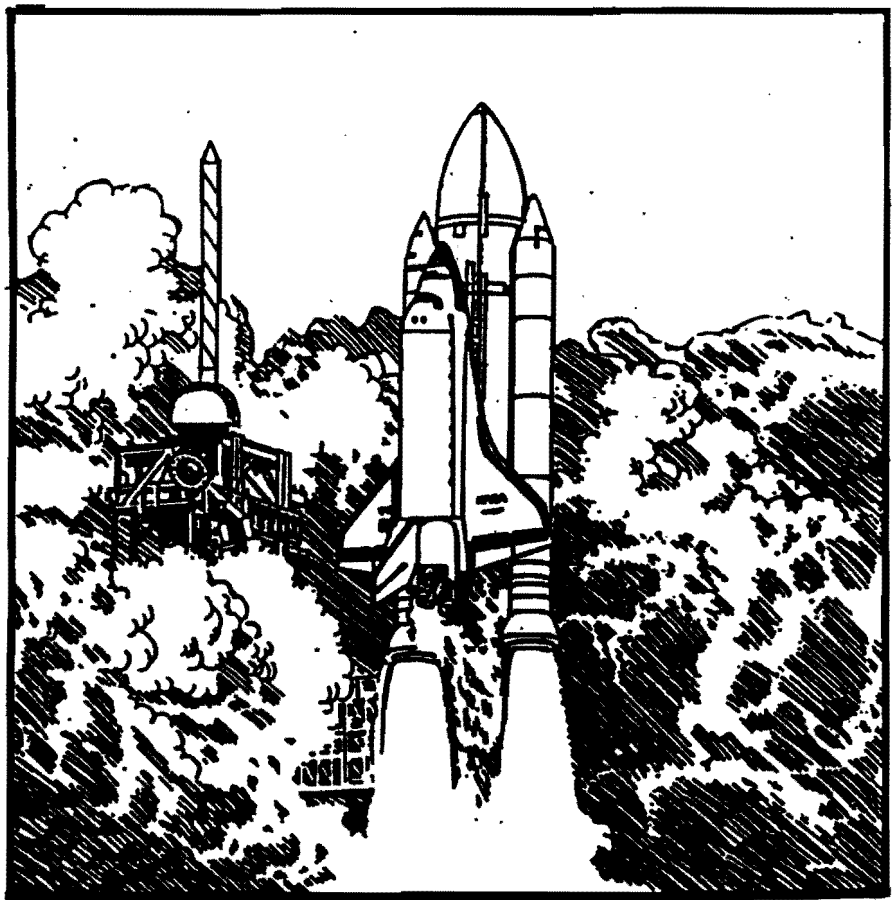
THIS PAGE
INTENTIONALLY
LEFT BLANK

March 8, 1988

Subcommittee on Space Science and Applications Committee on Science, Space and Technology House of Representatives

Statement by:

Richard H. Truly
Associate Administrator
for Space Flight



100th Congress

Statement of

Richard H. Truly
Associate Administrator
Office of Space Flight

National Aeronautics and Space Administration

before the

Subcommittee on Space Science and Applications
Committee on Science, Space and Technology
House of Representatives

Mr. Chairman and Distinguished Members of the Subcommittee:

Before discussing the budget specifics, I would like to briefly summarize the accomplishments of NASA's Office of Space Flight during the past year. It has been a period of significant progress and accomplishment.

Launch of STS-26 is projected to be in August 1988. Our schedule of major milestones for STS-26 is built around delivery of the flight aft SRM segments to Kennedy Space Center (KSC). Movement of Discovery from the Orbiter Processing Facility (OPF) to the Orbiter Modification and Refurbishment Facility (OMRF) is scheduled for April. In May, Discovery will move to the Vehicle Assembly Building for mating with the external tank (ET) and SRMs. Rollout to the launch pad and the flight readiness firing of the main engines is scheduled for June.

The effort to redesign the Solid Rocket Motor (SRM) has paced our return-to-flight effort. Three full-scale firings have been conducted during the past year, and three more are scheduled between now and mid-July 1988. Performance of the redesigned field joint and the case-to-nozzle joint have been superb. Redesigned joints were tested and verified by two full-scale firings, Development Motor (DM) -8 and DM-9, on August 30, 1987, and December 23, 1987, respectively. We have experienced no blow-by of gasses on the redesigned joints, even to the primary "O" ring seal.

Excellent progress is being made on our Failure Mode Effects Analysis/Critical Items List (FMEA/CIL), Hazard Analysis, and Design Certification Reviews. Considerable work remains to be done, but we are confident of completion without impact to launch schedule plans.

Astronaut crews for STS-27 and STS-28, as well as STS-26, have been selected and commenced training. Launch control teams at KSC, and mission control teams at the Johnson Space Center (JSC), Houston, Texas, have continued training and are operating at a high level of proficiency. The entire NASA team looks forward to the launch of Discovery with eagerness and confidence.

FY 1989 BUDGET REQUEST

It is in this spirit of progress and optimism that we have formulated our budget objectives for fiscal year 1989. They are as follows:

- o Accomplish a safe return to Space Shuttle flight operations at a sustained rate.
- o Develop a mixed fleet flight rate in support of the nation's space transportation needs.
- o Complete the implementation of recommendations of the Presidential Commission on the Space Shuttle Challenger Accident.
- o Continue construction of a fourth Space Shuttle orbiter.
- o Enhance capital investment in space transportation systems (STS) by initiating improvements in Space Shuttle performance, a program for an Advanced Solid Rocket Motor (ASRM), and an Extended Duration Orbiter (EDO). We continue to study aggressive advancements in space transportation, and we are full participants in the Advanced Launch System (ALS) study efforts where we are examining concepts such as the Shuttle-C cargo vehicle, expendable cargo vehicle with solid rocket motor strap-ons, and partially reusable cargo vehicle with flyback booster.

The budget authority requested for the Office of Space Flight (OSF) for the two appropriations which finance our development, productivity, and operations activities for fiscal year 1989 is \$3,805.9 million. This authority includes \$3,174.8 million for Space Flight, Control and Data Communications (SFCDC) and \$631.1 million for Research and Development (R&D). SFCDC includes Shuttle Production and Operational Capability, and Space Transportation Operations, and Expendable Launch Vehicles (ELV). The R&D funding provides for Spacelab, Upper Stages, Engineering and Technical Base (ETB), Payload Operations and Support Equipment, Advanced Programs, Tethered Satellite System (TSS), and Orbital Maneuvering Vehicle (OMV).

SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS

SHUTTLE PRODUCTION AND OPERATIONAL CAPABILITY

The OSF is requesting \$1,400.5 million in FY 1989 for Shuttle production and operations capability. Of this amount, \$320 million is for orbiter design modifications and systems improvements, mission kits, procurement of a spares inventory, safety modifications, initiation of a new set of structural spares to maintain the capability to produce orbiter vehicles, and continuation of work on the EDO.

ORBITER

The primary thrust of our current effort in orbiter operational capability is to complete the review, evaluation, production, and installation of orbiter modifications to enable a safe return to flight. In addition, the logistics program continues to procure lay-in and rate spares and establish a

centralized depot repair facility to fully support the flight program. Improvement programs for the orbiter, which were initiated prior to the Challenger accident, are well on the way to completion. Work continues on the Remote Manipulator System (RMS) to upgrade a test article to flight status. Flight software will be improved to incorporate all required changes for return to flight and introduction of the upgraded computers.

EXTENDED DURATION ORBITER

Work on extending the orbiter on-orbit stay time from 7-10 to 14-16 days will be funded in FY 89 within the R&D appropriation consistent with the 1988 Appropriations Act providing \$5 million for this purpose. Continuation of this work in FY 1989 is included in the Orbiter Operational Capability program.

REPLACEMENT ORBITER

A contract was signed with Rockwell International on August 1, 1987, to produce a replacement orbiter using the existing structural spares. Work has commenced on this new orbiter, which will provide a significant increase to our launch capability, necessary to fly off the backlog of payloads.

LAUNCH AND MISSION SUPPORT

For launch and mission support, we are requesting \$343.7 million. This funding supports JSC mission operations capability development, equipment provisioning of the facilities needed for launch and landing at KSC, and an initial lay-in of spares to replace those used in the replacement orbiter program as ground support equipment.

Modifications to major facilities and launch site equipment at KSC are providing more efficient launch processing operations. For example, the Launch Complex 39 permanent weather protection modifications on Pad A will be completed in FY 1989. Equipment continues to be procured for installation into the OMRF to provide a safing and deservicing capability. Other efforts under way include continued development of the Digital Operational Intercom System, extension of the Launch Equipment Test Facility, and incorporation of fiber optics to improve KSC on-site communications.

Weather prediction and reporting capabilities are being expanded, and runway barriers are being developed for the contingency landing sites. Fidelity and reliability improvements to the training simulators are being given high priority with the replacement of the host computers and selected software models under way.

PROPULSION SYSTEMS

For propulsion systems, we are requesting \$711.8 million in FY 1989. Development and life certification of the Space Shuttle Main Engine (SSME) is continuing in support of the flight and ground test programs. Design modifications on the high pressure pumps and the hot gas manifold are directed at increasing the SSME operating margins, reducing operating costs, and determining hardware life and replacement requirements. A major near-term effort is to continue development of design improvements to the high pressure

turbopump blades and bearings to enhance operating margins and extend operational life. The long-range plan is to replace these pumps with redesigned pumps from an alternate source. Redesign of the hot gas manifold is continuing with the goal of improving flow conditions which will extend engine life by decreasing systems resistance and reducing pump loads. These changes and alternate sources are planned to be introduced into the fleet during the early 1990's. The SSME program also includes an advanced technology effort to provide a technology test bed for detailed SSME environment characterization and will evaluate potential SSME component and system-level improvements, as well as evaluate technical advances arising from the Space Research and Technology Program in NASA's Office of Aeronautics and Space Technology.

Redesign of the SRM will be completed in FY 1988. Evaluation of flight data, including detailed analysis, will continue in FY 1989 to thoroughly assess the redesign. Development of the ASRM will commence in FY 1989, providing an anticipated 12,000-pound improvement in ascent performance. The ASRM will enhance reliability and safety by eliminating the redesigned SRM constraint of maximizing utilization of existing hardware. Configuration changes, design details, and materials may be employed to meet more stringent design requirements and enhance safety margins. Production processes will be examined to use the latest applicable technology and automation to enhance reliability and producibility.

Solid rocket booster (SRB) tooling and production streamlining are ongoing. No major design changes are anticipated in the ET as a result of extensive reviews following the Challenger accident.

CHANGES AND SYSTEMS UPGRADING

We are requesting \$25 million in FY 1989 for potential changes and system modifications, as well as new requirements not covered in the budget estimates for the above activities and other program elements.

SPACE TRANSPORTATION OPERATIONS

The funding request for space transportation operations in FY 1989 is \$2,405.4 million. This will provide \$2,209.9 million for the standard operational support services for the Space Shuttle and \$195.5 million for ELVs for NASA payload requirements. Within Shuttle operations, flight hardware is produced, refurbished, and repaired. Manpower, propellants, and other materials are also furnished to conduct and support both flight and ground operations. The operations program provides for the launch of NASA missions, Department of Defense (DOD), and other U.S. Government and certain commercial and international missions on a reimbursable basis. The launch schedule calls for one flight in FY 1988, seven in FY 1989, and ten in FY 1990.

The ELV portion of the mixed fleet provides launch services for unmanned civil U.S. government space missions not requiring the Space Shuttle capabilities. ELV services for selected high priority missions previously manifested on the Space Shuttle will be procured from the U.S. private sector, where possible.

FLIGHT OPERATIONS

Flight operations includes mission support, integration, and support. We are requesting \$660.1 million in FY 1989 for these activities. Mission support includes a wide variety of pre-flight training, crew training, and operations control activities. Activities range from development of operational concepts and techniques to detailed systems, operational procedures, and checklists. Tasks include flight planning, preparation of systems and software handbooks, flight rules, detailed crew activity plans and procedures, development and implementation of the mission control center (MCC) and network system requirements for each flight, and operations input to the planning for the selection and operation of Shuttle payloads. Also included are the maintenance and operation of critical mission support facilities including the MCC, flight simulators, crew training and flight software reconfiguration, and recertification facilities.

Integration includes orbiter sustaining engineering, payload integration, system integration, launch support services to the launch site, and development and verification software. The sustaining engineering provides all prime contractor engineering activities necessary to requalify the orbiter for flight including FMEA/CIL, design changes, and certification reviews. Software activities include development, formulation, and verification support of the guidance, targeting, and navigation systems software requirements in the orbiter.

Software includes base operations support to Shuttle operations and systems-level support at the manned space flight centers. Base operations provides for operation of aircraft for flight training, crew proficiency and ferry requirements, orbiter engineering and support, crew equipment, flight operations systems, and support to the NSTS program office.

Resources for flight operations are currently focused on preparing for resumption of flight; fixing a backlog of system discrepancies; and incorporating a large number of changes to ground systems hardware, software, and procedures including those resulting from the ongoing process of analysis and decision making in the wake of the Challenger accident. These efforts are critical to the safe operation of the Shuttle, and significant emphasis is being placed on insuring that the flight products and crew training satisfy revised and more stringent operational requirements.

FLIGHT HARDWARE

\$1,035.2 million in FY 1989 funds are being requested to procure ETs; manufacturing and refurbishment of SRB hardware and motors; operational support to the orbiter including component repairs and replenishment spares, ET disconnects, spare components, and flight support for the SSMEs; and maintenance and refurbishment of flight crew equipment. ET production continues at a minimum level necessary to retain a manufacturing capability. Requirements for the SRB and ET include procurement of materials and labor for refurbishment and fabrication of units to be flown in FY 1989 and support of the production of units which will be flown thereafter. Two static firing tests of the redesigned SRM will be conducted to monitor the consistency of production characteristics.

LAUNCH AND LANDING OPERATIONS

We are requesting \$514.6 million for launch and landing operations. This funding provides for manpower and support services necessary for processing launches from KSC. This includes manpower to assemble SRBs, mate boosters and tanks, orbiter processing, mate orbiters to integrated SRBs and tanks, process and checkout integrated flight elements through launch, SRB retrieval, and support orbiter landings at either Edwards Air Force Base, California, or a contingency landing site.

Launch and landing operations and equipment at KSC are the primary function of the Shuttle processing contractor. The base operations contractor is responsible for operations support functions, while the payloads and ground operations contractor provides standard service processing of all STS payloads into an integrated cargo prior to loading into the Shuttle. This contractor will also have primary responsibility for Spacelab and Space Station payload processing at KSC, funded under their respective budgets.

RESEARCH AND DEVELOPMENT

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT

The Space Transportation Capability Development budget request for FY 1989 is \$631.1 million. This activity includes Spacelab, Upper Stages, ETB support, Payload Operations and Support Equipment, Advanced Programs, development of the U.S./Italian TSS, and development of the OMV.

SPACELAB

To support Spacelab, we request \$80.4 million in FY 1989. Spacelab was developed jointly by NASA and the European Space Agency (ESA) and is a major element of the STS. It is a versatile, reusable laboratory which is flown to and from Earth orbit in the orbiter cargo bay. The development program is continuing with a recertification program and procurement of flight hardware and necessary modifications, including replacing the on-board computer system.

Four dedicated Spacelabs and several smaller Spacelab elements have been flown on the STS. These flights have demonstrated the unique capabilities and benefits offered by many of the Spacelab elements. The Spacelab Astro-1 mission, scheduled for the first quarter of 1989, will be the first Igloo Pallet configuration of the Spacelab Pallet System (SPS). Preparations are now being made for resumption of operational flights for the DOD, international, and NASA scientific experiments.

UPPER STAGES

\$146.2 million is requested in FY 1989 for upper stages required to deploy payloads to orbits and trajectories not attainable by the Shuttle or ELVs alone. These funds will provide for procurement of stages for NASA missions, for technical monitoring and management for government and commercial upper stages, and an SRM integrity program to establish an engineering data base for improving the success rate of U.S.-built solid stage components.

Funding is included for production, launch, flight support, and integration of Inertial Upper Stages (IUS) vehicles to accommodate the Tracking and Data Relay Satellite (TDRS) -D, -E, and -F missions and the Galileo, Ulysses, and Magellan planetary missions. There are currently no STS requirements for the commercially developed Payload Assist Module (PAM).

The Delta class PAM-D is capable of injecting up to 2,750 pound payloads into geosynchronous transfer orbit. The PAM D-II is capable of placing a 4,100 pound payload into geosynchronous transfer orbit. The Atlas/Centaur class PAM-A is capable of inserting 4,400 pound payloads into the same orbit and was system qualified in late 1984. Forty PAM's have been launched from the Delta, the Atlas, and the Space Shuttle.

The Transfer Orbit Stage (TOS) is being commercially developed by the Orbital Sciences Corporation for use with the Shuttle or the Titan. Production of a TOS vehicle for the Mars Observer mission is included in the FY 1989 budget request. The Solid Propulsion Integrity Program (SPIP) objective is to lay in place the necessary engineering capability for improving the success rate of U.S.-built SRMs. Started in 1984, the program has made good progress in determining root causes and solutions to the persistent problems plaguing motor nozzles. The program scope is being expanded to examine motor bondlines as well as continuing the nozzle investigations. The SPIP was initiated in 1984 to establish an urgently needed engineering data base for use of composite materials in upper stage nozzles to minimize risks to planned missions and to restore confidence in U.S. launch systems. Underlying root causes of motor nozzles have been identified, and required data are being generated. The results of this program will continue to be used in support of the Shuttle SRM.

ENGINEERING AND TECHNICAL BASE

We are requesting \$158.9 million to provide the core capability for the engineering, scientific, and technical support required at JSC, KSC, Marshall Space Flight Center (MSFC), and National Space Technology Laboratories (NSTL) for R&D activities. The core level of support varies from center to center due to programmatic and institutional differences.

The core level requirement at JSC is that one shift of operations be maintained in the engineering and development laboratories and the White Sands Test Facility. Safety, reliability, maintainability and quality assurance (SRM&QA) areas are also supported by the ETB core. The core level for the central computer complex is established as a two-shift operation. At KSC, the core level provides for R&D of technology to enhance launch site hardware, ground processing, support services, safety, and reliability assurance. ETB funds at MSFC provide for multiprogram support activities, including technical laboratories and facilities, reliability and quality assurance, computational and communications services and, at NSTL, for facilities operations.

The FY 1989 funding request will provide for a continuation of the FY 1988 level of support for basic R&D facilities and services at the centers with an expansion of computational capability by acquiring a Class VI computer for use at JSC and increased SRM&QA and engineering support at JSC, KSC, and MSFC.

PAYLOAD OPERATIONS AND SUPPORT EQUIPMENT

The objectives of this category are to centralize payload services, unique and common, which are required beyond the basic STS standard services for NASA missions and to provide multi-mission support equipment. We are requesting \$67.3 million for these requirements. This funding has increased \$1.6 million from the revised budget to include the Congressionally directed addition of initial activities for the EDO, studies on the use of the Commercially Developed Space Facility (CDSF), an increase in Space Station interface activities to begin analytical integration, and preliminary design of a docking system between the Shuttle and the Space Station. These increases were partially offset by reduced requirements for NASA payloads caused by the delay in resumption of Shuttle flights.

Payload operations funding will support continued services for currently scheduled NASA payloads. The funding request for FY 1989 is \$53.3 million. Major NASA payloads to be serviced this year include the Hubble Space Telescope, the TDRS, the Ulysses, the Astro, the Long Duration Exposure Facility (LDEF), the Upper Atmospheric Research Satellite (UARS), and the Gamma Ray Observatory.

For payload support equipment, we are requesting \$14 million in FY 1989 to modify and upgrade selected payload integration facilities for safer, more efficient operations. This funding will provide multimission payload support equipment required for development, testing, and delivery of Payload Common Communications Equipment (PCCE) and initial spares provisioning for Cargo Integration Test Equipment (CITE) and PCCE.

ADVANCED PROGRAMS

The advanced programs request is \$45 million in FY 1989. Identification of future space transportation-related initiatives is the focus for this program area which provides the technical as well as the programmatic data for definition and supporting advanced development activities. In FY 89, major emphasis will be placed on advanced space transportation systems, advanced operation support systems, satellite servicing systems, and advanced missions. Major efforts continue on studies for space transportation meeting national needs such as space operations over the next twenty years, including heavy-lift cargo vehicles, second generation Shuttles, and satellite servicing both near and remote from the orbiter.

In August 1987, as part of the Advanced Launch System (ALS) concept and system definition study efforts, NASA initiated Shuttle-C studies focusing on maximum utilization of Shuttle hardware, facilities, and operations. The concept offers a reliable near-term heavy-lift capability with minimum cost and schedule risk. The Shuttle-C could provide a step toward an early robust national launch posture in the mid-1990s.

For manned flight, we plan to continue study efforts addressing near-term Shuttle performance improvement for Shuttle evolution and a new generation Shuttle II vehicle. A new study for Liquid Rocket Boosters (LRB) was initiated in FY 1987 which examines the feasibility of replacing the SRMs with liquid-fuel engines. Potentially, the LRBs offer advantages in performance, thrust control, and operational reliability. Simultaneous with Shuttle

enhancement efforts, studies are under way to evaluate the evolution of the Shuttle to achieve cost and efficiency objectives through major changes to the current system or development of a new generation vehicle.

Studies will continue in FY 1989 to provide the assured, safe return to Earth of a Space Station Crew. This will build on previous studies for the Crew Emergency Return Vehicle (CERV) conducted by the Space Station.

The advanced mission program will continue to focus on manned missions beyond low Earth orbit. Transportation studies in FY 1989 are oriented toward definition of transportation elements in support of the President's policy to expand human presence and activity beyond Earth orbit into the solar system. Studies will concentrate on understanding and developing concepts for the space transportation infrastructure to support potential advanced missions. Further, Space Transfer Vehicle (STV) studies in FY 1989 will investigate concepts for alternate mission scenarios and will define the technology and advanced development efforts that must precede the development of such a vehicle. The STV concept is an expansion of the Orbital Transfer Vehicle (OTV) concept that has been studied in previous years.

A new operations effectiveness initiative in FY 1989 is focused on the identification and demonstration of technologies which can be applied to ground, flight, and on-orbit operations to reduce the operational costs of the STS while ensuring safe and reliable operations. Near-term efforts will be to reduce the cost of ground and flight operations through selective application of evolving technologies to existing labor-intensive and hazardous operations. Longer term activity will emphasize identification and demonstration of technologies and processes for application to the design and development of future vehicles and systems and will result in operational efficiency and reduced life cycle costs.

NASA has long recognized the need to address the hazards of orbital debris and maintains an orbital debris data base to monitor the changing environment. Improvements to the orbital debris environment models are planned. Studies are also currently being conducted to assess damage potential from debris and to develop protection techniques. Orbital debris management options are being formulated, and a better definition of the proposed orbital debris radar detection system is planned. Policy regulating orbital debris producing activities on a long-term basis will be established to minimize or reduce space debris accumulation. NASA is working closely with agencies interested in the management of orbital debris, particularly the U.S. Air Force.

The advanced development activity is one of identifying and maturing select technologies through systematic utilization of testbeds and subsystem demonstrations that could strengthen and enhance the National Space Transportation System, advanced space transportation systems, and on-orbit servicing and operations. Advanced development activities are included in the FY 1989 budget. These supporting efforts include development of on-orbit cryogenic transfer capabilities, fill and drain techniques, propellant mixing, and large on-orbit storage methods.

Satellite servicing is an emerging capability in the early stages of development. NASA on-orbit experience early in the manned space program

(Gemini and Apollo), the successful Solar Maximum Satellite repair mission, and the Palapa and Westar retrievals established the economic and technical validity of satellite servicing. Servicing currently depends upon man-in-space and is constrained to Shuttle-accessible orbits but could evolve to include Space Station-based activities and robotically serviced remote operations. Not only will servicing provide the means to assemble the Space Station on orbit, it will also enable maintenance for the permanently manned base.

The evolution of unmanned in situ servicing, including the OMV and future STV concepts, will enable spacecraft repair and maintenance to be performed in inclinations other than those accessible from Shuttle or Space Station. Longer term requirements are reflected in major science programs where plans are under way to achieve extended operational lifetimes and mission flexibility through the use of on-orbit servicing. Tether applications efforts are directed toward defining and implementing flight experiments and demonstrations for advanced development and proof-of-concept purposes. Applications under study include power generation, orbital altitude changes without the use of propellants, artificial gravity, and tethered space platforms for scientific use.

ADVANCED LAUNCH SYSTEM

DOD and NASA are jointly conducting the ALS studies. The ALS seeks to provide the focused technology which will lead to a heavy-lift launch system which is flexible, robust, reliable, responsive, operationally efficient, and significantly lowers the cost of getting payloads into low Earth orbit. The ALS goal is to have an operational capability no later than 1998.

On January 5, 1988, President Reagan signed a Report to Congress creating a joint DOD and NASA program for the development of the ALS. The report established a joint program office headed by an Air Force program manager with a NASA deputy program manager. DoD will lead the systems engineering and integration, vehicle, logistics, and payload module. NASA will lead liquid engine systems and the focused technology effort.

As per Congressional direction, \$108 million in FY 1987 and FY 1988 has been made available to NASA for ALS propulsion focused technology activities. We are requesting \$13 million in FY 1989 to carry out responsibilities to fulfill ALS requirements.

TETHERED SATELLITE SYSTEM

For FY 1989 we are requesting \$23.8 million for the development of a TSS, a new reusable facility for conducting space experiments at distances up to 100 kilometers from the Shuttle orbiter while being held in a fixed position relative to the orbiter. This program is being undertaken as a cooperative development effort with the Italian government under a Memorandum of Understanding signed in March 1984, which would provide a capability for conducting experiments in the upper atmosphere and ionosphere. The U.S. is responsible for overall program management, overall systems engineering and integration, orbiter integration, ground and flight operations, development of the deployment mechanism, and non-European science instruments. The Italians are responsible for the design and development of the satellite and the

European instruments, and the integration of the science instruments into the satellite.

A number of significant scientific and engineering objectives can be uniquely undertaken with the TSS facility such as the observation of important atmospheric processes in the lower thermosphere, new observations of crustal geomagnetic phenomena, and entirely new electrodynamic experiments interacting with the space plasma.

In 1987, qualification testing of tether was completed. The development work is progressing satisfactorily in anticipation of meeting the first TSS flight scheduled for early 1991.

ORBITAL MANEUVERING VEHICLE

For the OMV, we are requesting \$96.5 million in FY 1989. The OMV will provide a new STS reusable extension capability for conducting orbital operations with spacecraft and payloads beyond the practical operational accessibility limits of the baseline STS. Through direct man-in-the-loop control, the space-based OMV, operating as far as 1,200 nautical miles altitude above the orbiter, will provide delivery, maneuvering, and retrieval of satellite payloads to and from altitudes or inclinations beyond the existing STS capabilities, reboost of satellites to original operational altitudes or higher, delivery of multiple payloads to different orbital altitudes and inclinations in a single flight, and safe deorbit of satellites which have completed their useful lives. It will serve the Space Station as well as accommodate add-on future "mission kits" as needed. The OMV will also be capable of retrieval of space debris.

TRW was competitively selected and is under contract to develop the OMV. The preliminary design review will be held in FY 1988 and long-lead procurements will be initiated. The OMV flight readiness date is mid-1993.

EXPENDABLE LAUNCH VEHICLE/MIXED FLEET

The ELV/mixed fleet program was initiated in fiscal year 1987 as a result of a detailed study of NASA's space transportation requirements. This study recommended that U.S. civil governments' spacecraft be launched using a balanced mixed fleet to provide increased access to space, to assure continuity of space operations, and to enhance mission flexibility.

Based on this study, NASA has revised its space flight manifest plans for civil government payloads based on a mixed fleet concept that consists of the Space Shuttle and ELVs. The FY 89 funding requirement of \$195.5 million provides for necessary ELV services for primarily science missions.

Six vehicles are to be acquired by sole source procurements. We started with the ROSAT and the EUVE missions that are scheduled to fly on Delta II launch vehicles in 1990 and 1991. Funding for these two missions was started in FY 88 and continues through this year. Another 1990 mission being planned is the Combined Release and Radiation Effects Satellite (CRRES). The CRRES mission is split between an Atlas/Centaur and two Scout launch vehicles. We are in the process of acquiring the Atlas/Centaur launch services by exchanging residual Atlas and Centaur hardware for launch services. The

initial funding for the Scout vehicles is part of the FY 89 submission.

We are also evaluating acquisition of Titan III launch services commercially for a TDRS mission and the Mars Observer mission and, with the DOD, a Titan IV to back up the planetary missions scheduled to fly on the Shuttle in 1989 and 1990 -- Galileo, Magellan, and Ulysses. The Titan IV, as well as the two Delta IIs, will be acquired through the DOD on a quid pro quo arrangement.

The balance of our mixed fleet program encompasses competitive selection of private sector operators to provide commercial launch services in three vehicle performance classes: small, medium, and intermediate. We expect established vehicle systems to be leading candidates but not sole contenders in these competitions. We are in the process of developing the necessary procurement strategy and documentation to acquire launch services commercially to satisfy our payload needs. The main focus in our FY 89 budget will be in the small and medium-class launch services. Anticipated selection of the small and medium-class operator will occur in early FY 89. The small-class launch services are planned to be used to carry NASA's science/explorer-type missions starting in 1991. The medium class will support payloads of the International Solar Terrestrial Program missions.

Mr. Chairman and members of the Subcommittee, this budget package includes many bold, exciting new programs, in addition to the necessary steps to develop a safe, sustainable Space Shuttle program. We believe the initiatives placed before you today represent an investment in the future which will pay many scientific and economic dividends and will restore this nation's pride in its space program.

This concludes my formal testimony. I would like to introduce the members of the Office of Space Flight who are seated with me. They are Mr. Joseph Mahon, Deputy Associate Administrator, who is responsible for Flight Systems, and Mr. Arnold Aldrich, Director of the National Space Transportation System. We will be glad to answer any questions you may have.

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington D C
20546

Office of the Administrator

MAR 24 1988

Honorable Robert A. Roe
Chairman
Committee on Science, Space
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The enclosed report, "Launching Payloads by Means of Expendable Launch Vehicles," has been prepared in response to the provisions of Section 116 of the National Aeronautics and Space Administration Authorization Act of 1988 (P.L. 100-147). Section 116 stated that it is the sense of the Congress that "...a diversified family of expendable launch vehicles be incorporated into the Nation's civilian space program," and directed that NASA report on actions taken to ensure that expendable launch vehicles or, if available, commercial launch services be obtained for the launch of a series of specific payloads.

I, or my staff, would be pleased to discuss this report with you further, if you wish.

Sincerely,



James C. Fletcher
Administrator

Enclosure

cc: Honorable Manuel Lujan, Jr.

LAUNCHING PAYLOADS BY MEANS
OF EXPENDABLE LAUNCH VEHICLES

REPORT TO

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

AND

COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION
UNITED STATES SENATE

REPORT TO I. INTRODUCTION

The National Aeronautics and Space Administration Authorization Act of 1988 (P.L. 100-147), dated October 30, 1987, requires that the NASA Administrator report to the Congress by January 15, 1988, on NASA's compliance with the provisions of Section 116. Section 116 states that it is the sense of the Congress that: "(a)... a diversified family of expendable launch vehicles be incorporated into the Nation's civilian space program. (b) the Administrator shall establish a program for launching payloads by means of expendable launch vehicles and, if available, by commercial launch services. (c) the Administrator shall take such action as may be necessary to ensure that expendable launch vehicles or, if available, commercial launch services are obtained for the launch of the following payloads:

- (1) Roentgen Satellite (ROSAT), for launch in 1990.
- (2) Tracking and Data Relay Satellite (TDRS-F), or a planetary mission.
- (3) Extreme Ultraviolet Explorer (EUVE), for launch in 1991.
- (4) Mars Observer, for launch in 1992."

The Authorization Act also included an amount of \$60 million for Expendable Launch Vehicle operations. The FY 1988 Continuing Appropriations Act (P.L. 100-202) limited funding to \$28 million for two Delta-Class vehicles for ROSAT and EUVE.

II. APPROACH

A. GENERAL

NASA has established a Mixed Fleet Space Transportation program composed of the Space Shuttle and Expendable Launch Vehicles (ELV's). The ELV side of this program

will launch U.S. civil government payloads not requiring the unique capabilities of the Space Shuttle. NASA plans to acquire commercial ELV launch services competitively in several performance classes, whenever such services are available from industry. In procurement of these launch services, the requirements of the Competition In Contracting Act (CICA) will be strictly observed. The first phase of the program procures ELV's for five high priority spacecraft that were originally manifested near-term on the shuttle. They are already built and delivered and are to be matched to available ELV's. A total of seven ELV's will be utilized, because one spacecraft is to be redesigned and its experiment divided between three vehicles. A directed procurement process will be utilized for selection of these vehicles because of the need to launch these missions as soon as possible. Of the total of seven launch vehicles to be acquired, three will be acquired through the Department of Defense (DOD) and four directly from U.S. commercial operators.

NASA's testimony before the House Committee on Science, Space and Technology, Subcommittee on Space Science and Applications, on September 17, 1987, provides a full explanation of the phased implementation plan for procuring expendable launch vehicle services for NASA's needs. Further, NASA's ELV Mixed Fleet transitional plans for the first phase were provided to Congress on December 4, 1987, by the Determination and Finding Report containing the justification for other than full and open competition for seven launch vehicles.

B. PHASING OF IMPLEMENTATION PLAN

ELV launches for the ROSAT in 1990 and the EUVE in 1991, as specified in the Authorization Act, are being acquired through the DOD in accordance with a NASA/DOD Agreement, signed October 7, 1987, to exchange shuttle and ELV launch services on a quid-pro-quo basis. These two missions are being placed on USAF Delta-II vehicles. The third launch vehicle is a Titan-IV in support of either the Magellan, Galileo or Ulysses planetary mission manifested on the shuttle. The earliest requirement for the Titan-IV launch is May 1991, and it will be also be provided by the USAF on a quid-pro-quo exchange basis.

The four launch vehicles to be directly acquired from commercial operators in the transition phase include a Titan-III, an Atlas Centaur, and two Scouts. Use of the commercial Titan-III vehicle has been evaluated for launch of TDRS-F and the Mars Observer. Study and analysis over the past several months indicates that there are still some technical and cost uncertainties involved in placing the TDRS spacecraft on an ELV. The problem relates primarily to the fact that the expendable vehicle places greater loads on the spacecraft, which was designed to take advantage of the more moderate launch environment provided by the Space Shuttle. The primary concern involves potential damage to the delicate TDRS antenna system as a result of these greater launch loads.

At the same time, analysis indicates that the Mars Observer spacecraft is basically compatible with launch on a Titan III, but that modifications to the transfer orbit stage would be required. Launching the Mars Observer on an ELV would have the benefit of permitting use of the Shuttle flight now planned for that mission for another spacecraft. Launch of TDRS-F on the Shuttle would hold that spacecraft to a launch environment that it has successfully experienced before and also would permit full loading of the spacecraft fuel tanks, providing a potential for longer on-orbit lifetime. Given the present uncertainty of available appropriations, NASA plans to maintain a dual compatibility option for the Mars Observer, pending further Congressional indication of funding feasibility for the Titan III. If funding were provided, NASA would acquire the Titan III directly from the Martin Marietta Corporation.

The Atlas/Centaur launch service is being considered in the transition phase for acquisition commercially for the Combined Release and Radiation Effects Satellite (CRRES) to be launched in 1990. We are currently discussing with General Dynamics Corporation an exchange of residual Atlas/Centaur and Shuttle/Centaur assets for launch services for this mission. Several of the planned experiments, however, could not be accommodated on an Atlas Centaur launch, but could be accommodated by the launch of small payloads on two Scout vehicles.

Initial funding for the two Delta-II's is in the NASA FY 1988 budget. Funding for the Titans, Atlas/Centaur and Scouts is included in NASA's FY 1989 budget request to Congress.

For launches beyond the transitional period, 1992 and beyond, it would be our intent to competitively procure launch services in four performance classes from commercial operators where the opportunity exists. Launch services capabilities will be established for the U.S. civil government community in small (Scout class), medium (Delta class), intermediate (Atlas/Centaur/Titan-III class), and large (Titan-IV class) classes. In all performance classes, with the exception of the large class (Titan-IV), we expect viable commercial competition. In this class, we would expect to continue to contract through the DOD, since Titan IV's are not available commercially and there are no other vehicles in its capability range on which to base a competition. We can project overall requirements for the future on the order of approximately two small class launches per year, three to five in the medium class, and one to two in the intermediate and large classes.

III. SUMMARY

NASA is taking action in response to the direction of the Congress in the NASA Authorization Act of 1988 within the constraints of the FY 1988 Continuing Appropriation and a reasonable projection for future years. Where possible, commercial launch services are being acquired in the early transitional phase. Following this ELV startup phase, NASA will compete the procurement for launch services wherever the opportunity exists in the United States.

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of Administration

MAR 24 1988

Honorable Bill Nelson
Chairman
Subcommittee on Space Science
and Applications
Committee on Science, Space
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The enclosed report, "Launching Payloads by Means of Expendable Launch Vehicles," has been prepared in response to the provisions of Section 116 of the National Aeronautics and Space Administration Authorization Act of 1988 (P.L. 100-147). Section 116 stated that it is the sense of the Congress that "...a diversified family of expendable launch vehicles be incorporated into the Nation's civilian space program," and directed that NASA report on actions taken to ensure that expendable launch vehicles or, if available, commercial launch services be obtained for the launch of a series of specific payloads.

I, or my staff, would be pleased to discuss this report with you further, if you wish.

Sincerely,


James C. Fletcher
Administrator

Enclosure

cc: Honorable Robert S. Walker

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of Management Administration

MAR 24 1988

Honorable Donald W. Riegle, Jr.
Chairman
Subcommittee on Science, Technology
and Space
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The enclosed report, "Launching Payloads by Means of Expendable Launch Vehicles," has been prepared in response to the provisions of Section 116 of the National Aeronautics and Space Administration Authorization Act of 1988 (P.L. 100-147). Section 116 stated that it is the sense of the Congress that "...a diversified family of expendable launch vehicles be incorporated into the Nation's civilian space program," and directed that NASA report on actions taken to ensure that expendable launch vehicles or, if available, commercial launch services be obtained for the launch of a series of specific payloads.

I, or my staff, would be pleased to discuss this report with you further, if you wish.

Sincerely,

James C. Fletcher
Administrator

Enclosure

cc: Honorable Larry Pressler

(

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

MAR 24 1988

Honorable Ernest F. Hollings
Chairman
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The enclosed report, "Launching Payloads by Means of Expendable Launch Vehicles," has been prepared in response to the provisions of Section 116 of the National Aeronautics and Space Administration Authorization Act of 1988 (P.L. 100-147). Section 116 stated that it is the sense of the Congress that "...a diversified family of expendable launch vehicles be incorporated into the Nation's civilian space program," and directed that NASA report on actions taken to ensure that expendable launch vehicles or, if available, commercial launch services be obtained for the launch of a series of specific payloads.

I, or my staff, would be pleased to discuss this report with you further, if you wish.

Sincerely,


James C. Fletcher
Administrator

Enclosure

cc: Honorable John C. Danforth

THIS PAGE
INTENTIONALLY
LEFT BLANK



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

September 14, 1988

Honorable Robert A. Roe
Chairman
Committee on Science, Space
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

On March 24, 1988, I submitted our report, "Launching Payloads by Means of Expendable Launch Vehicles," in response to the provisions of Section 116(d) of the FY 1988 NASA Authorization Act (P.L. 100-147). I am writing again to keep you further apprised of our continuing activities to comply with Congress' direction to " . . . establish a program for launching payloads by means of expendable launch vehicles and, if available, by commercial launch services."

Over the past several months, we have been exploring with the General Dynamics Corporation (GDC) the possibility of procuring Atlas-Centaur launch services and crediting the acquisition cost of Government-owned Atlas-Centaur and Shuttle-Centaur assets against the value of those services. GDC and other Atlas/Centaur associate contractors have acquired these assets under NASA contracts and still retain cognizance of the items to be considered in this barter arrangement.

The missions to be supported by this barter arrangement were previously presented to Congress and include the Navy Fleet Satellite-8 Communication (FLTSATCOM) and the Joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES). The FLTSATCOM was to have been launched in July 1987, but was delayed because of an accident which seriously damaged the launch vehicle on the pad. The Navy is requesting launch as soon as possible. The CRRES was originally scheduled for launch on STS and now has a planned launch date on an Atlas-Centaur in mid-1990. NASA's Lewis Research Center (LeRC) is responsible for determining the assets available, negotiating the specific arrangements, and executing and administering the necessary contracts with a barter arrangement for launch of these missions.

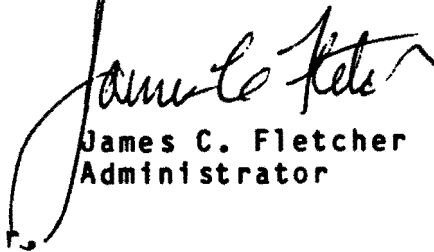
LeRC has undertaken and concluded barter negotiations with GDC in accordance with the authority to dispose of contractor inventory provided by 40 U.S.C. 484(f), as implemented by Section 45.603, in the Federal Acquisition Regulation. We anticipate entering into two launch services contracts for these missions on or about October 15, 1988.

In our judgment, the negotiated arrangements are highly beneficial to Government. Under these arrangements, the Government will receive needed launch services with the least impact on public funds, and the contractor will gain title to production hardware it needs for commercialization activities. We believe that allowing GDC to retain the assets in question supports the Congressional and Presidential initiatives to facilitate the commercialization of space launch services as embodied in the Commercial Space Launch Act (P.L. 98-575) and the revised National Space Policy approved by the President on January 5, 1988.

Because of their interest in the missions, the DOD has been briefed and has concurred with this arrangement. In addition, this matter has been discussed with appropriate officials in the Department of Transportation.

I would be pleased to discuss this matter further with you at your convenience.

Sincerely,



James C. Fletcher
Administrator

cc: Honorable Manuel Lujan, Jr.



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

September 14, 1988

Honorable Bill Nelson
Chairman
Subcommittee on Space Science
and Applications
Committee on Science, Space
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

On March 24, 1988, I submitted our report, "Launching Payloads by Means of Expendable Launch Vehicles," in response to the provisions of Section 116(d) of the FY 1988 NASA Authorization Act (P.L. 100-147). I am writing again to keep you further apprised of our continuing activities to comply with Congress' direction to "... establish a program for launching payloads by means of expendable launch vehicles and, if available, by commercial launch services."

Over the past several months, we have been exploring with the General Dynamics Corporation (GDC) the possibility of procuring Atlas-Centaur launch services and crediting the acquisition cost of Government-owned Atlas-Centaur and Shuttle-Centaur assets against the value of those services. GDC and other Atlas/Centaur associate contractors have acquired these assets under NASA contracts and still retain cognizance of the items to be considered in this barter arrangement.

The missions to be supported by this barter arrangement were previously presented to Congress and include the Navy Fleet Satellite-8 Communication (FLTSATCOM) and the Joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES). The FLTSATCOM was to have been launched in July 1987, but was delayed because of an accident which seriously damaged the launch vehicle on the pad. The Navy is requesting launch as soon as possible. The CRRES was originally scheduled for launch on STS and now has a planned launch date on an Atlas-Centaur in mid-1990. NASA's Lewis Research Center (LeRC) is responsible for determining the assets available, negotiating the specific arrangements, and executing and administering the necessary contracts with a barter arrangement for launch of these missions.

LeRC has undertaken and concluded barter negotiations with GDC in accordance with the authority to dispose of contractor inventory provided by 40 U.S.C. 484(f), as implemented by Section 45.603, in the Federal Acquisition Regulation. We anticipate entering into two launch services contracts for these missions on or about October 15, 1988.

In our judgment, the negotiated arrangements are highly beneficial to Government. Under these arrangements, the Government will receive needed launch services with the least impact on public funds, and the contractor will gain title to production hardware it needs for commercialization activities. We believe that allowing GDC to retain the assets in question supports the Congressional and Presidential initiatives to facilitate the commercialization of space launch services as embodied in the Commercial Space Launch Act (P.L. 98-575) and the revised National Space Policy approved by the President on January 5, 1988.

Because of their interest in the missions, the DOD has been briefed and has concurred with this arrangement. In addition, this matter has been discussed with appropriate officials in the Department of Transportation.

I would be pleased to discuss this matter further with you at your convenience.

Sincerely,



James C. Fletcher
Administrator

cc: Honorable Robert S. Walker



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

September 14, 1988

Honorable Donald W. Riegle, Jr.
Chairman
Subcommittee on Science, Technology
and Space
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

On March 24, 1988, I submitted our report, "Launching Payloads by Means of Expendable Launch Vehicles," in response to the provisions of Section 116(d) of the FY 1988 NASA Authorization Act (P.L. 100-147). I am writing again to keep you further apprised of our continuing activities to comply with Congress' direction to "... establish a program for launching payloads by means of expendable launch vehicles and, if available, by commercial launch services."

Over the past several months, we have been exploring with the General Dynamics Corporation (GDC) the possibility of procuring Atlas-Centaur launch services and crediting the acquisition cost of Government-owned Atlas-Centaur and Shuttle-Centaur assets against the value of those services. GDC and other Atlas/Centaur associate contractors have acquired these assets under NASA contracts and still retain cognizance of the items to be considered in this barter arrangement.

The missions to be supported by this barter arrangement were previously presented to Congress and include the Navy Fleet Satellite-8 Communication (FLTSATCOM) and the Joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES). The FLTSATCOM was to have been launched in July 1987, but was delayed because of an accident which seriously damaged the launch vehicle on the pad. The Navy is requesting launch as soon as possible. The CRRES was originally scheduled for launch on STS and now has a planned launch date on an Atlas-Centaur in mid-1990. NASA's Lewis Research Center (LeRC) is responsible for determining the assets available, negotiating the specific arrangements, and executing and administering the necessary contracts with a barter arrangement for launch of these missions.

LeRC has undertaken and concluded barter negotiations with GDC in accordance with the authority to dispose of contractor inventory provided by 40 U.S.C. 484(f), as implemented by Section 45.603, in the Federal Acquisition Regulation. We anticipate entering into two launch services contracts for these missions on or about October 15, 1988.

In our judgment, the negotiated arrangements are highly beneficial to Government. Under these arrangements, the Government will receive needed launch services with the least impact on public funds, and the contractor will gain title to production hardware it needs for commercialization activities. We believe that allowing GDC to retain the assets in question supports the Congressional and Presidential initiatives to facilitate the commercialization of space launch services as embodied in the Commercial Space Launch Act (P.L. 98-575) and the revised National Space Policy approved by the President on January 5, 1988.

Because of their interest in the missions, the DOD has been briefed and has concurred with this arrangement. In addition, this matter has been discussed with appropriate officials in the Department of Transportation.

I would be pleased to discuss this matter further with you at your convenience.

Sincerely,



James C. Fletcher
Administrator

cc: Honorable Larry Pressler



National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

September 14, 1988

Honorable Ernest F. Hollings
Chairman
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

On March 24, 1988, I submitted our report, "Launching Payloads by Means of Expendable Launch Vehicles," in response to the provisions of Section 116(d) of the FY 1988 NASA Authorization Act (P.L. 100-147). I am writing again to keep you further apprised of our continuing activities to comply with Congress' direction to " . . . establish a program for launching payloads by means of expendable launch vehicles and, if available, by commercial launch services."

Over the past several months, we have been exploring with the General Dynamics Corporation (GDC) the possibility of procuring Atlas-Centaur launch services and crediting the acquisition cost of Government-owned Atlas-Centaur and Shuttle-Centaur assets against the value of those services. GDC and other Atlas/Centaur associate contractors have acquired these assets under NASA contracts and still retain cognizance of the items to be considered in this barter arrangement.

The missions to be supported by this barter arrangement were previously presented to Congress and include the Navy Fleet Satellite-8 Communication (FLTSATCOM) and the Joint NASA/DOD Combined Release and Radiation Effects Satellite (CRRES). The FLTSATCOM was to have been launched in July 1987, but was delayed because of an accident which seriously damaged the launch vehicle on the pad. The Navy is requesting launch as soon as possible. The CRRES was originally scheduled for launch on STS and now has a planned launch date on an Atlas-Centaur in mid-1990. NASA's Lewis Research Center (LeRC) is responsible for determining the assets available, negotiating the specific arrangements, and executing and administering the necessary contracts with a barter arrangement for launch of these missions.

LeRC has undertaken and concluded barter negotiations with GDC in accordance with the authority to dispose of contractor inventory provided by 40 U.S.C. 484(f), as implemented by Section 45.603, in the Federal Acquisition Regulation. We anticipate entering into two launch services contracts for these missions on or about October 15, 1988.

In our judgment, the negotiated arrangements are highly beneficial to Government. Under these arrangements, the Government will receive needed launch services with the least impact on public funds, and the contractor will gain title to production hardware it needs for commercialization activities. We believe that allowing GDC to retain the assets in question supports the Congressional and Presidential initiatives to facilitate the commercialization of space launch services as embodied in the Commercial Space Launch Act (P.L. 98-575) and the revised National Space Policy approved by the President on January 5, 1988.

Because of their interest in the missions, the DOD has been briefed and has concurred with this arrangement. In addition, this matter has been discussed with appropriate officials in the Department of Transportation.

I would be pleased to discuss this matter further with you at your convenience.

Sincerely,



James C. Fletcher
Administrator

cc: Honorable John C. Danforth

PEB-SENSITIVE INFORMATION

AUDIT REPORT

AUDIT OF SELECTED ASPECTS OF HUBBLE SPACE
TELESCOPE AWARD FEES

MARSHALL SPACE FLIGHT CENTER

JULY 19, 1989

NOTICE - THIS REPORT RESTRICTED TO OFFICIAL USE

THIS DOCUMENT IS A FINAL REPORT OF AUDIT ISSUED BY THE NASA
OFFICE OF INSPECTOR GENERAL (OIG). CONTRACTOR INFORMATION
CONTAINED IN THIS AUDIT REPORT MAY BE COMPANY CONFIDENTIAL.
THE RESTRICTION OF 18 USC 1905 SHOULD BE CONSIDERED BEFORE
THIS DATA IS RELEASED TO THE PUBLIC. ANY FREEDOM OF INFORMATION
ACT REQUEST FOR THIS REPORT SHOULD BE DIRECTED TO THE NASA
INSPECTOR GENERAL FOR PROCESSING IN ACCORDANCE WITH TITLE 14 CODE
OF FEDERAL REGULATIONS, PART 1206.504.



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

PEB-SENSITIVE INFORMATION

PEB-SENSITIVE INFORMATION

AUDIT REPORT

AUDIT OF SELECTED ASPECTS OF HUBBLE SPACE
TELESCOPE AWARD FEES

MARSHALL SPACE FLIGHT CENTER

JULY 19, 1989

NOTICE - THIS REPORT RESTRICTED TO OFFICIAL USE

THIS DOCUMENT IS A FINAL REPORT OF AUDIT ISSUED BY THE NASA
OFFICE OF INSPECTOR GENERAL (OIG). CONTRACTOR INFORMATION
CONTAINED IN THIS AUDIT REPORT MAY BE COMPANY CONFIDENTIAL.
THE RESTRICTION OF 18 USC 1905 SHOULD BE CONSIDERED BEFORE
THIS DATA IS RELEASED TO THE PUBLIC. ANY FREEDOM OF INFORMATION
ACT REQUEST FOR THIS REPORT SHOULD BE DIRECTED TO THE NASA
INSPECTOR GENERAL FOR PROCESSING IN ACCORDANCE WITH TITLE 14 CODE
OF FEDERAL REGULATIONS, PART 1206.504.



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

PEB-SENSITIVE INFORMATION

Office of Inspector General
Marshall Space Flight Center
Alabama 35812



Reply to Attn of

M-DI: 134-89

July 19, 1989

TO: DA01/Director, Marshall Space Flight Center
Attn: DE01/Executive Assistant to the Director
J. A. Bethay

FROM: M-DI/Director, MSFC Office of Inspector General
Kenneth R. Atkins

SUBJECT: Final Report on Audit of Selected Aspects of Hubble
Space Telescope Award Fees, MSFC (A-MA-86-003)

The NASA Office of Inspector General has completed a review of selected aspects of award fees paid by MSFC to the two Hubble Space Telescope (HST) prime contractors. The purpose of the audit was to evaluate the effectiveness of selected policies, procedures, and internal controls relating to MSFC's determination of HST contractor entitlement to award fees.

We identified areas requiring increased management attention to ensure procedural/regulatory compliance and to improve internal controls. This report contains recommendations intended to aid management in improving award fee procedures and in strengthening needed internal controls.

A draft report was provided to MSFC on January 12, 1989, and a written response to the recommendations was received April 17, 1989. The management response, incorporated in this report as Appendix A, outlined positive measures and actions which were generally responsive to most of the recommendations. In addition to responding to each OIG recommendation, MSFC also provided further comments in their management response. These are separately addressed in Appendix B. After reviewing the Center's response, we remain of the opinion that all overrun on the HST contracts was not fully recognized and, therefore, award fees may have been overpaid.

In accordance with the Office of Inspector General's revised audit followup policy, we consider Recommendations 1, 2, 3, 4, 5, 6, 8, and 10 to be significant. Accordingly, we request to be included in the Center's concurrence cycle for closing these eight recommendations.

1

We wish to express our appreciation to NASA Headquarters personnel and to personnel of the MSFC Hubble Space Telescope Project Office, Procurement Office, Center Comptroller, as well as the Assistant Director for Policy and other Center personnel contacted during the audit for their courtesy, assistance, and cooperation.

Kenneth R. Atkins

Enclosure: A-MA-86-003 (4 Cys.)

cc: BC01/Mr. Hallisey w/12 Cys. Encl.)
TA01/Mr. Wojtalik (w/1 cy. Encl.)
AP01/Mr. Henke (w/1 cy. Encl.))

* * * * * PEB SENSITIVE * * * * *

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
DIGEST	1
INTRODUCTION	5
OBJECTIVE AND SCOPE	9
OBSERVATIONS AND RECOMMENDATIONS	11
1. Consideration of Contract Cost Overruns in Award Fee Evaluations	13
2. Performance Measurement Systems	45
3. Improving the Award Fee Process	55
GENERAL COMMENT	67
EXHIBIT 1 Fee Structure - LMSC	69
EXHIBIT 2 Fee Structure - Perkin-Elmer	71
EXHIBIT 3 LMSC Overrun Negotiated vs Cost Variance Recognized Under Cost Performance	73
EXHIBIT 4 P-E Overrun Negotiated vs Cost Variance Recognized Under Cost Performance	75
EXHIBIT 5 Glossary of Terms	77
EXHIBIT 6 Directive References on PMS/CPAF	79
APPENDIX A MSFC Response	A-1
APPENDIX B MSFC Additional Comments	B-1

* * * * * PEB SENSITIVE * * * * *

* * * * * PEB SENSITIVE * * * * *

A-MA-86-003

July 19, 1989

AUDIT OF SELECTED ASPECTS
OF
HUBBLE SPACE TELESCOPE AWARD FEES
MARSHALL SPACE FLIGHT CENTER

DIGEST

INTRODUCTION

The Office of Inspector General (OIG), Marshall Space Flight Center (MSFC), has completed an audit of selected aspects of Hubble Space Telescope (HST) award fees. The purpose was to evaluate the effectiveness of selected policies, procedures and internal controls relating to MSFC's determination of contractor entitlement to award fees on the two HST prime contracts. The review focused on the extent to which negotiated in-scope cost overruns were recognized by the Center in evaluating contractor performance in controlling cost and included performance periods completed as of April 30, 1987. Primary emphasis was placed on the Center's implementation, validation and surveillance of contractor Performance Measurement Systems (PMSs), and the impact of PMSs on the award fee process.

Both major HST contracts are cost-plus-award-fee (CPAF) contracts. As of June 30, 1987, most of the Center's major contracts, particularly those for research and development projects, were CPAF (at least 20 contracts valued at over \$6 billion). Award fee determinations are judgmental and are made unilaterally by a MSFC Fee Determination Official (FDO). The MSFC Performance Evaluation Board (PEB), after receiving input from the HST Project Office and the HST contractors, provides the FDO with recommendations on the fees to be awarded. MSFC directives required that Performance Evaluation Plans for CPAF contracts include as standard evaluation criteria Achievement, Business Management, and Cost Control. At the time of our review MSFC not only assigned a weight (importance) to each criterion, but also identified and weighted subcriteria within each criterion. This structured process permitted us to separately review the Cost Control criterion and its subcriteria. It should also be noted that we limited our review primarily to the more objective data gathering aspects of the award fee process. We did not evaluate the highly subjective process of scoring/rating contractor performance based on this data.

* * * * * PEB SENSITIVE * * * * *

OBSERVATIONS AND RECOMMENDATIONS

MSFC policies, procedures, and internal controls relating to the determination of contractor entitlement to award fees for controlling cost on the two Hubble Space Telescope (HST) prime contracts were generally effective. However, we identified certain areas in which increased management emphasis is needed to improve the award fee process at MSFC and ensure proper recognition of negotiated overruns, benefitting both contract and project management. Specific areas requiring management attention include the need for (i) improvements to award fee evaluation and documentation procedures as well as better compliance with existing procedures, (ii) more effective implementation and surveillance of Performance Measurement System (PMS) requirements, and (iii) the reduction of award fee processing time. We also noted that NASA Headquarters cancelled existing guidance on award fees several years ago but only recently provided revised interim guidance to the Centers.

1. Consideration of Contract Cost Overruns in Award Fee Evaluations

MSFC evaluations of the performance of Hubble Space Telescope (HST) contractors in controlling cost have not fully recognized approximately \$117 million of the \$183 million cost overrun negotiated during standard award fee periods on the two HST prime contracts as of April 30, 1987. The primary factors which have contributed to the above condition include needed improvements to (i) contractor Performance Measurement System (PMS) reports, and (ii) MSFC evaluation and documentation procedures. The impact of not fully recognizing all negotiated overrun is not precisely quantifiable due to the subjective nature of the award fee determination process. However, we believe not properly considering all negotiated cost overruns as cost variances within the Cost Control evaluation criterion may have resulted in higher than justified award fee ratings and the possible overpayment of as much as \$1 million in award fees.

We recommended that MSFC clarify existing procedures, provide additional policy and procedural guidance to those Center elements responsible for evaluating contractor performance in controlling costs on CPAF contracts, and emphasize the need to address all overruns. We also recommended that MSFC revise evaluation plans to require periodic comparison of negotiated overrun with overrun recognized by award fee evaluations; require contractors to clearly identify the causes and status (historical or future) of negotiated overruns; ensure evaluation procedures do not over-penalize contractors; revise certain evaluation methods; and emphasize the importance of properly documenting award fee evaluations. Although MSFC did not agree with our conclusion that all overrun was not fully recognized and possible overpayment of award fees may have occurred, the Center stated action was being taken to restructure the cost performance evaluation procedure by requiring that evaluations be made at the

criterion level rather than at the subcriterion level and agreed to provide policy and procedural guidance to ensure cost growth is appropriately considered; to re-emphasize the importance of identifying and recognizing cost growth; to continue to require contractors to account for all cost growth; and to place additional emphasis on ensuring that contractors are not over-penalized and on documenting support for award fee evaluations. (Page 13)

2. PERFORMANCE MEASUREMENT SYSTEMS

MSFC had not effectively implemented the performance measurement requirements of MMI 8020.7B. Factors which have contributed to this situation include the need for increased management emphasis on the use of PMSs, the need to maintain closer surveillance over PMSs, insufficient PMS training, and delayed validation of HST contractor PMSs as well as not periodically revalidating PMSs. In our opinion, these weaknesses in the use of PMSs have contributed to the Center not properly recognizing cost overruns, and the possible overpayment of award fees. We recommended that the Center place increased emphasis on the use of PMSs on CPAF contracts; train personnel to carry out assigned PMS responsibilities; maintain documentation on each contractor PMS; periodically review and revalidate each PMS; and review PMS requirements on the HST contracts and consider deleting any requirements identified as not required nor utilized. MSFC concurred with these recommendations and advised that a waiver to PMS requirements on the HST contracts was granted in April 1988. (Page 45)

3. IMPROVING THE AWARD FEE PROCESS

Additional areas where we believe the award fee process can be further improved include award fee processing time, the use of retroactive award fee adjustments, and recognition for minimal acceptable performance. Improvements in these areas would strengthen the award fee process at MSFC. There also was a need for updated NASA Headquarters guidance on incentive contracting. However, as Code H provided interim guidance during our audit, we made no recommendation. We recommended MSFC place added management emphasis on promptly completing the award fee process; re-emphasize the importance of properly supporting contractor performance ratings; provide policy and procedural guidance on retroactive fee adjustments; retain the Cost Control criterion in the Lockheed evaluation plan for the last period; and make appropriate use of the recently issued NASA Headquarters interim award fee guidance. MSFC agreed to continue efforts to complete performance evaluations in the most timely and effective manner; to continue to give emphasis to the importance of properly supporting performance ratings; to re-emphasize provisional fee payments and other fee adjustment techniques; to continue to retain the Cost Control criterion in the HST Project Plan; and to give all MSFC contracting officers a copy of the interim Headquarters guidance. (Page 55)

This page intentionally left blank.

INTRODUCTION

The Office of Inspector General, Marshall Space Flight Center (MSFC), has completed an audit of selected aspects of award fees paid by MSFC to Hubble Space Telescope (HST) prime contractors. The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMIs) 9910.1 and 1103.27A, dated January 28, 1980, and August 5, 1986, respectively.

The objective of the HST Project is to orbit a high quality 2.4 meter optical telescope system for use, in conjunction with NASA, by the astronomical community. The scientific objectives of the HST are to determine the constitution, physical characteristics, and dynamics of celestial bodies; the nature of processes which occur in the extreme physical conditions existing in stellar objects; the history and evolution of the universe; and whether the laws of nature are universal in the space-time continuum. Overall direction and evaluation of the HST Program are the responsibility of the Office of Space Science and Applications (OSSA) at NASA Headquarters. The HST Program Manager establishes major program requirements and approves funding.

In May 1972, the Associate Administrator selected MSFC as the lead project management Center for the HST. MSFC has overall implementation responsibility for meeting cost, schedule, and technical performance goals of the project. Definition studies were performed and Congressional go-ahead for the HST was received in July 1977. Design and development contracts were awarded in October 1977 to Perkin-Elmer (P-E) for the Optical Telescope Assembly (OTA) and to Lockheed Missiles and Space Company (LMSC) for the Support Systems Module (SSM).

In the early 1980s, the HST contractors experienced technical and management problems which resulted in significant schedule slips and cost growth. As a result, the HST Project received extensive attention by NASA Headquarters and the Congress. Efforts to remedy the problems included changes and increases in the MSFC HST Project Office staff and increased oversight of contractor operations. Additional HST Project Office personnel were located onsite at both contractor facilities. Due to the problems experienced, the planned November 1983 launch date had slipped about three years, to October 1986, at the time of the Challenger accident in early 1986. Due to the subsequent suspension of Space Shuttle launches, the HST schedule was further delayed to August 1989 (as of June 30, 1988).

At the time of our review in 1987, the HST Project was in the Assembly and Verification (A&V) Phase having completed such major milestones as Optical Telescope Assembly (OTA) delivery and thermal vacuum tests of the assembled vehicle. The staffing

levels of both LMSC and P-E were reduced pending launch. Both contractors were performing necessary modifications and upgrades to the HST, some of which were identified during thermal vacuum testing. The HST hardware is being maintained in a clean room facility at LMSC pending shipment to Kennedy Space Center (KSC) for verification tests and launch.

Both major HST contracts are cost-plus-award-fee (CPAF) type contracts. MSFC uses this type contract extensively for major research and development projects as well as for support services. As of June 30, 1987, most of their major contracts were CPAF (at least 20 contracts valued at over \$6 billion). Recognizing the inherent uncertainties of R&D projects, this type contract provides contractors the opportunity to earn enhanced profits or to forfeit potential fees based on the Government's subjective evaluation of performance. They are cost reimbursable type contracts which include an estimated cost, specific evaluation criteria, and a fee amount available for periodic award as determined by the performance evaluations. These award fee determinations are judgmental and made unilaterally by a MSFC Fee Determination Official (FDO).

There are certain advantages to using CPAF contracts on major research and development efforts as complex and technical as MSFC's HST Project. One such advantage is the flexibility in establishing and revising performance criteria. Changes can be made to the evaluation criteria or to the relative importance of existing criteria, to place emphasis on the areas of current concern. While CPAF contracts offer such advantages, their use generally requires more NASA resources (funds and personnel) to monitor and evaluate contractor performance, as well as a substantially greater requirement for contractor-provided performance/status data.

The HST Project Office assigned separate staffs to be responsible for monitoring and evaluating each HST contractor's performance. The coordinator and monitors in the Support System Module (SSM) Project are responsible for monitoring major efforts on the LMSC contract. In addition, smaller staffs are responsible for the Systems Engineering function on the LMSC contract which also includes the Refurbishment & Maintenance effort. Similarly, the coordinator and monitors in the Optical Telescope Assembly (OTA) Project are responsible for monitoring contractor performance on the P-E contract.

Under the direction of the coordinators, each monitor evaluates contractor performance in one or more of the criteria/subcriteria specified in the applicable LMSC or P-E Performance Evaluation Plan (PEP). Evaluations prepared by these monitors are used by the coordinators to prepare an evaluation on each criterion and subcriterion, as well as an overall evaluation of contractor performance for submission to the MSFC Performance Evaluation Board (PEB).

MSFC has established separate PEBs to address contractor performance on contracts for programs/projects, and to address contractor performance on mission services contracts. At the end of each evaluation period on each HST contract, the responsible HST Project Office coordinator submits an evaluation report to the PEB. Similarly, the HST contractors are required to submit self-evaluation reports. The PEB meets in executive session to deliberate on these reports, as well as oral presentations by the coordinators and the contractors, to arrive at a consensus on each contractor's performance. The PEB subjectively determines the overall numerical rating, award fee percent, and adjective rating to be recommended to the MSFC Fee Determination Official (FDO) who is ultimately responsible for fees awarded.

Marshall Manual 5151.5C requires that Performance Evaluation Plans (PEP) include Achievement, Business Management, and Cost Control as standard evaluation criteria. The PEPs for both HST contracts include these criteria. Subcriteria which describe significant aspects of each criterion were established and specified by the original PEPs, dated October 19, 1977. These subcriteria are shown below.

Achievement

- Schedule Performance
- Technical Performance
- Low Cost Planning

Business Management

- Project Management and Contract Administration
- Procurement and Subcontract Management
- Socioeconomic Program

Cost Control

- Total Cost (Cost Performance)
- NASA Cost and Funding Constraints
- Quality of Cost and Funding Estimates.

Over the 10-year life of the LMSC and P-E contracts, various other subcriteria were sometimes used for specific award periods. The HST Project Office determines the weight (importance) to be assigned each criterion and subcriterion prior to the beginning of each award fee evaluation period, the weights assigned totaling 100. The weight of each criterion and subcriterion generally represents that portion (percent) of the total available award fee which can be earned for that criterion.

MMI 8020.7B, MSFC Performance Measurement for Selected Major Procurements, dated July 8, 1976, requires that MSFC have contractors establish and operate a Performance Measurement System (PMS). PMSs are intended to provide pertinent information on a contractor's cost and schedule status. In addition, MM 8020.6A, Cost/Schedule Performance Criteria (C/SPC), dated July 8, 1976, requires contractors on CPAF contracts to demonstrate, within 90 days after contract award, that their PMS

is operational and meets all requirements. The responsible MSFC Project Office is required to review and formally accept the system. Shortcomings disclosed by such reviews are to be documented and the contractor required to make specific arrangements for corrections, with followup reviews until formal acceptance is achieved. Upon acceptance, the contractor is required to provide a description of the PMS as a basis for surveillance by Project Office and Comptroller personnel to assure it continues to meet the criteria. The document describing the PMS is the Performance Management Plan. Deviations from the approved PMS discovered during contract performance must be corrected by the contractor within 30 days. Any changes that would affect system integrity must be approved by MSFC.

The MSFC Comptroller, R&D Programs Office, is responsible for policy and procedural guidance on the use of PMSs, including reports (MA-02s) to monitor contractor cost and schedule performance. Similarly, the MSFC Financial Management Office is responsible for guidance on contractor financial management reporting (NASA Form 533 reports). Pertinent NASA and Center directives on the award fee process, including PMSs and financial reporting, are listed in Exhibit 6. NHB 9501.2B states that when the NASA Form 533P is not used, the NASA Form 533M will be the cost reporting medium for performance evaluation. However, since NASA directives authorize substitution of contractor reports, MSFC generally accepted and relied on the PMS reports, in the absence of Form 533Ps, to evaluate contractor cost performance. The PMS reports address cost variance (earned value) and schedule variance while the Form 533Ms do not.

OBJECTIVE AND SCOPE

The purpose of this audit was to evaluate the effectiveness of selected policies, procedures and internal controls relating to MSFC's determination of contractor entitlement to award fees on the two Hubble Space Telescope (HST) prime contracts. The review focused on the extent to which negotiated in-scope cost overruns were recognized by Center evaluations of contractor performance in controlling cost, including the Cost Control criteria and related schedule subcriteria used in the award fee evaluation process. The review included performance periods completed as of April 30, 1987. Primary emphasis was placed on the Center's implementation, validation, and surveillance of contractor Performance Measurement Systems (PMSs) as well as selected aspects of Center procedures for accomplishing award fee evaluations. We also reviewed the appropriateness of the criteria used to monitor contractor cost and schedule performance, including baseline maintenance, as well as the contractor's adherence to the Performance Management Plan (MA-01) including the validity and timeliness of PMS data.

It should be noted that we limited our review primarily to the more objective data gathering aspects of the award fee process. Specifically, we evaluated Center procedures for accurately determining and properly reporting cost variance (overrun) to the PEB. We did not evaluate the highly subjective process of Center HST personnel, or the PEB, scoring/rating the contractor's performance based on that cost variance (overrun) data which had been documented and reported.

Our review addressed practices and procedures followed by the MSFC HST Project Office, Center Comptroller, Institutional and Program Support (I&PS) Directorate Procurement Office, and other MSFC elements as appropriate.

The audit was performed in accordance with generally accepted Government Auditing Standards and accordingly included such tests of internal controls as considered necessary under the circumstances. We reviewed the adequacy of certain current award fee policies, procedures, and internal controls; tested award fee practices for compliance with directives; and interviewed selected MSFC and NASA Headquarters personnel to obtain and/or clarify information applicable to the audit.

This page intentionally left blank.

OBSERVATIONS AND RECOMMENDATIONS

MSFC policies, procedures, and internal controls relating to the determination of contractor entitlement to award fees for controlling cost on the two Hubble Space Telescope (HST) prime contracts were generally effective. However, we identified certain areas in which increased management emphasis is needed to improve the award fee process at MSFC and ensure proper recognition of negotiated overruns, benefitting both contract and project management. Specific areas requiring management attention include the need for (i) improvements to award fee evaluation and documentation procedures as well as better compliance with existing procedures, (ii) more effective implementation and surveillance of Performance Measurement System (PMS) requirements, and (iii) the reduction of award fee processing time. We also noted that NASA Headquarters cancelled existing guidance on award fees several years ago but only recently provided revised interim guidance to the Centers.

This report contains recommendations for several actions which should aid management in improving award fee procedures and strengthening needed internal controls. Details on our audit observations and recommendations are provided below.

This page intentionally left blank.

1. Consideration of Contract Cost Overruns in Award Fee Evaluations. MSFC evaluations of the performance of Hubble Space Telescope (HST) contractors in controlling cost have not fully recognized approximately \$117 million of the \$183 million cost overrun negotiated during standard award fee periods on the two HST prime contracts as of April 30, 1987. Specifically, evaluation reports provided by the HST Project Office to the Performance Evaluation Board (PEB) properly identified as cost variances, within the Cost Performance subcriterion, only \$56 million of the \$143 million cost overrun which had been negotiated on the Lockheed Missiles and Space Company (LMSC) contract as of April 30, 1987. Similarly, evaluation reports for award periods 1-7 and 10 on the Perkin-Elmer (P-E) contract properly identified as cost variances, within the Cost Performance subcriterion, only about \$10 million of the \$40 million cost overrun which had been negotiated during these periods. (The combined total LMSC and P-E negotiated overrun was \$311 million. Another \$128 million of P-E overrun negotiated between 1981-1986, when there were no standard award periods, was addressed during the 1983 restructuring negotiations or is included in the negotiations in process on 1983-1986 Cost Control).

The primary factors which have contributed to the above conditions include needed improvements to (i) contractor Performance Measurement System (PMS) reports, and (ii) MSFC evaluation and documentation procedures. Specifically, contractor PMS reports, which MSFC had often used to determine contractor entitlement to award fees, did not properly identify and report all the cost overruns. Additionally, MSFC award fee procedures for evaluating contractor performance in controlling costs could be improved to ensure that all negotiated overruns were properly identified and considered and the award fee process better documented.

While not precisely quantifiable due to the subjective nature of the award fee determination process, we believe not properly considering all negotiated cost overruns as cost variances within the Cost Control evaluation criterion may have resulted in higher than justified award fee ratings and the possible overpayment of award fees. Specifically, although substantial overruns occurred, the HST contractors were still awarded about 75 percent of the \$27,024,345 total award fee available on overall evaluations completed as of April 30, 1987. These awarded fees included approximately 75 percent of the \$6,765,968 total award fee available under the Cost Control criterion. In addition, as of September 30, 1987, the Center was still evaluating P-E performance in controlling cost for the period August 1983 - June 1986, for which a \$2.3 million award fee is available.

The overall average weight (importance) the HST Project Office had assigned to the Cost Control criterion on both contracts for the standard award fee periods completed as of

April 30, 1987, was about 28 percent. The Cost Performance subcriterion represented about \$4.4 million (65 percent) of the fees available for Cost Control and the HST contractors were awarded fees of about \$3.3 million (75 percent) under this subcriterion. However, the fact that only about \$66 million (one-third) of the \$183 million of overrun which MSFC negotiated with HST contractors was recognized as cost variance under the Cost Performance subcriterion (comparison of actual to planned cost) indicates ratings and fees awarded for this subcriterion may have been too high.

The Center maintained that about \$154 million (\$66M + \$88M) of the \$183 million overrun negotiated during standard award fee periods thru April 30, 1987, had been recognized and that only about \$29 million had gone unrecognized. In addition to the \$66 million of overrun recognized as cost variance, the HST Project Office evaluation reports submitted to the PEB also had addressed, but in a different manner, another \$88 million of overrun:

- About \$20 million was addressed as contractor estimate at completion (EAC) increases under the Cost Performance subcriterion.
- About \$68 million was addressed as projected overrun under other Cost Control subcriteria such as Cost Forecast/Budget Projections or Financial Reporting.

However, we believe this \$88 million was not fully recognized in the reports submitted to the PEB for the following reasons:

- The weight (significance) given to EAC was less than that given to cost variance according to HST personnel.
- The weight assigned to the other Cost Control subcriteria, per the HST Performance Evaluation Plans, was generally much less than that assigned Cost Performance (some were only a half or a third the weight). Also, it is appropriate to address overrun under both Cost Performance and other subcriteria when there are multiple contractor deficiencies. Therefore, addressing overrun under other subcriteria does not always satisfy the need to also address overrun under Cost Performance.

We attempted to determine the extent of any overpaid award fees due to MSFC not fully recognizing \$117 million of negotiated overrun as cost variance under the Cost Performance subcriterion. However, the fact that there is no specific rating scale or guideline --- correlating overrun amount to a suggested rating under the Cost Performance subcriterion --- permits only a subjective determination. To obtain an approximation of any possible award fee overpayment, we used a macro approach. Specifically, MSFC recognized \$66 million of overrun as cost

variances and, although given less weight, another \$20 million as EAC increases under Cost Performance. This combined total, over \$86 million, was almost half of the \$183 million overrun negotiated during LMSC and P-E standard award periods. As a result, the Center did not award HST contractors about \$1.1 million (25 percent) of the total \$4.4 million award fee available under the Cost Performance subcriterion. Therefore, we believe that if MSFC had similarly recognized the other half of the \$183 million negotiated overrun under Cost Performance the ratings may have been lower and comparable award fees of over \$1 million may not have been awarded. Further, since EAC increases were given less weight than cost variances, fully recognizing all the overrun as cost variance may have further reduced the fee awarded. This macro approach does not individually address each award period but does, in our opinion, reflect the potential, overall significance of not properly recognizing all negotiated overrun as cost variance under Cost Performance.

It should be noted that although HST personnel expressed concern over the low effective fee on HST contracts, they did agree that ratings and fees awarded for Cost Performance would generally have been lower for a given award period if more overrun had been recognized. Also, it should be noted that MSFC will have an opportunity to evaluate the overall cost performance of LMSC in the last award period and address any previously unrecognized overrun in determining fees to be awarded for this last period. This is discussed in more detail in Observation 3.

Cost Growth. The estimated cost of developing the HST flight hardware has increased by over \$900 million, from \$140 million at contract award in 1977, to \$1.042 billion as of April 30, 1987, with more cost to be negotiated. HST prime contractors have experienced significant cost increases due primarily to technical difficulties and schedule adjustments over the 10 year life of the development phase. In addition, the schedule adjustments resulting from the Challenger accident will cause additional cost increases. As of September 30, 1987, MSFC was negotiating the extension of the launch date to December 1988 and plans to negotiate additional schedule adjustments to a launch date of 1989, which will result in additional cost increases. It should be noted that while most of the unrecognized negotiated overrun occurred in earlier award periods, MSFC procedures currently do not provide guidance for specifically addressing negotiated overrun.

The total \$311 million cost overruns negotiated on the LMSC and P-E contracts, \$142.8 million and \$168.7 million respectively as of April 30, 1987, were non-fee-bearing costs, and thus reduced the overall effective fee rate on each contract to about 3 percent. However, even though there were significant cost overruns, as previously stated, the contractors were awarded most of the fee available under the Cost Control criterion. As shown by the following chart, a substantial portion of the cost

increase as of April 30, 1987 was due to overruns for in-scope efforts.

<u>COST GROWTH^a</u>					
	<u>Basic Contract (Cost)^b</u>	<u>Added Effort (Out of Scope)</u>	<u>Negotiated Overrun (In-Scope)</u>	<u>Contract Value</u>	<u>Estimate at Completion^b</u>
LMSC	\$76.8M	\$318.1M	\$142.8M	\$537.7M ^c	\$626.4M
P-E	<u>63.4</u>	<u>157.9</u>	<u>168.7</u>	<u>390.0^d</u>	<u>416.0</u>
Total	<u>\$140.2M</u>	<u>\$476.0M</u>	<u>\$311.5M</u>	<u>\$927.7M</u>	<u>\$1,042.4M</u>

^aCost Without Fee

^bPer April 30, 1987 Form 533s

^cThru Mod 576

^dThru Mod 467

The combination of added effort and cost overruns has resulted in an overall cost increase of more than 500 percent (unadjusted for inflation) as of April 30, 1987. A 1986 MSFC study of about 20 DOD and NASA spaceflight hardware development programs determined the average cost increase on these programs, adjusted for inflation, was about 78 percent (weighted average was 109 percent). The cost increases ranged from underruns on some programs to a high of a 275 percent cost increase at that time on the HST Program. Our review of award fees focused on the consideration given this significant cost increase, much of which was in-scope growth.

a. History of Fees Awarded to HST Contractors. Details on the fee structure of the LMSC and P-E contracts, including actual fees awarded to the contractors, are presented below and in Exhibits 1 and 2 to this report.

(1) LMSC. Between 1977 and 1984 (SSM periods 1-12) the Support Systems Module (SSM) and Systems Engineering (SE) efforts were jointly reviewed by MSFC under a single evaluation system. The SSM portion of the contract represented over 85 percent of the available award fee, and the SE portion less than 15 percent. In 1984, the SE portion was separately identified for award fee evaluation purposes in order to place additional fee emphasis on the SE area where increased staffing and resources were being applied to solve technical and schedule problems.

As of April 30, 1987, LMSC had been awarded \$2,016,198 (78 percent) of the \$2,579,640 available award fee for evaluation periods 1-6 on the SE effort. This included \$324,583 (76 percent) of the \$426,955 award fee available under the Cost Control criterion. As of the same date, the total available fee on the SSM portion of the contract for award periods 1 thru 17

was \$16,952,108, of which the contractor had been awarded \$12,388,510 (73 percent). This SSM total included \$4,785,790 for Cost Control, of which the contractor had been awarded about \$3,475,000 (73 percent). The major subcriteria generally used by MSFC under the Cost Control criterion were Cost Performance (a comparison of actual cost to the time phased cost plan) and Cost Forecasting (the ability of the contractor to estimate/forecast future costs). These two subcriteria represented 80 percent of the total weight assigned to the Cost Control criterion, as shown below.

<u>Subcriterion</u>	<u>Average Weight</u>
Cost Performance	63%
Cost Forecasting	17%
Other (Financial Reporting, etc.)	<u>20%</u>
Total Cost Control	100%
	====

Our review of the ratings of LMSC Cost Performance for SSM award periods 1 through 17 disclosed an average rating of about 77, which permitted the contractor to be awarded most of the available fee for this subcriterion. This review also disclosed an average rating of 82 for Cost Forecasting for the same periods.

(2) Perkin-Elmer. As of April 30, 1987, P-E had been awarded \$5,992,454 (80 percent) of the \$7,492,597 available award fee for completed award evaluation periods. The available fee included \$1,553,223 for Cost Control, of which the contractor had been awarded an estimated \$1,275,000 (82 percent). As previously pointed out, MSFC was still evaluating P-E performance in controlling cost for the period August 1983 - June 1986 for which additional award fee of \$2,369,726 was available. The P-E contract also includes a base fee of 1.49 percent, and fixed fees associated only with spares acquisitions. As of April 30, 1987, they had been awarded \$5,753,151 in base fees and \$258,510 fixed fees.

In addition to having a number of standard award fee periods, P-E had an unusual award fee arrangement between 1981 and 1986 which eliminated the standard award periods. Due to significant cost and schedule problems in the early 1980s, MSFC and P-E agreed in 1983 to restructure the contract, retroactively eliminating award fee periods 8 and 9 (June 1981 - November 1982) which had been completed but not finalized for award fee purposes. During this restructuring process, P-E agreed to forfeit award fees of \$1.46 million due to these problems, including over \$100 million in overrun during periods 8 and 9. The restructured contract established three equally weighted fee pools totaling \$3,707,620 available award fee for the period 1983 thru the planned 1986 launch. The performance

criteria included (i) schedule (delivery of hardware), (ii) cost control, and (iii) on-orbit verification.

As of April 30, 1987, the three pools had been increased due to fee bearing contract modifications. P-E had completed the hardware deliveries earning \$2,723,120 of the \$3,228,592 available award fee for schedule. The HST Project Office evaluation of cost control for the period August 1983 - June 30, 1986, was in process as of September 1987 and the fee available had been adjusted to \$2,369,726. The evaluation of on-orbit verification will occur after the planned launch in 1989, and as of September 30, 1987, had an available fee pool of \$3,192,971. Due to the delayed launch, additional award fee periods were being established for Fiscal Years 1988 and 1989.

The two major subcriteria evaluated during the standard award fee periods (1 - 7 and 10) under the Cost Control criterion were Cost Performance and Cost Forecasting. These two subcriteria represented 93 percent of the total weight for the Cost Control criterion. The overall average weight assigned to Cost Control subcriteria were:

<u>Subcriterion</u>	<u>Average Weight</u>
Cost Performance	71%
Cost Forecasting	22%
Other (Financial Reporting, etc.)	7%
Total Cost Control	100%
	====

Our review of HST Project Office ratings of P-E on the Cost Performance subcriterion for the 8 standard periods (1-7 and 10) showed an average rating of about 72 percent. Therefore, the contractor received most of the available award fee for this subcriterion. The HST Project Office evaluations of P-E Cost Forecasting for these same 8 periods showed an average rating of 78 which permitted P-E to also receive most of the fee available for this subcriterion.

The two major reasons for not properly considering the HST contractor overruns under the Cost Control criterion, contractor PMS reporting deficiencies and Center evaluation procedures, are discussed below.

b. Cost Overruns Not Identified in Contractor Performance Measurement System (PMS) Reports. HST contractors not properly identifying all contract cost overruns in required reports, and MSFC's reliance on these reports, contributed to contract cost overruns not being properly identified in the HST Project Office's award fee evaluations of Cost Control. These reports include PMS MA-02 reports designed to identify cost and schedule variances, and NASA Forms 533 (Contractor Financial Management Reports) designed to disclose budget variances. We reviewed such reports available for the period from contract award in 1977

through June 1987 to determine the extent the reports identified contract overruns. Our review disclosed that although the reports did provide a comparison of planned to actual costs, the amount of overrun identified as cost or budget variance was substantially less than the amount of overrun actually negotiated on each contract. The following chart provides a comparison of the overrun negotiated on the two contracts versus the overruns reported by the contractors for the 10 year period 1977 thru April 30, 1987. (NOTE: All MA-02 reports prior to Fiscal Year 1984, were not available, we therefore used alternate sources such as HST Project Office evaluation reports to determine the approximate amount of overrun reported on MA-02s.)

<u>Contractor</u>	<u>Overrun Negotiated</u>	<u>Net Overrun Reported</u>		<u>Overrun Not Reported</u>	
		<u>533</u>	<u>MA-02</u>	<u>533</u>	<u>MA-02</u>
LMSC*	\$142.8M	\$60.8M	\$56.9M	\$82.0M	\$85.9M
P-E **	<u>40.7</u>	<u>0</u>	<u>10.0</u>	<u>40.7</u>	<u>30.7</u>
Totals	\$183.5M =====	\$60.8M =====	\$66.9M =====	\$122.7M =====	\$116.6M =====

*Periods 1 - 17: From 1977 to April 1987.

**Periods 1 - 7 and 10: From 1977 to 1981 and 1986 to April 1987. An additional \$128M overrun was negotiated between 1981 and 1986, when there were no standard award fee periods.

Our review of HST Project Office award fee evaluation reports to the Performance Evaluation Board disclosed the overruns considered under the Cost Performance subcriterion in early periods (through award period 10 on the LMSC contract and through award period 7 on the P-E contract) were generally limited to only those overruns which had been reported by the contractors. The Center stated that the HST Project Office did not rely only on PMS reports, but also utilized other sources such as project assessments and review. However, the substantial reliance on contractor PMS reports during earlier award fee periods and the understatement of overrun by the contractors had a significant impact on the amount of overrun recognized by MSFC evaluations of contractor Cost Control performance. (HST PMS problems are discussed in more detail in Observation 2.)

As a result, the amount of overrun considered by HST Project Office evaluations under the Cost Performance (planned vs. actual cost) subcriterion, as shown in the table below, was only about one-third of the overrun actually negotiated in these early periods.

Contractor	<u>Overrun Negotiated</u>	<u>Overrun Considered</u>	<u>Overrun Not Considered</u>
LMSC	\$44.9M	\$14.7M	\$30.2M
P-E	<u>37.3M</u>	<u>10.9M</u>	<u>26.4M</u>
Totals	\$82.2M =====	\$25.6M =====	\$56.6M =====

NOTE: In addition to this \$56.6 million of overrun not considered, at the end of award period 10 (April 1983) almost \$20 million more in overruns had been included in contractor cost proposals for modifications of the LMSC contract.

We expected to find the contractors to be in compliance with both the contract terms and NASA Handbook 9501.2B, which requires that HST contractors identify and accurately report such overruns, as well as the baseline maintenance provisions of MM 8020.6A. MM 8020.6A, Cost/Schedule Performance Criteria (C/SPC) with Implementing Provisions, dated July 8, 1976, states that "Performance measurement baseline visibility will be continuously maintained that will show original contract baseline, current baseline, and all contractual and reprogramming changes with the effect of each change to the cost account level." Provisions of both the LMSC and P-E contracts require compliance with this directive. However, the HST Project Office did not ensure HST contractors complied with this requirement. As a result, contractor performance baselines did not provide needed visibility of overruns. The capability to distinguish between historical and future overrun, and where it is included in the baseline, is significant because it will have a direct impact on the amount of overrun identified by future contractor PMS reports.

Failure of the contractors to properly report cost overruns was caused primarily by the contract baseline maintenance procedures employed and, to a lesser extent, the use of level of effort technique to manage specific contract tasks on the LMSC contract during early periods. These areas are discussed in detail below.

(1) Baseline Maintenance. A primary reason contractor reports understated overrun, for both current period values, and cumulative-to-date values, was the practice of adding the proposed/estimated value of authorized contract modifications, which often included overruns, to the contract performance measurement budget baseline without separately identifying the overrun. In addition, the Work Breakdown Structure (WBS) elements to which the overrun was distributed, and whether the overrun was incurred (historical) or projected (future), were not always identified.

Our review disclosed that contractor PMS reports would understate overrun to the extent that negotiated overrun (non-fee-bearing) had been added to the performance measurement budget baseline. The authorized/negotiated in-scope non-fee-bearing overrun was not separately identified within the performance measurement budget baseline, but was handled the same as out-of-scope authorized increases to the contract. This action increased the budgeted/planned cost of those WBS elements to which the overrun was distributed. Thus, when actual costs were subsequently compared to these budgeted/planned amounts for cost performance evaluation purposes, the amount of overrun disclosed in PMS reports was substantially understated. In some instances, the overrun was added to the PMS baseline prior to negotiation and definitization of the contract modification which documented the overrun amount. These negotiations often were not concluded for periods ranging from several months up to a year after the related efforts were authorized and added to the baseline budgets. For example, Change Order No. 219 for certain reprogramming actions on the LMSC contract was authorized in February 1983, for \$11.9 million, but was not negotiated and definitized until May 1984, over a year later.

Our review of the baseline planned cost for individual tasks in the WBS showed that neither HST Project Office records or PMS reports could separately identify the overrun amounts included in planned cost. Program Control personnel responsible for the LMSC contract were asked to identify those contract tasks (WBS elements) to which the contractor had added the \$49 million of non-fee-bearing overrun definitized by Supplemental Agreements 340 and 341 when the HST Program was restructured in 1984. They stated they could only identify the total overrun, and were not aware of how LMSC distributed the overrun to individual tasks within the WBS. They also stated the contractor did not maintain visibility over overruns to the individual cost account level within the baseline. Another factor which has contributed to the lack of visibility of overruns is the fact that contract modifications which included both in-scope effort and overrun were often negotiated together, on a total basis. Therefore, the specific impact of each overrun on baseline WBS elements or the subsequent impact on contractor reported overrun could not readily be determined. However, any overrun added to the baseline increases planned cost and causes PMS reports to understate overrun.

Historical vs Future Overrun. We also attempted to determine whether negotiated non-fee-bearing overrun was for historical (incurred) or future (projected) costs at the time it was negotiated and added to the baseline. Our review disclosed that neither contractor nor MSFC records could readily disclose such information. Under the earned value concept, overrun which has been incurred should be recognized as cost variance. We asked HST Project Office program control personnel responsible for the LMSC contract to separately identify historical versus future overrun in the \$49 million overrun

negotiated by Supplemental Agreements 340 and 341. They stated that this could not be accomplished with either MSFC or contractor records. However, they stated that the overrun generally was historical because the contractor has been reluctant to identify any overrun until it had actually occurred. However, they did acknowledge that a portion of the total \$311 million negotiated overrun did apply to future tasks at the time it was negotiated, and therefore would have contributed to the failure of subsequent contractor reports to properly disclose overruns.

In this respect, our review disclosed some instances where negotiations indicated overrun was attributable to future periods. For example, the LMSC \$93 million cost proposal submitted in 1983, as a result of Change Order No. 250 which directed a major restructuring of the HST Program, contained data which showed that the proposal included over \$13 million of overrun. The proposal further stated that about 90 percent, almost \$12 million, was future overrun projected for fiscal years 1984, 1985, and 1986. The change order was subsequently negotiated for \$92 million, of which \$38.5 million was attributed to overrun. Although the overrun actually negotiated was not identified to specific fiscal years, the LMSC proposal had clearly indicated most of the overrun was expected to occur in future years. HST Project Office personnel stated that they believed most of the \$38.5 million overrun was probably historical. However, they did not specifically address this significant overrun in their evaluations of contractor performance in controlling costs during award periods 11 or 12 when Change Order No. 250 was negotiated. To the extent any of the \$38.5 million was added to the contract baseline for future periods, it would have caused subsequent contractor PMS reports to understate overrun.

During the early years of the HST Program, MSFC identified and documented certain baseline deficiencies in the LMSC PMS. These were identified by MSFC in the 1977-1981 timeframe while attempting to validate the contractor's system. For example, Technical Directive TA01-63, dated June 13, 1979, states that HST Project Office personnel had persistently complained about LMSC's uncontrolled baseline, and that past plans and historical performance records were constantly changing. The TD stated that as a result of the baseline problems HST Project Office personnel were reviewing misleading performance data and contract status.

(2) Level of Effort. A factor which we believe also contributed to the contractor PMS reporting problems was the use of the level of effort (LOE) technique. MM 8020.6A, Cost/Schedule Performance Criteria, dated July 8, 1976, states that "Only that effort which cannot be identified in discrete short-span work packages or apportioned effort will be classed as level of effort and must be kept to a minimum." However, it was used extensively to manage certain contract tasks and measure the

cost performance of LMSC during the two year period following contract award and, to a lesser extent, continued to be used at the time of our review. Technical Directive TA01-033 issued by the HST Project Office on November 27, 1978, authorized the use of LOE on a number of work breakdown structure (WBS) elements. This technique permits the contract baseline budget to vary and essentially equal actual costs incurred. As a result, actual accomplishments of the contractor cannot be as readily determined under LOE, and cost overruns may not be identified and reported.

By mid-1979, the adverse impacts of using LOE on the LMSC contract were evident. The HST Project Office issued Technical Directive (TD) TA01-052, dated May 3, 1979, documenting LOE problems and directing LMSC to more extensively work package the contract. The TD stated "the disproportionate amount of level-of-effort... distorts contract performance and inhibits detail and accurate planning." The TD provided an example of LOE distortions stating "...when several subcontracts were rebaselined in February (1979), the reported cost variance reversed by 270 percent from an underrun in January (1979) to an overrun and the behind schedule condition increased by 80 percent." Use of LOE had caused overrun to be understated. The contractor subsequently work packaged additional LOE tasks. However, HST Project Office personnel agreed that distortions of the contractor's cost performance during the period LOE was used would have caused contractor PMS reports to have understated overrun. Additionally, they acknowledged that LOE was still being used on the HST contracts, but stated that they planned to work package additional LOE tasks. We believe minimum use of the LOE technique ensures better visibility over cost performance. Because HST personnel were initiating action to further reduce the use of LOE, we will make no recommendation at this time.

The problem of HST contractor reports understating overrun was previously addressed by DCAA Report No. 7481-4B110714, dated October 19, 1984. In response to an OIG assist audit request, DCAA reviewed LMSC records on contract NAS 8-32697 for the period November 1977 through June 1984 and determined the LMSC reports had identified only \$43 million of \$101 million total overruns at that time. The DCAA report stated there was an unreported overrun of \$58 million because the contractor had not identified the cost overrun included in changes to the original contract baseline which had been negotiated by contract modifications. Our current review has updated and further addressed this problem identified by the DCAA audit.

c. Cost Control Evaluation Procedures. Procedures used by the HST Project Office to evaluate the contractor's cost control performance could be further improved to better ensure that negotiated cost overruns are properly identified and considered in award fee determinations. Specific areas requiring management attention include (i) current evaluation methods, (ii) recognition of negotiated overruns, (iii) recognition of

contractor identified overruns, (iv) impact of contract rebaselining, and (v) documentation of evaluation methods and results. Each of these areas are discussed below.

(1) Evaluation Methods. Our review of methods used to evaluate the performance of HST contractors in controlling costs disclosed areas where improvements could be made in the recognition of contract cost overruns. We also noted there had been a number of substantial changes in the evaluation methods used during the life of the contracts. For example, while evaluations prior to 1983 used PMS data extensively, and employed the earned value concept (i.e. comparing the actual cost of work performed to the budgeted cost of work performed) to identify overrun, present methods employ neither of these techniques.

During the early years (1977 to 1983) of the HST development phase, HST Project Office personnel used similar methods on both contracts to evaluate contractor Cost Control performance. Our review disclosed that, within the Cost Control criterion, the HST Project Office weighted the Cost Performance subcriterion an average of about 60 percent, with other subcriteria such as Cost Forecasting and Financial Reporting assigned less weight. The "earned value" concept was used to evaluate contractor cost performance and recognize overruns. Also, the source of the "earned value" data generally was the contractor's Performance Measurement System (PMS) reports which identified cost and schedule variances both for current award periods and cumulative to date.

Our review of evaluation methods used for the LMSC contract between May 1983 - April 1987, and the P-E contract between November 1986 - April 1987, disclosed performance measurement system (PMS) earned value data generally was not utilized. Instead, alternate methods have been employed, which we believe can be further improved to provide more realistic evaluation results. These evaluation methods are separately discussed below for each of the contracts.

(a) LMSC. The present method used to evaluate Cost Performance has evolved over several evaluation periods. The LMSC cost monitor advised OIG auditors that the PMS data are not used due to lack of confidence in the accuracy of LMSC PMS reports (PMS problems are discussed in Observation 2). As a result, the HST Project Office implemented the current alternative evaluation procedures. The current evaluation method includes two factors, (i) a modified cost variance and (ii) changes in the contractor's estimate-at-completion (EAC). Each factor is discussed below.

Cost Variance. The procedure currently used to compute a modified cost variance is a two-step process. First, actual cost for the evaluation period is compared to funds budgeted for the period per the HST Program Operating Plan (POP), adjusted for authorized changes. The resulting budget variance

is then combined with a computed schedule variance (milestone slip in days X contractor average daily operating cost) to obtain the modified cost variance. This method does not follow NHB 9501.2B and MM5151.5C guidance for computing cost variance. These regulations specify that cost variances be computed by identifying work accomplished during the period, computing the Actual Cost of Work Performed (ACWP), and comparing this ACWP with the Budgeted Cost of Work Performed (BCWP). Instead, the current method focuses on changes in schedule milestones (slippage as an indicator of scheduled work not accomplished) and estimates the value of that unaccomplished work.

Relatively small amounts of budget variance have been computed in award periods where this alternate method has been utilized. This is due, at least in part, to the fact that POPs are generally revised at least semiannually, and contractor budget projections are also accomplished periodically. Because both POPs and projections tend to be more accurate on a short term basis (6-12 months), budget variances during a 6 month award period usually will be small. As a result, the modified LMSC cost variances (budget variance plus schedule variance) in most periods have been primarily attributed to the computed schedule variance. For example, the \$9.5 million cost variance recognized by the HST Project Office in award period 14 consisted of a \$9.1 million schedule variance, and a \$.4 million budget variance. If the budget variance is zero, the modified cost variance computed is essentially a schedule variance.

We also noted that if the adjustments made in computing the budget variance include any negotiated overrun, then the computed variance can be understated. HST Project Office personnel did not have written procedures on their present LMSC evaluation method, and existing evaluation documentation did not always provide a clear audit trail. However, they stated that in computing the budget variance they do not include authorized/negotiated contract change orders for overrun in their adjustments to the POP.

We concluded that this alternate method of computing a modified cost variance primarily reflects LMSC schedule variances attributable to work not accomplished, rather than work actually done (output). Therefore, it does not provide a true earned value cost variance (i.e., the difference in ACWP and BCWP). Further, as with other methods, its validity depends upon the accuracy and completeness of the data selected by evaluators, and the manner in which that data are utilized. HST Project Office personnel acknowledged their method is not precise, but stated that they believe it identifies about 90 percent of the cost overrun occurring in an award period.

Effectiveness of Procedures. To determine the extent to which the present method of computing cost variances effectively identifies LMSC overrun, we compared

the amount of overrun actually negotiated and/or proposed by LMSC, to the amount considered as cost variance under the Cost Performance subcriterion by the HST Project Office during award fee periods 11-17 (See Exhibit 3). This comparison disclosed that LMSC had negotiated/proposed \$123 million in overruns during these periods, whereas the HST Project Office had considered only \$41.6 million of cost variance under the Cost Performance subcriterion, leaving a difference of \$81.5 million. Further analysis disclosed that most of this overrun not fully considered was negotiated in award periods 11 and 12 when \$74.7 million of overrun was negotiated, but only \$13.6 million of cost variance was considered under the Cost Performance subcriterion in HST Project Office evaluation reports submitted to the PEB.

Procedures used by the HST Project Office in accomplishing LMSC award fee evaluations under the Cost Performance subcriterion in periods 11 and 12 did not include provisions to specifically address the \$74.7 million overrun negotiated in those periods (EAC increases also were not routinely addressed under Cost Performance until period 13). When overrun which occurred, but was not recognized, in a prior award period is subsequently identified/negotiated, we believe it should be promptly addressed by current award period evaluations. During the HST Project Office presentation to the PEB for period 11, a footnote to the Cost Performance viewgraph mentioned \$24 million of overrun negotiated that period. But it was not clear to what extent, if any, this was considered since the report to the PEB did not mention this negotiated overrun under the Cost Performance subcriterion and identified a cost variance of only \$1.6 million. Similarly, the total of almost \$50 million of overrun negotiated in period 12 also was not addressed under the Cost Performance subcriterion. We concluded this was mainly due to lack of specific MSFC or HST Project Office policy and procedural guidance for addressing authorized/negotiated overrun in evaluations. In these two instances, the HST Project Office did not perform a comparison and reconciliation of negotiated versus recognized overrun to date. Such an analysis was not required by the HST PEP for LMSC or by MSFC directives.

HST personnel maintained that the \$74.7 million of LMSC overrun was not addressed as it was all historical (occurred in prior periods). However, available documentation did not clearly identify whether the overrun was historical or future. More importantly, if the overrun was historical, action was not taken during these two evaluations to ensure that any historical overrun not previously recognized was properly addressed. Unless all overrun is properly identified in reports to the PEB, it may not be properly recognized.

Estimate-at-Completion (EAC). The present method of evaluating LMSC Cost Performance also addresses contractor changes to the EAC which have occurred during the evaluation period. As shown by the Table on page 28, evaluations for LMSC periods 13-17 addressed total EAC increases of \$38.6

million. To compute the EAC increase, the beginning EAC, adjusted for contract changes authorized during the period, was compared to the ending EAC. When the ending EAC exceeded the adjusted beginning EAC, the difference was considered overrun and used as a basis for reducing the contractor Cost Performance rating. Although the relative importance assigned to the EAC factor within the Cost Performance subcriterion, and the rationale for that weight, was not documented in the work files, HST Project Office personnel stated it was generally given less weight than the computed cost variance previously discussed.

One benefit of considering EAC changes is the recognition of future overrun, a capability not assured by the present method of computing cost variance. Also, because the current LMSC evaluation method does not include a procedure for specifically addressing overruns negotiated during the current evaluation period, the EAC review was relied upon to disclose such overruns. For example, a \$23 million overrun was negotiated during award period 16, however, the evaluation of Cost Performance for period 16 addressed only the computed budget/schedule cost variance of \$1.9 million. Although HST Project Office evaluation documentation did not correlate the \$23 million negotiated overrun to previously recognized EAC increases, we determined that a comparable amount of overrun was recognized as EAC increases during award periods 13, 14, and 15 (See following Table). However, there should be a periodic reconciliation/comparison of overrun negotiated to the overrun recognized as cost variances and EAC increases.

While EAC increases generally included (duplicated) the cost variance amounts reported for the period, as discussed in the following paragraphs, they also provided some recognition of additional overrun amounts not addressed as cost variance. A comparison of the amounts of cost variance and EAC increases addressed under Cost Performance by HST Project Office reports to the PEB for LMSC periods 13 - 17 is provided in the following table:

OVERRUN RECOGNIZED AS COST VARIANCE VS EAC

(1)	(2)	(3)	(4)	(5)
<u>PERIOD</u>	<u>COST VARIANCE</u>	<u>EAC INCREASE</u>	<u>AMOUNT DUPLICATED*</u>	<u>ADDED OVERRUN RECOGNIZED BY EAC</u>
				(Col 3-Col 4)
13	\$12.2M	\$13.8M	\$12.2M	\$ 1.6M
14	9.5	8.1	8.1	
15	1.6	1.1	1.1	
16	1.9	2.5	1.9	.6
17	<u>2.8</u>	<u>13.1</u>	<u>2.8</u>	<u>10.3</u>
Totals	\$28.0M =====	\$38.6M =====	\$26.1M =====	\$12.5M =====

* Amount included in both Cost Variance and EAC.

As shown by the above Table, \$12.5 million of additional overrun not included in cost variances was addressed by the EACs computed by the HST Project Office and reported to the PEB. While this does provide some further recognition of overrun, as stated previously, EAC increases were given less weight than cost variances, and, therefore, did not provide full recognition of overrun in our opinion.

Duplicate Recognition. Our review disclosed that the consideration of EAC changes (increases) in evaluating contractor Cost Performance can result in the HST Project Office considering the same overrun twice, once as cost variance and again as EAC increase. This can result in possibly overpenalizing the contractor, unless the duplication is clearly identified. Our analysis of HST Project Office work files for LMSC periods 13 - 17 disclosed that only \$23 million of overrun was negotiated during these five periods. However, a total of \$66.6 million of overrun (\$28M Cost Variance + \$38.6M EAC) was addressed in HST Project Office reports to the PEB in these periods --- \$26.1 million of this overrun was addressed twice under Cost Performance, both as cost variances and EAC increases (See Col. 4 of Table above). For example, in period 13 overrun of \$12.2 million was considered a significant weakness in both the cost variance and EAC factors (the \$12.2 million cost variance was included in the \$13.8 million EAC increase that period). The potential for this to happen exists because cost overruns can also cause an increase in the EAC.

Recognition of the same overrun twice under the Cost Performance subcriterion can occur unless the reasons for the total increase in the EAC are analyzed and such duplication detected and identified in reports to the PEB. However, our review disclosed that HST Project Office personnel do not always accomplish such analysis and clearly identify the duplication. They did agree that the possibility exists for the same overrun to be considered twice and the contractor overpenalized. Because the EAC increases were given less weight than cost variances, and the duplicate overrun amounts we noted were generally small in recent periods, the duplication may not have significantly affected award fee ratings of those periods reviewed. However, procedures are needed to prevent similar, and possibly more significant, distortions on future evaluations.

While further improvements can be made to evaluation procedures, the current evaluation method has addressed most of the LMSC overrun actually considered as cost variance to date. During periods 11-17, the current method recognized cost variances of \$41.6 million. This represents over 70 percent of the \$56.3 million cost variances considered under the Cost Performance subcriterion thru April 30, 1987. Also, the use of EAC in the current method has permitted increased recognition of overrun --- providing at least partial recognition of additional overrun of over \$12 million as increases to the contractor's EAC.

(b) Perkin-Elmer. The method used presently to evaluate P-E Cost Performance (e.g. award period 10) is substantially different from that used in prior award periods 1-7 (periods 8 and 9 were not finalized).

Cost Variance. The adjusted HST Program Operating Plan (POP) amount is compared with actual costs for the period, to determine a budget variance. This method provides only a budget variance, and does not include use of the earned value concept (i.e., recognition of work accomplished) necessary to compute a cost variance.

The HST Project Office personnel responsible for this contract stated that the value of work accomplished was not considered because there are currently few measurable milestones of major significance. However, our review disclosed that the Achievement performance criterion continues to include a Schedule subcriterion which evaluates schedule/milestone accomplishments. We also noted that POP supporting documentation identify numerous milestones over the remainder of the HST Program.

While the effort remaining on the P-E contract is relatively small compared to completed work, we believe that revision of current cost performance evaluation methods to include consideration of data on schedule performance would permit work accomplished to be addressed in a manner

similar to the earned value concept. Such revisions should improve the evaluation process and provide a more meaningful award fee rating for Cost Performance.

Estimate at Completion (EAC). Although HST Project Office procedures for evaluating P-E ability to control costs generally did not address EAC increases under the Cost Performance subcriterion, in period 7 a cost variance of \$4.8 million and a projected overrun (EAC increase) of \$13 million were both addressed in the report to the PEB. However, similar to the procedures used for LMSC evaluations, the \$4.8 million cost variance was also included in the \$13 million EAC according to HST Project Office work files. As a result of this duplication, the EAC increase provided recognition for only \$8.2 million (\$13M - \$4.2M) of additional overrun not addressed as cost variance. However, similar to procedures used for LMSC, the weight (significance) given EAC was less than that of cost/schedule variance, only half the weight according to HST period 7 work files. Therefore, in our opinion the \$8.2 million overrun was not fully recognized. Also, although some (\$4.2M) of the overrun was addressed twice, once as cost variance and once as EAC increase, the report to the PEB did not clearly identify the duplication. As previously discussed, unless any duplicated amounts are clearly identified as such in Project Office reports to the PEB, the contractor may be overpenalized.

We noted that the present method of evaluating P-E cost performance also does not include a specific procedure for recognizing overrun negotiated during the current award period. For example, during P-E award period 10, a \$3.45 million overrun was negotiated. However, the HST Project Office evaluation of P-E Cost Performance addressed only the favorable budget variance (underrun) of \$890,000, and recommended a rating of 92 - Superior. In our opinion, it is important that evaluations address negotiated overruns when they occur. Because authorized/negotiated P-E overruns are included in both the POP and the contract baseline, budget and cost variances subsequently computed in future award periods using the inflated data will not identify the overruns. It should also be pointed out that because the remaining fee pool under the restructured P-E contract only addresses on-orbit performance, not Cost Control, there currently are no provisions at contract end for retroactively addressing any negotiated overrun not addressed by previous evaluations. This makes it even more important that negotiated overruns be promptly addressed.

(2) Negotiated Overrun. A major objective of our review was to determine if the significant amounts of overrun negotiated on the two HST contracts had been fully recognized by the HST Project Office in award fee evaluation reports provided to the PEB. We limited our review to the more objective data gathering/reporting aspects of the award fee process and did not evaluate the highly subjective rating/scoring process.

As previously stated, our review disclosed that approximately \$117 million of the \$183 million in contract overruns negotiated on the two HST contracts during standard award periods had not been addressed as cost variance (planned vs actual cost) by HST Project Office award fee evaluations. The \$183 million in contract cost overruns had been negotiated into the contracts as non-fee-bearing increases to the contract values. However, the net overruns of \$66 million which had been recognized as cost variance under the Cost Performance subcriterion thru April 30, 1987, were computed from sources other than the known contract negotiated overruns. As pointed out in our comments on evaluation procedures, there was no policy or procedure for specifically addressing the overrun negotiated during a period.

In addition to the \$66 million of overrun recognized as cost variance, the HST Project Office evaluation reports provided to the PEB also addressed another \$88 million of overrun. As shown in the following table, the overrun was addressed either as EAC increases under the Cost Performance subcriterion, or under other Cost Control subcriteria.

<u>Contractor</u>	<u>Period</u>	<u>Overrun Addressed</u>		<u>Combined Total</u>
		<u>As EAC</u>	<u>Under Other Subcriteria</u>	
LMSC	5		\$17.8M	\$17.8M
	11		22.6	22.6
	13	\$ 1.6M		1.6
	16	.6		.6
	17	10.3		10.3
P-E	6		27.2	27.2
	7	<u>8.2</u>	<u> </u>	<u>8.2</u>
Totals		<u>\$20.7M</u> =====	<u>\$67.6M</u> =====	<u>\$88.3M</u> =====

The Center maintained that the \$88 million overrun was fully recognized although it was not addressed as Cost Variance under the Cost Performance subcriteria, and that only about \$29 million (\$117M - \$88M) of the \$183 million negotiated overrun had not been recognized as of April 30, 1987. However, we believe the \$88 million was not fully recognized for the following reasons:

Overrun As EAC. Our review disclosed that those amounts of overrun addressed as increases to the contractor's EAC were generally assigned less weight (significance) than was given to overrun addressed as cost

variance. While the relative weight was not documented, the extent to which EAC was given less weight may have permitted the HST contractors to receive somewhat higher ratings than if the overrun were addressed as cost variance. In the absence of evaluation procedures for specifically addressing negotiated overrun, and with the concern expressed over the validity of HST PMS data, we believe use of the EAC factor can be helpful in recognizing negotiated overruns. However, EAC should be given appropriate weight and any overrun amounts duplicated in both cost variance and EAC be clearly identified.

Overrun Under Other Subcriteria. Our review also disclosed that the HST PEPs generally gave the Cost Performance subcriterion significantly more weight than other Cost Control subcriteria such as Cost Forecast or Financial Reporting. For example, the HST PEP for LMSC period 11 assigned 60 percent of the total Cost Control weight to Cost Performance and only 20 percent to Cost Forecast where \$22.6 million of negotiated overrun was actually addressed. The weight (significance) assigned Cost Performance was three times that of Cost Forecasts. Therefore, if the overrun had been identified as cost variance as it occurred and addressed under Cost Performance, LMSC may have been given a lower rating and awarded less fee.

Although addressing overrun under subcriteria other than Cost Performance generally provides at least partial recognition of overrun, in our opinion this is not always adequate. Specifically, if there are multiple contractor deficiencies associated with the same overrun, then it could be appropriate for the contractor to be penalized under two or more subcriteria. In such instances, recognizing overrun under other Cost Control subcriteria is not a substitute for recognition under Cost Performance. Although Center personnel expressed concern that the contractor might be overpenalized by addressing the same overrun twice, they agreed that it could be appropriate at times to do so. In this regard, a concern for overpenalizing the HST contractors was frequently expressed by Center personnel and may have been a factor in not routinely recognizing overrun under more than one subcriteria. They similarly expressed concern over the low effective fee earned by the HST contractors, and the difficulty in motivating contractors when little fee is awarded. However, the amount of fee previously awarded, or not awarded, should not be a direct consideration in evaluations of contractor performance in subsequent periods. As pointed out by the HST PEPs, the contractors are not automatically entitled to fee, but must earn it through performance.

Our review disclosed instances where the HST Project Office did on occasion address the same overrun under more than one Cost Control subcriterion. For example, in LMSC period 13 the report to the PEB addressed \$11.9 million of the same overrun under both the Cost Performance and the Resource Requirements Forecasts subcriteria. The HST Project Office

report to the PEB addressed overrun under both subcriteria in order to recognize contractor forecasting deficiencies in addition to the cost overrun incurred.

Because the same overrun can properly be addressed under more than one Cost Control subcriteria, addressing it under other Cost Control subcriteria does not satisfy the requirement to also address it under Cost Performance. For example, in period 5 the HST Project Office's revised report to the PEB recommended severely penalizing the contractor under the Financial Reporting subcriterion. The contractor's 533Q financial management reports had failed to include and identify to NASA anticipated cost growth (overrun). This resulted in an unexpected significant (\$17.8M) increase in run-out costs which, in our opinion, constitutes a separate contractor reporting deficiency---in addition to the actual occurrence of the overrun. Therefore, addressing the cost growth (\$17.8M) not properly identified by financial reports under the Financial Reporting subcriterion is not a substitute for addressing the \$17.8 million overrun as cost variance, under Cost Performance, as it actually occurred. For these reasons, we believe that overrun only addressed under other subcriteria has not been fully recognized and does not satisfy the need to also address such overrun under Cost Performance.

Overrun was not always fully recognized because existing policy and procedural guidance did not ensure Center elements responsible for award fee evaluations properly addressed all negotiated overrun. While contractors should not be penalized twice for the same deficiency, in our opinion it is appropriate to address an overrun under more than one subcriterion when there are separate overrun related deficiencies under each of the subcriterion. The HST PEPs specified the evaluation criteria to be used to measure contractor Cost Control and typically included such subcriteria as Cost Performance, Cost Forecast, and Financial Reporting. Potentially, a contractor could be penalized for the same overrun under all three if he were responsible for (i) incurring cost overrun, (ii) failing to forecast the overrun, and (iii) failing to report the overrun in financial management reports when it occurred. However, this evaluation concept was not always readily accepted by Center personnel. Some expressed concern that the contractor would be overpenalized if overrun was addressed under multiple subcriteria.

We contacted NASA Headquarters (Code HC) personnel and discussed the appropriateness of addressing the same overrun under multiple subcriteria. They agreed that each separate contractor deficiency should be recognized and evaluated, in accordance with the established Performance Evaluation Plan (PEP), and if there are multiple deficiencies relating to a single cost overrun then it should be addressed more than once. However, neither MSFC nor HST Project Office

guidance on award fees specifically addressed this issue and provided clear direction.

A major cause for not properly considering all overruns negotiated on HST contracts, as stated in our comments on HST evaluation procedures, is the need for additional MSFC policy and procedural guidance specifying how such overruns are to be addressed by award fee evaluations. Neither MSFC directives nor HST Performance Evaluation Plans (PEPs) provide guidance as to how negotiated overruns are to be addressed in evaluating contractor performance within the Cost Control criterion. Also, the HST Project Office has not established procedures to periodically compare the amount of overrun authorized/negotiated with the amount of overrun which has been recognized by Project Office evaluations under the Cost Performance subcriterion. Because such reconciliations were not performed on a routine basis during evaluations, the extent to which negotiated overrun had actually been addressed was not readily apparent. We believe such reconciliations are an essential part of award fee evaluations.

(3) Contractor Identified Overrun. Our review disclosed that overruns identified and reported by LMSC as "anticipated overrun" or "unrecognized variance" were not always properly considered by HST Project Office evaluations of LMSC cost control performance. In two instances between April 1980 and July 1983, Financial Management Reports (NASA Form 533) submitted by LMSC identified a total of over \$45 million of such cost growth. Our review showed that although the contractor also included these amounts in revised estimates-at-completion, Project Office evaluations of contractor Cost Performance, for the seven award periods (5-11) during which the cost growth was reported, generally did not address this information.

In one instance, our review of LMSC Financial Management Reports (533s) submitted to MSFC during the period April 1981 thru October 1983 disclosed the contractor regularly reported such "unrecognized variance". This information was apparently being provided in response to MSFC concerns over significant cost growth and resulting cost constraints during this period. The amount of such "unrecognized variance" reported grew from \$3.2 million in April 1981, to \$22.5 million as of July 1983. In October 1983, this "unrecognized variance" was negotiated as a \$24.762 million in-scope non-fee-bearing overrun.

During the 30 month period this cost variance was being reported, Project Office award fee evaluations of LMSC (periods 7-11) under the Cost Performance subcriterion recognized a total of only \$11 million of overrun, less than half the \$22 million variance (overrun) reported by the contractor during these periods. However, this \$11 million was not considered on the basis of the contractor reported variance, but was computed by other means, primarily the PMS reports. The HST Project Office evaluation reports to the Performance Evaluation Board for

the period in which the \$24 million overrun was negotiated (period 11) did briefly comment on the overrun, as a footnote, under the Cost Performance subcriterion. However, it was not clear to what extent, if any, this was considered in determining the fee to be awarded.

Project Office personnel agreed that the "unrecognized variance" reported by the contractor was overrun costs and should have been considered each evaluation period under the Cost Performance subcriterion. They viewed the \$24 million negotiated in period 11 as "historical" overrun that had occurred in the prior periods, not future/projected overrun. They stated they had assumed the contractor reported variance (overrun) would be fully reflected in the cost variances they computed each period and, therefore, had not taken any specific action to consider this overrun. In our opinion, this "unrecognized variance" was not properly considered primarily due to the lack of specific award fee evaluation procedures relative to how and when such a contractor reported variance should be addressed.

(4) Impact of Contract Rebaselining. Our review disclosed that cost overruns occurring during a period in which a contract is rebaselined are not always properly identified and considered in evaluating contractor performance in controlling cost for that period. This condition generally only occurs in evaluation methods utilizing PMS data in the computation of cost overruns. Our review of the HST Project Office evaluations of LMSC Cost Control performance disclosed instances where contract rebaselining actions effectively eliminated cost and schedule variances previously reported on contractor PMS reports. Both the LMSC and P-E contracts have been rebaselined several times during the life of the HST Project. Such rebaselining actions are required to incorporate significant schedule revisions, etc.

One such instance occurred during LMSC period 4 when the LMSC contract was rebaselined in October 1979 to implement a "Rephased Program Cost Proposal." Because this rebaselining occurred in the last month of the 6 month evaluation period (May - October 1979), the LMSC PMS reports for October 1979 did not reflect all overrun variances which had occurred during the period. HST Project Office personnel, using LMSC September 1979 PMS reports and related documentation, identified unfavorable cost and schedule variances of \$3.908 and \$2.669 million, respectively, for the first five months of this six-month award period. However, when they reported these amounts in their period 4 evaluation report to the Performance Evaluation Board (PEB), they stated that they anticipated these overruns would be eliminated when the contract was rebaselined. Our review of the PEB minutes for that evaluation period disclosed that in the subsequent oral presentation to the PEB, HST Project Office personnel reported revised unfavorable cost and schedule variances of only \$.8 and \$.15 million respectively. Thus, a cost variance of \$3 million and a schedule variance of \$2.5

million were not properly included in the presentation, and the Project Office recommended an award fee rating of 96 - Superior for Cost Performance for the period.

Evaluations using PMS data to compute cost overruns and evaluate cost performance should employ procedures which ensure that rebaselining during the period does not preclude appropriate recognition of overrun which occurred prior to the rebaselining. Since the award fee evaluation methods currently used on both HST contracts do not use PMS data, this procedural problem does not adversely affect current evaluations.

(5) Documentation of Award Fee Evaluations. The award fee evaluation work files maintained by HST Project Office personnel do not always comply with the documentation requirements of MM 5151.5C, Performance Evaluation Operating Manual For CPAF Contracts, dated September 24, 1986, or with the HST Performance Evaluation Plans (PEPs). The MM and the PEPs specify that coordinators and monitors responsible for evaluating the contractor performance will maintain work files for the life of the contract. The MM states that these files should contain "...all documentation used in evaluating the contractor's performance" and should "...provide an audit trail from the monitor through the Fee Determination Official." Our review of work files, particularly those for recent periods, disclosed several areas where documentation supporting award fee evaluations of contractor cost control performance can be improved.

We believe the documentation weaknesses discussed below adversely affect the credibility of award fee ratings. The MM and PEPs require coordinators to establish, publish and disseminate to monitors the procedures and formats necessary for the acquisition and evaluation of data pertaining to contractor performance. The PEPs also require monitors to prepare a plan prior to the start of each evaluation period outlining the "yardstick" or specific accomplishments expected of the contractor during the period and the management tools to be used in measuring performance.

Our review disclosed that specific written instructions have not been provided to the cost monitors, nor have individual plans for each evaluation period been prepared in accordance with the PEP requirements. Project Office personnel stated the evaluation procedures used by the cost monitors have in some instances "evolved" over several periods. During our review, we noted several procedural changes from period to period which confirm this statement.

In the absence of the required individual evaluation plans, specific factors evaluated within each subcriterion, or their relative importance, cannot be clearly determined. For example, the present Cost Performance

subcriterion on the LMSC contract addresses both cost variances and estimates-at-completion, but the relative importance of each of these factors is not clear. In addition, some working papers and pertinent source documents used by cost monitors to develop cost and schedule variances are not included in the files. We found documentation to adequately support the computation of LMSC schedule variances was not available in the work files for some periods. Such documentation, including the source of both the milestones used to compute the number of days of schedule slip and the daily labor rates used to place a value on the slip, should be retained to support the cost variance reported to the coordinator, and to the Performance Evaluation Board (PEB). In one instance, the work files for some of the early evaluation periods for the P-E contract were not available. However, these files were subsequently located in records storage.

The files for recent award fee periods generally do not contain written narratives by the cost monitors to support the coordinator's evaluations of contractor performance. The cost monitors provided only oral input, and the files did not include the cost monitors' adjective rating of contractor performance required by MM 5151.5c. Therefore, it could not be determined from the files what input (rating) the monitor submitted or whether the coordinators revised those ratings. MSFC directives require the files to be documented to show such adjustments, and the rationale for any such action. The lack of written input also contributed to the difficulty in recreating the cost monitor's evaluation process. The PEPs require the cost monitors to periodically submit written reports to coordinators on contractor performance. We noted that files for earlier evaluation periods on both contracts included written documentation. However, coordinators stated that they no longer require the cost monitors to submit written evaluations.

HST Project Office personnel acknowledged that evaluations of contractor performance in controlling cost should have been better documented. They explained that they are primarily concerned with such documentation while the current period evaluation is in process, and did not anticipate further requirements for such documentation. In our opinion, the lack of necessary documentation can adversely impact the creditability of award fee ratings. The HST Project Office should ensure that the award fee evaluation process is properly documented in compliance with Center directives and Performance Evaluation Plans.

RECOMMENDATION 1

MSFC should provide additional guidance to those Center elements responsible for evaluating contractor performance in controlling costs on cost-plus-award-fee (CPAF) contracts. Specifically:

- a. Provide policy and procedural guidance to ensure proper recognition of overrun amounts included in both undefinitized

cost proposals and negotiated modifications to CPAF contracts. Evaluation plans for CPAF contracts should be required to include appropriate provisions for addressing such overruns. Also, a periodic reconciliation of such overrun amounts with overruns previously considered by award fee evaluations should be required to ensure all overrun is properly considered.

b. Clarify award fee procedures regarding the recognition of cost overrun under more than one subcriteria. Advise personnel responsible for evaluations that it may be appropriate to address the same overrun under more than one subcriteria when there are multiple contractor deficiencies.

c. Emphasize to Center program control personnel the need to ensure all of the contractor identified overruns are properly addressed by award fee evaluations.

d. Provide guidance to ensure award fee evaluations properly identify and recognize cost overruns when contract rebaselining has occurred during an award period. Those overruns which have occurred during the period, prior to rebaselining, should be properly recognized.

MANAGEMENT RESPONSE

Parts a., b., and d:

MSFC has already initiated action to restructure the cost performance criterion that should alleviate any real or perceived problems in effectively evaluating cost performance. The new procedure requires that total cost performance be evaluated at the criterion level, as opposed to the previous procedure which required evaluation at the sub-criterion level. This change in procedure allows all cost factors to be evaluated under a single criterion, thus eliminating any possible confusion or errors in judgement in the appropriate treatment of findings at the sub-criterion level.

The MSFC Performance Evaluation Operation Manual is currently being amended to incorporate the above change. Policy and procedural guidance will be included in this revision to ensure that cost growth is appropriately considered in the evaluation of cost performance for both the period under evaluation as well as for the total contract. Performance Evaluation plans will be reviewed to ensure they are in compliance with the requirements of the revised Performance Evaluation Operating Manual.

Part c.:

MSFC places a great deal of emphasis on identifying and recognizing cost growth and will re-emphasize the importance of this area to appropriate Center personnel.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken and planned are considered generally responsive to this recommendation. However, it was not the intent of the recommendation that the Center eliminate the requirement to evaluate subcriteria. Therefore, we contacted Center personnel to determine the rationale for the new procedures.

MSFC Procurement Office personnel stated that new evaluation procedures, deleting the requirement for evaluation of subcriteria and requiring evaluation at criterion level, were intended to provide the Center more latitude in the award fee process. They stated that at times, during an award fee period or even after it has ended, the Center may want to place increased emphasis (weight) on an aspect (subcriterion) of contractor performance. Increasing the emphasis permits the Center to increase the reward or penalty. However, the assignment of weights at subcriterion level substantially restricts such changes since PEB approval is required. They pointed out that by requiring that evaluations be made only at criterion level, and only assigning weights at that level, the Center may place emphasis on any aspect of contractor performance falling within a given criterion. According to Center personnel, such areas of emphasis may be added or dropped before, during or after completion of an award period.

It should be noted that, contrary to the new Center procedures, NASA Headquarters interim guidance on award fee contracting, dated July 8, 1988, clearly provides for the identification, weighting, and evaluation of subareas (subcriteria) within each major performance area (criterion). We also support the evaluation of subcriteria and believe it generally improves the award fee process, particularly where it increases the use of more objective data. In this regard, NASA Headquarters Interim Guidance states "Quantative measurements do not substitute for judgement, but the greater the ability to identify and quantify the facts considered in arriving at the judgemental assessment required, the more credible that assessment is likely to be (and the easier it will be to prepare the supporting documentation required)."

While we understand the Center's desire for greater flexibility, we believe this objective might also have been achieved by continuing to evaluate subcriteria, but not assigning fixed weights to them. We would hope that elimination of the requirement to evaluate subcriteria does not adversely affect the validity of the award fee process at MSFC. Revised procedures should not unnecessarily increase subjectivity of the evaluation process or reduce the availability of supporting documentation.

We have requested that the Center provide for our review a copy of MM 5151.5C, containing the amended evaluation procedures, as well as copies of the revised HST Performance Evaluation Plans.

Audit followup should evaluate effectiveness of the Center's revised procedures in addressing negotiated overrun and ensuring that rebaselining does not preclude recognition of overrun.

RECOMMENDATION 2

Hubble Space Telescope Project Office should revise the performance evaluation plans (PEPs) for the two prime contractors to incorporate provisions for properly addressing negotiated overrun amounts in the evaluations of contractor cost performance during the remaining life of the contracts. The PEPs should require a periodic comparison of negotiated overrun amounts on the contracts with overrun amounts recognized by award fee evaluations.

MANAGEMENT RESPONSE

The actions outlined under Recommendation 1 above will essentially accomplish this recommendation. That is, all cost performance will be evaluated at the criteria level to ensure consistent recognition of cost growth in award fee evaluations.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken and planned are considered generally responsive to this recommendation. However, as stated in our evaluation of the MSFC response to Recommendation No. 1, we have requested that the Center provide the OIG with copies of the revised HST performance evaluation plans (PEPs). Audit followup should evaluate the extent to which the Center's new procedures and the revised PEPs implement the intent of this recommendation.

RECOMMENDATION 3

Hubble Space Telescope Project Office should:

a. Require contractors to clearly identify the specific causes of all negotiated overruns and their impact on the contract baseline in order to ensure the overruns can be properly considered in award fee evaluations.

b. Require contractors to identify negotiated overruns as either historical (already incurred) or future (projected).

MANAGEMENT RESPONSE

The Project Office requires its contractors to account for all cost growth--incurred and/or prospective during negotiations, budget planning and other management review. As already mentioned, MSFC believes that the HST evaluations adequately recognized the contract cost variances and that full reconciliation would not have affected award fees.

EVALUATION OF MANAGEMENT RESPONSE

MM 5151.5C instructions for preparation of award fee evaluation reports state "Cause(s) of any over/underrun will be explained." Also, NASA Headquarters (Code HC) personnel have advised the OIG that it is essential to understand the cause(s) of overrun in order to properly evaluate the contractor's performance in controlling cost. We agree, contractors should not be penalized the same for all overrun. In some instances NASA actions may even contribute to overrun. Additionally, since overrun should be recognized in the award fee period in which it occurs, it is also essential to know when it actually did occur (historical) or will occur (future). However, as stated in the audit report, neither the contractor nor the Center could identify the specific impact of negotiated overruns on the baseline, although HST contractors were already required to maintain baseline visibility. Therefore, the overall intent of this recommendation included having the HST Project Office ensure contractor compliance with existing baseline visibility requirements. In this regard, MM 8020.6A, MSFC Cost/Schedule Performance Criteria (C/SPC), dated July 8, 1976, states, "Performance measurement baseline visibility will be continuously maintained that will show original contract baseline, current baseline, and all contractual and reprogramming changes with the effect of each change to the cost account level."

We remain of the opinion that the Center did not fully recognize all negotiated overrun and that better visibility over the causes and impacts of overrun would improve MSFC's evaluation process. Audit followup should evaluate the actions taken by the HST Project Office to ensure contractor compliance with existing overrun accountability and baseline maintenance requirements.

RECOMMENDATION 4

Hubble Space Telescope Project Office should:

- a. Ensure Cost Control award fee evaluation procedures which combine assessments of budget variance, schedule variance, and changes in the estimate-at-completion (EAC) do not overpenalize the contractor by considering current period overrun twice---once as budget/schedule variance and again as EAC change. The causes of all EAC increases should be determined and documented to preclude this possibility.
- b. Specify the relative importance assigned to award fee evaluation factors, such as schedule variance and the contractor's estimate-at-completion, used in evaluating contractor performance in controlling cost. Monitors should specify and document any weights they assign to milestones, factors, and items within subcriteria or criteria.
- c. Revise the present method for evaluating cost

performance on the Perkin-Elmer contract to include consideration of available data on contractor performance in meeting schedules/milestones since such data would reflect work accomplished.

MANAGEMENT RESPONSE

Regarding item a., HST procedures already address the actions called for in this recommendation. Additional emphasis will be placed in this area to ensure that contractors are not over-penalized.

Concerning part b., the weighting process has been revised to assign weights at the criteria level rather than the sub-criteria level. This should eliminate problems and misunderstandings associated with assigning weights to individual sub-criteria.

The actions outlined in part c. of this recommendation are a part of the Perkin-Elmer contract.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken and planned are considered generally responsive to this recommendation. Our comments on elimination of the requirement to evaluate subcriteria were previously provided under Recommendation No. 1 but also apply here. The effectiveness of specific actions taken by the HST Project Office on this recommendation should be evaluated during the followup review.

RECOMMENDATION 5

Hubble Space Telescope Project Office should emphasize the importance of complying with MM 5151.5C and performance evaluation plan documentation requirements and properly documenting award fee evaluations to ensure that a clear audit trail is established from monitors to the Fee Determination Official. Specifically:

a. Coordinators should publish and provide monitors with the procedures and formats necessary for the acquisition and evaluation of contractor performance data.

b. Monitors should document their plan or specific approach for evaluating contractor performance each award period to include the specific accomplishments expected.

c. Monitors should provide written input to coordinators, documenting their evaluation results, to include an adjective rating for each area of responsibility.

d. Evaluation work files should include all documentation used in evaluating contractor performance, and documentation should be maintained until the end of the contract.

e. Deviations should be requested, where justified, for any procedures not brought into compliance with MM 5151.5C.

MANAGEMENT RESPONSE

The HST Project Office has placed additional emphasis on the documentation supporting award fee evaluations. Additionally, deviations from MM 5151.5C were implemented as appropriate during the last update of the performance evaluation plan. The plan requires coordinators to provide an assessment of contractor performance in specific areas and its relative importance. Monitors are required to assess strengths and weaknesses rather than adjective ratings.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken are considered generally responsive to this recommendation. The revised PEPs as well as effectiveness of specific actions taken by the HST Project Office to improve documentation of the award fee evaluation process in response to this recommendation should be evaluated during audit followup.

This page intentionally left blank.

2. Performance Measurement Systems (PMSs). Our review of the award fee process on the two Hubble Space Telescope (HST) contracts disclosed MSFC has not effectively implemented the performance measurement requirements of MMI 8020.7B, MSFC Performance Measurement for Selected Major Procurements. PMS data provided by NASA contractors can be used as an indicator of their cost and schedule performance. However, PMS data provided by HST contractors currently is not used to evaluate contractor cost and schedule performance in determining award fee ratings. The primary reason given by HST Project Office personnel for not using contractor PMS data was lack of confidence in the validity of the data. Factors which have contributed to this situation include the need for increased management emphasis on the use of PMSs, the need to maintain closer surveillance over PMSs, insufficient PMS training, and delayed validation of HST contractor PMSs as well as not periodically revalidating PMSs. In our opinion, these weaknesses in the use of PMSs have contributed to the Center not properly recognizing cost overruns, and the possible overpayment of award fees, as discussed in Observation 1 of this report. Improvement and increased use of PMSs could benefit HST contract and project management, and could provide a useful tool in the preparation of award fee ratings. Areas in which we believe improvements will be beneficial are discussed below.

a. Use and Surveillance of PMSs. PMS requirements have been in effect on both of the HST development contracts since their inception in 1977. The cost of all PMS data provided by the contractors during this 10-year period is estimated to be at least \$2.5 million. Our review of the HST award fee process showed that only intermittent use has been made of this data for project and contract management. Use of PMS data to evaluate Lockheed Missiles and Space Company (LMSC) cost and schedule performance was generally discontinued about 1983, in large part due to concerns over PMS data validity, whereas, reduced use of PMS data to evaluate Perkin-Elmer (P-E) performance between 1983 and 1986, was due mainly to elimination of the regular semiannual award fee periods in the restructured contract. Although award fee periods were reestablished on the P-E contract in FY 87, HST Project Office personnel stated that they were not using P-E PMS data because there were not enough measurable milestones remaining.

Some HST Project Office personnel stated they were reluctant to rely on PMS data for project and contract management functions due to their concern over the credibility of the data. Project Office personnel, particularly those responsible for the LMSC contract, stated that over the years they had frequently noted invalid or questionable data in the PMS reports provided by the contractor. Problems which they had experienced included frequent manual mark ups to correct data in PMS reports; the necessity for notations on PMS reports to "qualify" the data; and

the general tendency of the contractor to delay the reporting of cost growth/overrun causing PMS data to be more favorable to the contractor. They also pointed out that additional costs would have to be incurred to upgrade the quality of the contractor's PMS.

One of the primary purposes of PMS data is to serve as an "indicator" of contractor performance to support management determinations in various other areas of project management. However, our review showed PMS data, due at least in part to its questionable validity, were no longer used by HST Project Office program control personnel to evaluate contractor performance for award fee purposes, or to serve as an "indicator" (benchmark or standard) against which to compare the results of other data sources or evaluation methods. One indication of the limitations as to validity of PMS data which we noted in our review was that LMSC reports sometimes contained current period data that reflected actual work performed to be negative amounts. This occurred because adjustments made to historical cumulative data were also included in the current month data. Project Office officials explained that LMSC's Cost and Scheduling Performance Evaluation Reporting (CASPER) system was old, and that it often had problems and produced questionable data. In this respect, we noted that some PMS reports generated from the LMSC CASPER contained qualifying comments. For example, the May 1987 reports included a statement that month end data on the prior report (April 1987) had been corrected due to an error in CASPER. Project Office personnel stated this was not unusual.

A major problem HST Project Office personnel pointed out which reduced the usefulness of PMSs for both HST contractors was baseline instability due to frequent rebaselining. Although NHB 9501.2B requires that negotiated and certain work relative to major unnegotiated contract Change Orders be included in the baseline within 30 days, the contractors often required three to five months to complete a major rebaselining. Since rebaselining can result in substantial changes to PMS data, PMS reports prepared by the contractors during the period of rebaselining were not always considered reliable. For example, during rebaselining, the adjustments to historical cumulative contract data were also included in the current month data thereby causing some distortions.

Center personnel also advanced the belief that PMS data were only "historical" and thus it generally did not identify new problems or issues requiring management attention. They also pointed out that there may be other sources of the same type cost and schedule data (i.e., weekly manpower reports). While both these rationale may have some validity, it should be recognized that PMS is intended to provide a common data base from which both the contractor and MSFC can exercise program and contract management. Such use of a common baseline should result in better communication and coordination of efforts.

The MSFC Comptroller has responsibility for policy and procedural guidance on PMS use at the Center, however, broad management support is essential if PMS is to be used effectively. Our review included discussions with various levels of Center management regarding management emphasis on PMS. There were varying opinions on PMS; while some personnel clearly supported PMS, others were not so enthusiastic. Clear, consistent management support for PMS was not readily evident. Recent initiatives by the Comptroller, including a review of Center PMS activities and a survey of PMS policy, discussed in more detail below, are positive steps toward establishing a clear management position. These reviews disclosed that individual MSFC projects have established PMS requirements as each deemed appropriate, and as a result PMSs are not always implemented uniformly across Center projects. Management actions have yet to be taken in response to these recent initiatives. However, we believe that continued management emphasis is required to ensure effective use of PMS on Center projects.

The validity of PMS data should be monitored on a regular basis as part of continuing surveillance by qualified program control personnel. Such surveillance should ensure that appropriate corrective actions are taken to maintain data validity. However, our review disclosed that the HST Project Office had not established and maintained effective surveillance procedures. Although PMS data continue to be received from both HST contractors, little or no surveillance of the data is currently being performed, and Project Office personnel acknowledged only limited surveillance had been performed in the past. In some instances, personnel indicated they had received more PMS data than could be monitored and used with existing staffing levels. Effective management and surveillance of PMS data are necessary, both to expedite resolution of any turbulence due to such major program events as rebaselining, and to improve data validity.

b. PMS Training. MMI 8020.7B requires that implementation and surveillance of PMSs be "...performed only by formally trained, qualified individuals" and that the Comptroller "Maintain a Center performance measurement training program..." to assure that such qualified personnel are available. However, the Comptroller has not established the required PMS training program. As a result, there are no "...formally trained, qualified individuals" designated as members of a Center-wide pool to serve on MSFC PMS validation teams.

Our review of the HST evaluation process disclosed that some of the personnel assigned to evaluate the cost and schedule performance of HST contractors had not received formal PMS training. Others stated that it had been several years since they had received such training. Other instances were noted, both within the Project Office and the Comptroller's Office where individuals had recently been assigned PMS responsibilities but had received no formal training. When this condition was pointed

out to responsible supervisors, they responded that required training will be scheduled. In our opinion, PMS training would enhance the understanding and capability of Center personnel to effectively monitor and use PMS for improved project and contract management.

During our review, we determined that there were several PMS training courses currently available. NASA Headquarters offers a 3-day training course which addresses PMSS and other related cost analysis and cost control topics. This course had not been conducted recently at MSFC, however, NASA Headquarters Comptroller personnel stated that it is tentatively scheduled at MSFC early in fiscal year 1988. Additionally, we determined there are PMS courses currently available from other Government agencies. For example, the Defense Systems Management College, Huntsville Office, offers a 1-week resident course on PMSS. We believe the Center should fully implement the PMS training requirements of MMI 8020.7B in order to establish and maintain an effective capability to validate, monitor and use PMSS.

MSFC Comptroller personnel acknowledged the requirement in MMI 8020.7B for a PMS training program and advised the OIG that training efforts were to be initiated in November 1987. They agreed that such training is needed by Center personnel due to the Center's dependence upon CPAF type contracts on major R&D programs. However, the overall status of PMS training at the Center was not available because documentation, such as a roster of those personnel assigned PMS responsibilities as well as the training status of each, is not currently maintained.

c. Validation of PMSS. Improvements are needed in center procedures for performing the initial validation of a contractor PMS as well as ensuring that the PMS continues to meet established criteria. For example, our review disclosed extensive delays in the initial validation of the LMSC PMS. Additionally, although HST Project Office personnel had concerns over the validity of PMS data, there were no periodic reviews and revalidations of either HST contractors' PMS over the 10-year life of this program. As a result, contractors submitted PMS reports which contained data of questionable validity and, as discussed in Observation 1, did not identify all overrun.

MM 8020.6A, Cost/Schedule Performance Criteria (C/SPC), dated July 8, 1976, requires contractors on CPAF contracts to demonstrate within 90 days after contract award that their PMS is operational and meets all C/SPC requirements. MSFC project offices, with the support of the Center Comptroller, are to conduct a formal review and validation of the contractor's PMS. In the event the PMS fails to pass the formal review, the specific shortcomings are to be documented, and the contractor required to make specific arrangements to correct the deficiencies. Followup reviews are to be conducted until formal

validation is achieved, after which the PMS should be under continuing surveillance to ensure compliance.

The PMSs for both HST contracts awarded in 1977 were initially validated by the Center. The P-E PMS was validated in April 1979. However, the initial review of the LMSC PMS in 1978 disclosed significant deficiencies. Between November 1977 and March 1981, MSFC issued nine Technical Directives (TDs), including various revisions, to LMSC identifying PMS deficiencies or specifying needed changes, and directing corrective actions. Seven complete reissues of the LMSC Performance Management Plan (PMP), the document describing the contractor's PMS, were required before approval of the system on March 27, 1981, over three years after contract award.

TD No. TA01-063, which MSFC issued to LMSC on June 13, 1979, was very critical of the lack of progress made by LMSC in correcting PMP problems, and stated: "The plan and procedures still do not accurately and sufficiently describe the system in detail nor fully meet the Performance Management Requirements. The need for accurate planning, control, reporting and analysis is becoming more critical as we reach PDR (Preliminary Design Review) and proceed into final design. Recent MSFC Project Manager's Reviews have emphasized the need for a disciplined system. The Design and Development Office and the Chief Engineer's Office have persistently complained about LMSC's uncontrolled baseline where past plans and historical performance records are constantly changing. As a result, they are reviewing misleading performance data and contract status, cannot perform meaningful trend analysis, and are limited in early problem detection."

Other deficiencies cited by the TDs included the need for improved PMP wording in such critical PMS areas as baseline maintenance, level-of-effort versus work package development, variance analysis, and use of cost/schedule performance criteria (C/SPC) on subcontracts. Such weaknesses in the LMSC PMS lead to the following comment in TD TA01-52 which MSFC issued to LMSC on May 3, 1979: "Perturbations in the system have created a credibility problem in the use of PMS reports by MSFC managers for evaluation of performance." However, almost two years later, during the fourth year of the contract, the needed improvements to LMSC's PMS, as reflected by MSFC TD TA01-128, dated February 17, 1981, still included such basic PMS areas as estimates at completion, baseline management, resource control and earned value/variance identification.

In our opinion, these extended delays in accomplishing the validation reduced the validity and usefulness of PMS data provided by LMSC during this early period. This situation most likely contributed to some of the difficulties experienced in effectively performing project and contract management of the HST, including evaluations of contractor cost performance.

Our review also showed that neither of the HST contractor's PMSs have been reviewed and revalidated subsequent to the initial acceptance reviews although there were continuing concerns over the validity of the PMS data, particularly LMSC data. This condition occurred because there is no MSFC requirement for periodic revalidation reviews. We also determined that personnel in the Comptroller's Office responsible for the Center's PMS program do not maintain performance measurement documentation as required by MMI 8020.7B. For example, there is no inventory or data base to identify major MSFC contracts on which PMS requirements have been imposed, the date of initial validation and current status including any subsequent reviews and revalidations. Although Comptroller Office personnel acknowledged that revalidations should be accomplished on major programs of long duration, they stated that surveillance of PMSs has been limited, and that few systems have been revalidated.

There are no detailed PMS validation/revalidation procedures or checklists published by the Center for use by MSFC PMS validation teams. As a result, validation teams have to prepare their own guidelines. Comptroller Office personnel stated that they plan to provide some additional guidance on the conduct of PMS validation reviews. In our opinion, such guidance is needed to ensure validations are done in a consistent and effective manner.

d. Integrity of Contractor Management Systems. Certain LMSC internal management systems used to develop and maintain HST cost and schedule data contained weaknesses which caused HST PMS data to be of questionable validity. Since this condition generally resulted in data more favorable to the contractor, it could have contributed to the understated HST overrun in LMSC reports provided to MSFC.

Data relative to cost and schedule performance on the HST program is generated and maintained on the LMSC Cost and Scheduling Performance Evaluation Reporting System (CASPER). This system is also used to generate performance data for the contractor's DOD programs. The Air Force Plant Representative Office (AFPRO) Administrative Contracting Officer (ACO) for the HST contract (NAS8-32697), advised us that DOD identified significant weaknesses (59 areas of noncompliance) in the LMSC PMS, including CASPER, during 1984. As a result, on December 5, 1984, AFPRO withdrew the validation of the LMSC PMS on the basis that it did not meet existing standards to ensure production of valid cost and schedule performance data.

One of the major weaknesses cited by AFPRO for their action was the CASPER's delay in identifying and accurately reporting cost overruns, which generally resulted in cost data more favorable to the contractor. This weakness was due in part to such LMSC baseline maintenance problems as unauthorized over-target baselines, and baseline budgets being moved without

movement of related work. Additionally, AFPRO determined that the schedule portion of the CASPER lacked traceability, and that the overall quality of variance analysis was poor. We recognize that there can be unique aspects to the PMS used on individual DOD and NASA programs. However, according to the AFPRO, the identification of HST cost overruns would have similarly been delayed and understated on contractor reports generated by systems such as the CASPER.

LMSC was required to make substantial improvements during 1985 and 1986 before the PMS could be reapproved by DOD. As a result, the PMS remained unvalidated from late 1984 until February 19, 1987. The difficulties experienced between 1977 and 1981 by MSFC in the initial validation of LMSC's PMS, combined with the AFPRO withdrawal of validation for DOD programs between 1984 and early 1987, further indicate the questionable validity of HST cost and schedule performance data reported by the contractor. In our opinion, these LMSC PMS deficiencies contributed to the unreported overrun on contractor reports as previously discussed in Observation 1. Also, the existence of the DOD identified PMS problems clearly demonstrates the need for revalidating the LMSC PMS for HST.

e. Review of PMS Requirements. Project Office personnel responsible for oversight of HST contracts acknowledged that they seldom use the PMS data (MA-02 reports) at this time and can obtain essentially the same data from other sources. In January 1986, LMSC proposed (Project Change Proposal No. P0093) that the requirement to provide the MA-02 report be deleted from their contract. While this action would have saved about \$150,000 annually, MSFC declined, according to HST Project Office personnel, because (i) MSFC directives require PMS be imposed on major programs such as HST, and (ii) copies of PMS reports must be submitted to NASA Headquarters.

Project Office personnel responsible for the LMSC contract stated that the LMSC program control staff for HST, which maintains the PMS, was significantly reduced in 1985. This action was taken in view of the 1986 scheduled HST launch date and the need to cut costs. The reduction was achieved by decreasing MSFC PMS data requirements and converting to a different media. As a result, PMS data is not currently received in the same media or level of detail. For example, LMSC PMS data are currently received electronically and not hard copy.

HST Project Office personnel stated they also have reduced the PMS requirements in the P-E contract. They are receiving only limited PMS data which they estimated cost \$100,000 annually. We noted that the current modified PMS report format used on the P-E contract does not include earned value data. Budgeted Cost of Work Performed (BCWP) has been deleted and the report is essentially a comparison of budgeted cost to actual cost, without regard to what work has been performed (See Observation 1).

In view of the mature status of this program, with most major milestones having been completed, HST Project Office management should review the current need for PMS data, and determine whether to continue to buy such data. While the use of valid PMS data is encouraged, we do not believe that data which are not valid and/or not used should continue to be procured. Discontinuing certain PMS reporting requirements could save an estimated \$250,000 annually for the remainder of the HST program.

f. Center Reviews of PMSs. The MSFC Comptroller's Office has performed several reviews of the status of the Center's implementation of PMS. These reviews have disclosed that PMS has not been fully implemented to the extent that it has become a uniformly applied operational management tool. The specific weaknesses disclosed by these reviews include the need for PMS training, validation, surveillance practices, and other areas similar to those discussed in this report.

The most recent such MSFC review was performed by the Internal Control Office in September 1987 in response to a request from the Center Comptroller for input in determining the Center's future PMS policy. Internal Control Office personnel concluded PMSs offer considerable potential for contributing to effective program management and recommended Center management provide added emphasis and support to use PMSs on Center programs. Center Comptroller personnel anticipate revisions of Center directives to clarify PMS policy and procedural issues.

RECOMMENDATION 6

Center Management should place increased emphasis on the effective surveillance and use of Performance Measurement Systems (PMSs) for managing NASA programs which use cost-plus-award-fee contracts. Specifically:

a. Ensure procedures are established for maintaining surveillance over PMSs and monitoring validity of PMS data.

b. Ensure available PMS data is considered and used, at least as an indicator, in evaluating contractor cost and schedule performance for award fee purposes.

MANAGEMENT RESPONSE

MSFC has taken steps to accomplish this recommendation.

EVALUATION OF MANAGEMENT RESPONSE

The management response is considered responsive to this recommendation. The effectiveness of specific steps taken by MSFC to improve surveillance and use of PMSs, to include related corrective actions identified elsewhere in the management

response (i.e., Comment 13, Appendix A), should be evaluated during audit followup.

RECOMMENDATION 7

MSFC Comptroller should:

a. Establish a Performance Measurement System (PMS) training program, as required by MMI 8020.7B, to develop a pool of formally trained, qualified personnel to validate, implement, and maintain surveillance of PMSS at the Center.

b. Identify individuals currently assigned PMS responsibilities who have not received formal PMS training, determine necessary training, and assist in arranging such training.

c. Establish procedures to periodically review the training and experience of personnel assigned PMS responsibilities to ensure that adequate training is provided and updated at appropriate intervals.

MANAGEMENT RESPONSE

Concur. This recommendation has been implemented.

EVALUATION OF MANAGEMENT RESPONSE

The management response is considered responsive to this recommendation.

RECOMMENDATION 8

MSFC Comptroller should:

a. Revise MMI 8020.7B to require that contractors' Performance Measurement Systems (PMSs) on major programs be reviewed and revalidated at periodic intervals.

b. Provide validation/revalidation guidelines or a checklist to assist validation teams in effectively and consistently evaluating the adequacy of contractor PMSs.

c. Establish and maintain documentation on each contractor PMS as required by MMI 8020.7B. Include the dates and results of each validation/revalidation review.

MANAGEMENT RESPONSE

Concur. This recommendation has been implemented.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken are considered responsive to this recommendation. The effectiveness of specific actions taken to improve validation/revalidation reviews should be evaluated during followup.

RECOMMENDATION 9

Hubble Space Telescope (HST) Project Office should review the current contractual reporting requirements for PMS data, consider the extent to which PMS data are actually being used, and the availability of cost and schedule data from other sources. HST contracts should be modified to delete those PMS reporting requirements which are identified as not required nor utilized.

MANAGEMENT RESPONSE

The HST Project Office has implemented this recommendation. The waiver of PMS requirements was granted on April 6, 1988.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken are considered responsive to this recommendation.

3. Improving the Award Fee Process. Our review of MSFC's award fee evaluation process and the resultant ratings given Hubble Space Telescope (HST) contractors disclosed other areas where we believe the process can be further improved. Specifically, we found (i) an extensive amount of time is required to complete performance evaluations, (ii) a potential exists for increased use of periodic retroactive award fee adjustment and "look back" provisions, (iii) instances of recognition for minimal acceptable performance by the contractor, and (iv) a need for updated NASA Headquarters guidance on incentive contracting. Each of these areas is discussed below.

a. Award Fee Processing Time. Our review disclosed that the time required for MSFC to complete and publish evaluations of HST contractor performance under CPAF contracts often resulted in the contractor not being formally notified (Contracting Officer/Project Office letter transmitting PEB report) of the rating, including any specific weaknesses requiring attention, until more than half of the following six month evaluation period had passed. For example, in one instance we noted that the contractor (LMSC) was not notified of the rating until approximately 133 days after the end of the award fee period. This situation is caused by delays in the Project Office submission of evaluation reports to the Performance Evaluation Board (PEB), delays in holding PEB meetings, and delays in preparing and issuing the PEB evaluation reports. Such delays can reduce the effectiveness and usefulness of award fee determinations, if contractors are not advised of deficiencies and required corrective actions are not initiated in a timely manner. Timely PEB evaluation reports can be a useful tool for NASA managers to encourage top level contractor management attention to resolution of technical and contractual problems.

The Performance Evaluation Operating Manual for CPAF Contracts, MM 5151.5C, dated September 24, 1986, provides time standards for completing the evaluation process, including individual schedule milestones. The MM specifies that the entire performance evaluation process, including preparation of the contract modification for payment of award fee earned, should be completed within 75 calendar days (55 work days) after the end of each award fee period. The MM also specifies that the contractor be notified of the PEB recommended rating within approximately 55 calendar days (40 work days). The time required to complete the evaluation process for each HST contractor is discussed below.

LMSC. Our review showed the elapsed time to complete the evaluation process and notify LMSC of the recommended rating had increased significantly during the more recent evaluations. For example, the time required to notify LMSC for the last seven periods (periods 10 through 16) averaged about 110 calendar days. Additionally, as of September 11, 1987, over 120 days after the end of period 17, LMSC had not been notified of their rating. In contrast, evaluations and contractor notifications for earlier periods (1 through 9) were

completed in about half the time---an average of only 60 days. However, both these average elapsed times exceeded the old standard of 48 days and the current standard of 55 days established in 1986.

We found that delays in submitting the coordinator's evaluation reports and delays in convening the PEB meetings, in at least two instances, were contributing factors in the delays experienced in the recent evaluations. For example, although current directives require coordinators to submit their evaluation reports within about 30 calendar days (20 work days) after the end of the evaluation period, submission of the reports exceeded this standard by an average of 40 days in 6 of the last 7 periods (periods 10 through 16). However, the PEB Executive Secretary stated that some of these reports were not submitted on time because the coordinators were advised the PEB meetings would be delayed. In this regard, our review disclosed that an average of 75 calendar days elapsed after periods 10 through 16 ended before the PEB convened to receive presentations on the contractor's performance. This exceeds the current 40 calendar day milestone standard per MM 5151.5C by 35 days. In addition, subsequent to the PEB presentations, an average of 34 calendar days were required for these same periods to prepare the PEB evaluation report, coordinate it within the Center, and provide it to LMSC. The current MM 5151.5C scheduled milestone standard for this step in the process is 15 calendar days.

Perkin-Elmer. Our review of award fee evaluations for the Perkin-Elmer (P-E) contract disclosed that while they were more timely than the LMSC evaluations, they still were not always completed within the established time standards. The elapsed time from the end of the period until contractor notification averaged 74 calendar days for periods 1 through 7 and period 10. This is an average of 26 days more than the old standard of 48 calendar days in effect most of that time, and 19 days more than the current 55 day standard. This condition was due to delayed submission of coordinator reports (5 of 8 periods), and an average of 2 additional weeks, in excess of the two week standard, for completing the PEB review and notifying the contractor of the recommended rating. The PEB Executive Secretary stated that some coordinator reports were not submitted on time because coordinators were advised that the PEB meetings would be delayed.

We also reviewed the timeliness of recent P-E award fee evaluations for (i) hardware "delivery" milestones scheduled between November 1984 and April 1985, and (ii) Cost Control criteria for the period August 1983, thru June 1986. Our review of MSFC's evaluation of the contractor's delivery schedule on fine guidance sensors (FGS) Nos. 2, 3, and 4 disclosed that P-E was promptly notified of the evaluation results (no fee due to late deliveries) only about 35 days after delivery of the last of the FGSs. In contrast, the processing time for evaluation of the P-E delivery of the optical telescope assembly required 118

days to notify the contractor of the PEB recommended rating (100 percent fee for timely delivery). Most of this additional processing time occurred subsequent to presentations to the PEB. One reason given by MSFC personnel for this delay was the need to resolve certain questions regarding the allocation of fee under the P-E contract as restructured in 1983.

Our review of the processing of the special P-E Cost Control evaluation disclosed that it was still in process as of September 30, 1987, 15 months after completion of the August 1983-June 30, 1986, evaluation period. HST Project Office personnel stated that a significant schedule slip from a planned 1986 launch to the current 1989 launch required that the original cost plan for that period be revised substantially. Thus, this delay was due primarily to negotiations to redefine the cost plan against which actual costs would be measured. As of September 30, 1987, the contract had been modified to reflect the new schedule and cost plan. HST Project Office personnel stated that the coordinator's report had been submitted to the PEB, and that they expected the evaluation to be completed in the near future. We consider this evaluation to be an exception clearly warranting more time than provided by the Center's milestone standards.

Center officials provided several reasons for the delays in completing the evaluation process for LMSC and P-E. However, they stated one of the recurring problems is caused by the number of CPAF contracts at the Center requiring simultaneous evaluations of contractor performance. The PEB Executive Secretary stated that the single core staff (Chairman, Executive Secretary, etc.), consisting of the same individuals on the PEBs established for evaluation of all MSFC program/project contracts, sometimes could not accomplish all these evaluations within the allotted time. Another problem was the nonavailability of PEB members or contractor personnel for various reasons, although alternates are normally designated. In view of these limitations and the potential for increasing use of CPAF contracts, award fee processing time may become so lengthy as to require specific management attention.

We previously reviewed the Center's award fee evaluation processing time during our Survey of Award Fee Contracting (A-MA-83-302). In our October 28, 1983, survey report, we pointed out that from 71 to 140 days were required to complete an award fee evaluation and notify the contractor of the rating, and stated that the effectiveness of award fee determinations could be enhanced by reducing the processing time. At that time, MM 5151.5B authorized about 48 calendar days (34 work days) to evaluate contractor performance and notify the contractor of the rating. Center officials indicated they were studying ways to streamline and significantly reduce the processing time with a target processing period of only 30 to 45 days. Subsequently, MM 5151.5B was revised to increase the standard from 48 to 55 calendar days. Center personnel explained

that this action was taken because the Center had difficulty meeting the old standard. The fact that this more relaxed standard is not being achieved indicates that additional management emphasis is required to ensure more timely completion of award fee evaluations. More timely completion of the award fee process should enhance the effectiveness and usefulness of award fee determinations in identifying to the contractors those areas requiring improvements.

b. Retroactive Award Fee Adjustment. A feature that can be applied to CPAF contracts is the capability to make retroactive award fee adjustments, granting additional award fees or requiring the contractor to forfeit a portion of fees previously awarded. Interim guidance on CPAF contracts issued in July 1988 by NASA Headquarters includes discussions and guidelines for the use of such after-the-fact award fee adjustment techniques. A study report on CPAF contracting within NASA performed by the Sterling Institute also confirmed the desirability of upward and downward award fee adjustments as a means of matching total award fee payments with overall long term performance. We determined that MSFC has not issued management guidelines on the use of such retroactive adjustment provisions, and that management has not specifically emphasized the use of such provisions.

Our review disclosed that neither of the HST contracts include specific provisions for such periodic retroactive award fee adjustments for any of the evaluation criteria, including Cost Control. Therefore, there is no contractual capability to retroactively adjust award fee based on periodic reevaluations of the contractor's overall cost control performance. However, the Performance Evaluation Plan (PEP), dated October 19, 1977, for the LMSC contract (NAS8-32697) allocated 25 percent of the total award fee to the final evaluation period at the end of the contract. As of June 1987, this amounted to about \$3.63 million. The PEP states that the final evaluation period will address overall contract performance including cost and schedule performance and on orbit verification of the telescope. The weight to be assigned each criteria will be established just prior to the final evaluation period. This feature of the contract will permit the Center to consider the overall cost performance of the contractor and to recognize the total overrun on the contract (to the extent of the weight assigned to the Cost Control criterion). Any previously unrecognized negotiated overruns, as well as any resulting award fee overpayments, can be considered at that time.

During our review HST Project Office Personnel advised us that they were giving consideration to elimination of both the cost and schedule criteria in the last period of the LMSC contract and assigning all weight (100 percent) to on-orbit performance. This would have eliminated the capability to evaluate overall cost performance, a capability which we consider necessary in view of the significant overrun on this

contract. We were subsequently advised that current plans are to retain the cost performance criterion for the final period.

The original Performance Evaluation Plan (PEP) for the P-E contract (NAS8-32700) also reserved 25 percent of total fee for the last evaluation period, and was also to address overall cost, schedule and on-orbit performance. However, when the contract was restructured in 1983, all available fee, including the 25 percent, was combined into three fee pools, including a separate fee pool established to evaluate overall P-E cost performance from August 1983 thru the then planned completion date of the contract, June 30, 1986. Under this fee structure, P-E's final allowable cost for the period was to be compared to the OTA contract expenditure cost plan to determine cost performance and entitlement to the \$2.3 million available fee. This provision effectively eliminated the end of contract overall cost performance assessment since it did not include consideration of the contractor's cost performance for 1977 to 1983, although cost overruns of over \$37 million were negotiated during the period 1977-1981, and additional cost overruns of over \$100 million were identified during the period 1981-1983.

The use of periodic retroactive award fee adjustment provisions on the HST contracts would have been beneficial, in our opinion, as it would have permitted the Center to assess the overall performance of the contractor in controlling cost at intervals over the more than 10 year life of these contracts. Such an assessment would have permitted the Center to retroactively consider the full extent of the cost growth on these HST contracts and make any award fee adjustments considered appropriate. For example, a periodic comparison of the amount of non-fee-bearing overrun authorized/negotiated and the amount of overrun recognized by award fee evaluations under the Cost Performance subcriterion could have better ensured all overrun was fully recognized. We believe the cost growth on the HST program clearly demonstrates a need to consider use of some type of retroactive award fee adjustments on future major hardware development programs anticipated to be of long duration. We previously reviewed NASA's use of retroactive award fee adjustments during the Survey of Cost-Plus-Award-Fee (CPAF) Contracting, (A-MI-83-302) dated June 6, 1984. This multi-Center survey, which included MSFC, was conducted in 1984 and identified only limited use of retroactive adjustments in CPAF contracts. At that time NASA procurement officials generally agreed that retroactive adjustments should be used on some CPAF contracts. They indicated that this award fee technique could be most effectively utilized on major hardware development contracts.

Discussions with NASA Headquarters (Code HC) personnel disclosed an alternate technique which may also offer advantages when used on major long term programs such as the Hubble Space Telescope. Under this technique the award fee earned each period is paid as a "provisional" payment subject to an end of contract assessment of overall performance. The provisional award fee

could be adjusted up or down based on this final assessment. Limits are established on the possible amount of such adjustment. We believe this method has merit and should also be considered by Center management.

c. Recognition for Minimal Acceptable Performance. Our review disclosed a few instances where the contractor received a high rating for only meeting minimum standards on certain award fee subcriteria. The evaluation reports did not include specific justification (i.e., identifiable strengths) as support for the high ratings. These unsupported high ratings generally occurred in early award fee periods.

We noted some instances where the PEB questioned the support for high ratings recommended by the HST Project Office, and subsequently lowered the ratings. For example, in period 11 on the LMSC contract, the HST Project Office coordinator rated the contractor Excellent on the Cost Constraint subcriterion. However, the PEB Chairman's letter to the Center Deputy Director (Fee Determination Official) contained the following comment on this rating: "The Coordinator's rating of performance on the Cost Constraint Adjustment Subcriterion was adjudged to be too high as there were no constraints in Period 11." This was one of several reasons which led the PEB to lower the overall rating recommended by the coordinator for this period.

We also noted instances during early award periods, where the PEB did not challenge the justification/support for such high ratings. For example, both the Project Office and PEB evaluation reports for period 6 of the LMSC contract rated the contractor Superior, the highest rating available, on the Cost Control subcriterion "Financial Reports". However, the strength cited in the evaluation reports to justify this high rating was: "The contractor's financial reports (Form 533) were submitted on time during this period." HST Project Office personnel agreed this is not a notable strength, but only the minimum contractually required and expected of the contractor. As a result of this unsupported high rating in period 6, the contractor may have been awarded more fee than justified.

Definitive guidance on required support for ratings was not provided by the version of MM 5151.5 which was applicable in period 6. However, the current version of this directive (MM 5151.5C) provides the following guidance regarding award fee evaluation reports "The report shall not address activities a contractor is expected to accomplish as part of minimal acceptable performance. For example, timely submittal of information is no measure of performance unless quality and usefulness are addressed."

We noted two other instances in the early award periods where the contractor received similar high ratings although the specific justification provided in the evaluation reports reflected no contractor performance. Specifically, during award

periods 1 and 2 on the LMSC contract, we noted the HST Project Office evaluations rated the contractor performance as Superior for the NASA Cost/Funding Constraint subcriterion (ability to adjust to NASA Cost/Funding Constraints). However, there were no identified cost funding constraints in effect during these two periods. The award fee available for Cost Constraint during these periods should have been reallocated to other Cost Control subcriteria, as was done in period 3 when no such constraints existed. However, as there was no significant difference in the ratings for Cost Constraint and other Cost Control subcriteria in these two periods, there apparently was little impact on the overall rating and award fee earned. However, since overstated ratings can possibly result in the payment of excessive award fees, all ratings should be properly supported.

d. NASA Headquarters Guidance on CPAF. Our review disclosed that both the NASA Cost Plus Award Fee Contracting Guide, NHB 5104.4, issued in 1967, and the DOD/NASA Guide on Incentive Contracting, NHB 5104.3A, issued in 1969, were cancelled in 1979 and 1986 respectively, pending revision. As of September 1987, these directives had not been reissued to provide NASA Centers with guidance on CPAF contracts. NASA Headquarters personnel (Code HC) explained that DOD and NASA had agreed to reissue one joint DOD/NASA directive addressing both incentive and award fee contracts. They stated that each Agency was responsible for drafting portions of the new directive, and that NASA had drafted the portion of the directive addressing CPAF contracts 2 to 3 years ago. However, they were awaiting DOD completion of the remaining portions of the joint directive. While they agreed with the OIG that updated CPAF guidance was needed and would be beneficial to NASA Centers managing such contracts, they were not sure when the joint directive would be reissued.

Code HC personnel later advised us that, in view of the continuing delay in DOD completion of remaining portions of the joint directive, on October 1, 1987, NASA Headquarters had provided the drafted CPAF guidance to the Procurement Officers of NASA Centers for their use. However, the draft was reidentified as a "paper," rather than a draft NASA directive, and its use was optional. At that time, we recommended to Code HC personnel that the "paper" be distributed in a more official capacity pending completion of the joint DOD/NASA directive. Subsequently, on July 8, 1988, NASA Headquarters (Code H) notified all Center Directors that the "paper" was being distributed "on a NASA-wide basis, to provide interim guidance on award fee contracting pending availability of the still unpublished revision of the DOD/NASA Guide." We consider the Code H action a positive management initiative which should provide benefits as an interim measure and we encourage MSFC to take advantage of these latest guidelines on CPAF.

The absence of NASA agency-wide guidance on award fee contracts was also noted during an OIG evaluation of the Report

of the Presidential Commission on the Space Shuttle Challenger Accident. This internal OIG evaluation report, dated July 2, 1986, concluded that components of the National Space Transportation System have typically been procured through CPAF and incentive fee contracts although no agency-wide criteria exists for evaluating performance under such contracts.

RECOMMENDATION 10

MSFC should place additional management emphasis on the importance of promptly completing the award fee evaluation and notification process to assure compliance with MM 5151.5C scheduled milestones. This should include at a minimum the following actions.

a. Review the current award fee evaluation processing procedures and determine if the process can be expedited.

b. Consider alternatives such as appointing additional personnel to serve on program/project PEBs, particularly if existing procedures and milestones cannot be improved substantially and it is anticipated the number of Center CPAF program/project contracts will increase in the future.

MANAGEMENT RESPONSE

MSFC management is sensitive to the importance of promptly completing the award fee evaluation and notification process. It is recognized that the time required for completing the evaluations exceed the standard time contained in MM5151.5C. However, it must be recognized that the standard time is somewhat "theoretical" in that it does not (and really cannot) recognize the numerous day-to-day problems that influence or impact the performance evaluation schedule. Typical of these are critical project reviews, key milestone events and launches, availability of key civil service and contractor personnel and other considerations.

The above interferences tend to extend the performance evaluation time; however, this is not considered to be a big problem. Steps have been taken to decouple the completion of one evaluation period from the start of the next evaluation period. Contractors are provided with Areas of Emphasis and criterion weightings prior to the start of a period, both of which are greatly influenced by the contractor's performance for the previous period. In addition, the contractor has the benefit of the periodic performance status meetings with the project office which provides a good indication of areas that are going well or where improvements are needed.

In summary, MSFC is satisfied with its current evaluation processing procedure and does not see a need for changing them simply for the purpose of expediting the time required for

performance evaluation. Nevertheless, we will continue our efforts to complete the performance evaluations in the most timely and effective manner.

EVALUATION OF MANAGEMENT RESPONSE

NASA Headquarters interim guidance on award fee contracting, issued July 8, 1988, points out the importance of thorough, timely evaluations of contractor performance: "The timing of events...is critical, for delays may compromise the benefits accruing from periodic evaluations and reporting. Unless final evaluation results are transmitted to the contractor in a timely manner, and any award fee payments promptly made, these results and payments may not have the desired influence upon the contractors' performance during the follow-on evaluation period."

We understand that circumstances can sometimes delay timely completion of award fee evaluations. However, we remain of the opinion that more timely completion of MSFC's award fee process could enhance its effectiveness, and that increased management emphasis should be placed on the timeliness of evaluations. MSFC's response states that the center plans to continue efforts to complete evaluations in a timely and effective manner. Audit followup should determine the extent to which these efforts improve the existing condition disclosed by our audit.

Note: The Center's response states "Contractors are provided with Areas of Emphasis and criterion weightings prior to the start of a period...." However, this would not be in compliance with Center guidance which prohibits informing the contractor of weights assigned. MSFC personnel contacted by the OIG stated this was an incorrect statement, weights are not to be given to contractors.

RECOMMENDATION 11

MSFC management should re-emphasize to Monitors and Coordinators the importance of complying with the MM 5151.5C requirement that contractor performance ratings be properly supported and that evaluation reports should not cite, as support for high ratings, activities a contractor is expected to accomplish as part of minimal acceptable performance.

MANAGEMENT RESPONSE

The problems cited in the report that led to this recommendation seem to have occurred several years ago. Failure to properly support the performance evaluations is not considered to be a current problem. However, emphasis will continue to be given to Monitors and Coordinators on the importance of properly supporting contractor performance ratings.

EVALUATION OF MANAGEMENT RESPONSE

Action planned is considered responsive to this recommendation.

RECOMMENDATION 12

MSFC Procurement Office should provide policy and procedural guidelines on the use of such award fee techniques as provisional fee payment, retroactive fee adjustment, and look back provisions, which provide the capability to assess overall contractor performance and to either adjust fee earned on prior periods or adjust current period fee. Use of such procedures should be encouraged, where appropriate, in order to ensure overall award fee payments are commensurate with overall contractor performance.

MANAGEMENT RESPONSE

MSFC is continually assessing policies and procedures to provide the most effective CPAF contract management system. Pursuant to this recommendation, MSFC will re-emphasize provisional fee payments, look back and roll forward provisions and other fee adjustment techniques in establishing evaluation methods for each CPAF contract.

EVALUATION OF MANAGEMENT RESPONSE

Actions taken and planned are considered responsive to this recommendation.

RECOMMENDATION 13

Hubble Space Telescope (HST) Project Office should retain the Cost Control criterion in the Lockheed Performance Evaluation Plan for the last period. This will permit MSFC to assess the contractor's overall cost performance over the life of this contract, which has experienced significant cost growth, and give proper consideration to any previously unrecognized negotiated overruns as well as any resulting award fee overpayments. By assessing the HST contractor's performance over longer periods of time, problems which existed in a prior award fee period, but were either not evident or their full magnitude was not measurable until a later award fee period, can be recognized. This would provide MSFC an opportunity to ensure overall award fee is commensurate with performance in controlling costs. Additionally, the potential for an upward award fee adjustment may motivate the contractor to a higher level of performance.

MANAGEMENT RESPONSE

This recommendation has been and continues to be a part of the Project Plan.

EVALUATION OF MANAGEMENT RESPONSE

MSFC's retention of the Cost Control criterion is considered responsive to this recommendation.

RECOMMENDATION 14

MSFC Procurement Office should make appropriate use of the recently issued NASA Headquarters interim award fee guidance in implementing the OIG recommended improvements to award fee procedures and in subsequently managing award fee contracts.

MANAGEMENT RESPONSE

MSFC concurs with this recommendation and has given all contracting officers a copy of this Headquarters' guidance. As already noted, this CPAF process must be flexible and additional guidance must reflect this requirement.

EVALUATION OF MANAGEMENT RESPONSE

Action taken is considered responsive to this recommendation.

This page intentionally left blank.

GENERAL COMMENTS

We wish to express our appreciation to NASA Headquarters personnel and to personnel of the MSFC Hubble Space Telescope Project Office, Procurement Office, Center Comptroller, as well as the Assistant Director for Policy and other Center personnel contacted during the audit for their courtesy, assistance, and cooperation.

K. R. Atkins
Kenneth R. Atkins

This page intentionally left blank.

FEE STRUCTURE
LOCKHEED MISSILES AND SPACE COMPANY
(CONTRACT NAS8-32697)

Contract NAS8-32697 was awarded to Lockheed Missiles and Space Company (LMSC) in October 1977 for the HST Support Systems Module (SSM) and Systems Engineering (SE). MSFC negotiated a total contract value of \$82,725,000 including an estimated cost of \$76,758,500 and a 7.84 percent award fee of \$5,966,500.

As of April 30, 1987, contract changes for added effort had increased available award fee to \$19,531,748 and LMSC had earned \$14,404,708 (74 percent). Specifically, LMSC had earned \$12,388,510 (73 percent) of the \$16,952,108 available award fee on the SSM portion of the contract and \$2,016,198 (78 percent) of the \$2,579,640 available award fee on the SE portion of the contract. As of April 30, 1987, LMSC had expended a total of \$524,775,000. Therefore, through that date LMSC had earned award fees totalling an effective fee of 2.74 percent. In addition to the award fee, as of April 30, 1987, MSFC had also negotiated a fixed fee of \$1,697,954 (8 percent) for HST Spares costing about \$21 million of the total estimated contract cost of \$537,658,134. This equates to an effective fixed fee of .32 percent. Together, LMSC had earned an effective total fee of 3.06 percent (award plus fixed fee).

This page intentionally left blank.

A-MA-87-007

AUDIT REPORT

REPORT ON SELECTED ASPECTS OF THE SPACE
TRANSPORTATION SYSTEM NATIONAL RESOURCE
PROTECTION PROGRAM

MARSHALL SPACE FLIGHT CENTER

SEPTEMBER 29, 1987

NASA

National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Reply to Attn of

M-DI: 327-87

September 29, 1987

TO: DA01/Director, Marshall Space Flight Center
Attn: DE01/J. A. Bethay

MO/Director, Shuttle Operations
NASA Headquarters
Attn: MOF/R. G. Snyder

FROM: M-DI/Director, MSFC Office of Inspector General
Kenneth R. Atkins

SUBJECT: Report on Selected Aspects of the Space
Transportation System National Resource Protection
Program, Marshall Space Flight Center (A-MA-87-007)

Introduction

The Office of Inspector General (OIG), Marshall Space Flight Center (MSFC), has completed a review of MSFC's implementation of selected aspects of the Space Transportation System National Resource Protection (STS NRP) Program. Specifically, in response to an assist audit request from the Kennedy Space Center (KSC) OIG, we reviewed the status of certain security measures taken by MSFC for the STS NRP program. Our review was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMIs) 9910.1 and 1103.27A, dated January 28, 1980, and August 5, 1986, respectively.

Our review was performed in accordance with generally accepted Government auditing standards and accordingly included such tests of accounting records and related internal controls as considered necessary under the circumstances. This included limited testing of MSFC records and related supporting documents that addressed the Center's implementation of certain STS NRP security measures, including security training and facility security. For certain MSFC classified STS NRP contracts we determined: (i) whether the Center properly delegated contract administration office responsibility for the security functions; and, (ii) whether the Center performed required inspections of contractor compliance with the DOD

Industrial Security Program. We also evaluated the adequacy of certain NASA Headquarters guidance that directly affected the adequacy of STS NRP security measures implemented by MSFC. The results of our review are applicable to STS operations at MSFC, MSFC operations at KSC, and at certain contractor plants.

While our review was limited to specific aspects of the STS NRP program and related security requirements, we considered the issues significant enough to be brought to the attention of MSFC management. The results of this review have been discussed with responsible NASA Headquarters personnel as well as Center management officials who generally agreed that increased management emphasis on the STS NRP program is required, and outlined positive corrective actions which are planned.

A draft report was submitted to MSFC and NASA Headquarters on May 7, 1987 and May 26, 1987, respectively, and management responses were received on June 1, 1987, and July 14, 1987, respectively. Although the NASA Headquarters' response stated they plan to modify or eliminate some of the STS NRP requirements in NMI 8610.19, the management responses outlined positive measures and actions which are generally responsive to the recommendations. The entire NASA Headquarters and MSFC responses are included as Attachments 1 and 2, respectively, to this report.

Background

a. STS NRP Program.

On July 4, 1982, Presidential Directive No. 42 designated the Space Transportation System (STS) a vital national resource because of its unique space exploitation capability, and the significant investment of the Nation's resources in its development, production, and operation (over \$28 billion). The STS is a vital element of the United States space program and is the primary space launch system for both national security and civil government missions. In order to protect this capability, the STS is to be afforded the degree of survivability and security protection required for a critical national space resource.

NMI 8610.19, Space Transportation System National Resource Protection, dated March 31, 1984, establishes policy and provides guidance for implementation of those security measures/systems to protect identifiable segments of the STS resource (Space Shuttle, associated upper stages, and related facilities). Two of the numerous security requirements of the NMI are:

(i) Providing security training for STS program and operations personnel (civil service and contractor) to assure proper awareness and response to the STS NRP requirements.

(ii) Protecting the facilities and systems associated with STS mission planning, training, turnaround, launch, flight control, landing, and related logistics and production capabilities.

MSFC's primary role in support of the STS is managing the development, production, refurbishment and logistics support of Shuttle propulsion systems. Major elements include the Space Shuttle Main Engine (SSME), the Solid Rocket Boosters (SRBs), and the External Tank (ET). MSFC-managed STS activities are performed at the Center, and at numerous contractor locations. Contractor locations include SRB production facilities in Utah, SSME production facilities in California, and ET production facilities in Louisiana. MSFC also has contractor-operated SRB refurbishment facilities at KSC. Therefore, STS NRP security responsibilities of MSFC include facility security at numerous locations and security training for thousands of civil service and contractor personnel. Additionally, MSFC's STS prime contractors have numerous suppliers and subcontractors who may also require STS security measures. The MSFC Security Division has primary responsibility for implementation of the Center's STS NRP program.

b. Industrial Security Program (ISP).

A separate but related NASA security program applicable to those MSFC STS NRP contracts which are classified is the DOD Industrial Security Program (ISP). NMI 1650.1A, Industrial Security Policies and Procedures, dated February 11, 1986, states that: "By agreement between the NASA Administrator and the Secretary of Defense, the Industrial Security Program (ISP) of the Department of Defense (DOD) has been extended to include NASA classified contracts." The NMI defines a classified contract as any contract which requires access to classified information by the contractor in the performance of the contract.

The security tasks/responsibilities of the Center on each NASA classified contract may vary. Two Center elements which have specific responsibilities under the ISP are the MSFC Security Division and MSFC Procurement Office. The Security Division provides security oversight/cognizance of MSFC classified contracts and provides technical security assistance to the Procurement Office contracting officers who are responsible for performing contract administration security functions on such contracts. This relationship within the Center is similar to the relationship of DIS and DCAS within DOD under the ISP. DIS provides security office cognizance over contractor facilities and also provides technical security assistance to DCAS which performs contract administration office security functions.

(1) Security Division.

In addition to the STS NRP Program, the MSFC Security Division administers the Center's overall security program including industrial security. NMI 1650.1A states that, under the DOD Industrial Security Program (ISP), "The standard security provisions of NASA contracts require the contractor to execute a DOD Security Agreement (DD Form 441) which binds the contractor to observe the provisions of the DOD Industrial Security Manual (ISM)." Security cognizance must be maintained over NASA classified contracts to include periodically reviewing contractor compliance with the ISP and providing certain security support services per NMI 1650.1A, paragraph 9. For NASA classified contracts performed at contractor facilities, the Defense Investigative Service (DIS) generally is requested, via a Contract Security Classification Specification (DD Form 254), to provide security cognizance to include the following security support services:

- (i) Executing Security Agreements (DD Form 441) with contractors.
- (ii) Conducting security surveys and inspections at contractor facilities.
- (iii) Granting contractor facility and personnel clearances.
- (iv) Investigating loss/compromise of classified information in the hands of contractors.
- (v) Serving as the primary point of contact on all security matters between the Government and contractor.

However, in those instances where contractor activities are performed on the installation, NMI 1650.1A, paragraph 5.c.1. authorizes the Director of that NASA installation to decide whether to retain security cognizance or request DIS to exercise security cognizance. In most instances the MSFC Security Division has generally retained from DIS those Cognizant Security Office (CSO) functions which are not restricted to DIS (items (ii), (iv) and (v) above). Those CSO functions which are retained by the Center should be specified on the DD Form 254, Contract Security Classification Specification, which is submitted to DIS by the Center and attached to the applicable NASA contract.

(2) Procurement Office.

DOD Regulation 5220.22-R, Industrial Security Regulation, dated November 1986, Appendix C, identifies certain contract administration industrial security functions for which the contracting officer of a classified contract is responsible. Included are such functions as controlling classified visits and the release or retention of classified material, approving expenditure of funds to meet security requirements, and reviewing reports of security violations and recommending appropriate action. Due to the extensive use of

contractors to support STS development, production, and operation, it is essential that responsibility for MSFC contracting officer security functions be properly established and performed on each classified STS contract. In this regard, the NASA Supplement to the Federal Acquisition Regulation, paragraph 18-42.171, states that when a contract issued by a NASA installation requires contractor performance on another NASA installation, the contracting officer security functions will be delegated to the contracting office of the NASA installation at the place of performance. Therefore, it is the responsibility of the MSFC Procurement Office to ensure that contracting officer security functions on MSFC contracts are properly delegated for work performed at other NASA installations.

Results of Audit

Security measures implemented by MSFC to protect the Space Transportation System did not comply with NASA directives to ensure proper protection of this national resource. Specifically, STS NRP security training was not always provided to MSFC personnel having STS responsibilities; security plans/surveys and monitoring at STS facilities, to include industrial security inspections, were not always accomplished; and the MSFC Procurement Office did not properly delegate the contract administration office security function on six STS contracts. These issues are discussed in more detail below.

1. STS NRP Security Training

The MSFC Security Division had not provided specific STS NRP security training to most STS program and operations personnel (civil service and contractor). Only a few management personnel at some of the STS contractors, such as Rockwell's Rocketdyne Division, had been provided STS NRP "briefings" as of March 31, 1987. The total number of personnel who will require the training had not been determined. However, at least 5,000, and possibly as many as 15,000, personnel having access to STS components and facilities at MSFC and at MSFC contractor locations have not received the security training required by NMI 8610.19 to assure proper awareness and response to STS NRP security requirements. As a result, there is less assurance the STS will be properly protected and the potential for security vulnerabilities is increased.

Examples of personnel who have not received the required STS security training include: (i) approximately 1,000 personnel (civil service and contractor) at MSFC who work in such facilities as the Huntsville Operations Support Center (HOSC) and the Central Communications Building, both of which support Shuttle launches; (ii) approximately 4,000 contractor personnel who produce the External Tank at the Michoud Assembly Facility; and, (iii) over 600 MSFC and contractor personnel at

MSFC's facilities on KSC where the SRBs and SRB parachutes are refurbished. Personnel of other STS prime contractors, and possibly even their subcontractors, also will require STS security training.

The MSFC Security Division had not established a records system to identify those personnel (civil service and contractor) who require and who have actually attended STS NRP training (briefings). Such records are required to assure that all current STS personnel, as well as newly assigned personnel, receive the required security training. Additionally, the SRB Memorandum of Agreement (MOA) between MSFC and KSC did not address STS NRP security training requirements for the more than 600 MSFC personnel (civil service and contractor) stationed at KSC. While MSFC continues to be responsible for the training, the alternative of having it provided by KSC should be considered.

While NMI 8610.19 establishes an STS NRP security training requirement, it does not define the specific training to be provided, nor does it address the content or frequency of refresher training. NASA Headquarters Flight Operations Branch (Code MOF) personnel stated that implementation of the training requirement was the responsibility of each NASA installation performing STS functions. However, we believe that the lack of specific training criteria provided by the NMI may have contributed to delays in accomplishing the training. Also, with STS functions assigned to various NASA installations, we see the potential for possible inconsistencies in STS security training.

In our opinion, revising the NMI to more specifically define the minimum STS security training requirements would ensure that all STS personnel receive proper and comparable training. In this regard, during our review the MSFC Security Officer, in an April 17, 1987 letter, National Resource Protection Training, recommended to the NASA Headquarters Security Officer that the development of standardized and uniform NRP training be considered as an agenda item of a future NRP working panel meeting.

RECOMMENDATION 1 (NASA Headquarters/MO)

Revise NMI 8610.19 to specifically define minimum STS NRP security training requirements for all STS operations and program personnel (civil service and contractor). The NMI should also address the content and frequency of any refresher training considered appropriate.

MANAGEMENT RESPONSE

The change from relying exclusively on the Space Shuttle as the primary space launch system to a mixed fleet system, has reduced the overall vulnerability of maintaining a space launch

capability. We are no longer strictly dependent on a single space launch system. NMI 8610.19, "Space Transportation System National Resource Protection," will be modified to reflect this change (enclosure #2).

A review of the security training requirements as stated in NMI 8610.19 concluded that this was an overstatement within the NMI at the time it was written. Normal security training and security awareness program is currently deemed to be satisfactory. However, we do agree that it would be prudent to address security training at a future NRP working panel meeting to assure ourselves that this conclusion is totally valid.

Another item contained within NMI 8610.19, is the requirement for security effectiveness and evaluation reviews after each flight and annually. We have concluded that this is an excessive requirement within the NMI (enclosure #2). Security incident reports combined with the NASA Security Office annual security audits are deemed to satisfy this requirement.

EVALUATION OF MANAGEMENT RESPONSE

The actions planned by NASA Headquarters are generally considered responsive to the intent of the recommendation. However, we have requested that NASA Headquarters (Code MO) advise us of the resulting STS NRP security training requirement after it has been reviewed at a future NRP working panel meeting. In defining the training requirement, it should be recognized that most personnel involved with the STS are contractor personnel and existing security training for these personnel may vary from contractor to contractor. According to personnel of the NASA Headquarters Security Office and the MSFC Security Division, there is no NASA or MSFC requirement for security training of contractor personnel who do not have a security clearance. Many MSFC STS contractor personnel do not have security clearances.

ADDITIONAL AUDITOR COMMENTS

The management response from NASA Headquarters states the vulnerability of NASA's space launch capability has been reduced by the change to a mixed fleet system. The response further states certain STS NRP requirements in NMI 8610.19 are overstated and excessive, and proposes modification and reduction of these requirements. However, on the basis of subsequent discussions with NASA Headquarters (Code MO) personnel, it is our understanding that activity for STS NRP will be accelerated rather than downgraded and STS NRP coverage will be expanded to include the expendable launch vehicles. For these reasons, we believe any changes made to the STS NRP Program should ensure the continued effective protection of

this national resource in accordance with Presidential Directive No. 42. The effectiveness of management actions taken on OIG recommendations relative to the STS NRP Program will be evaluated during our normal follow-up reviews.

RECOMMENDATION 2 (MSFC)

The MSFC Security Division should implement an STS NRP security training program to include:

- a. Identification of all MSFC personnel (civil service and contractor) who require STS NRP security training.
- b. Maintenance of training records showing who requires the training, who has received the training, and any required refresher/update status information.
- c. Establishment of MSFC STS NRP security training requirements and procedures in accordance with NASA Headquarters defined STS NRP security training criteria (see Recommendation 1). Such security training should address aspects, if any, of the STS NRP which are unique to MSFC.
- d. Establishment of milestones for accomplishing the required training.

MANAGEMENT RESPONSE

Implementation of an STS NRP security training program by the MSFC Security Division is pending issuance of a revised NMI 8610.19 pursuant to Recommendation 1. However, MSFC STS operations and program personnel who require STS NRP security training are being identified. Target completion dates: Subparagraph a., July 15, 1987; subparagraphs b., c., and d., depend on Headquarters issuance of revised NMI.

RECOMMENDATION 3 (MSFC)

MSFC Security Division should determine if required STS NRP security training for MSFC personnel (civil service and contractor) stationed at KSC could be more appropriately provided by KSC.

MANAGEMENT RESPONSE

The MSFC Security Division has determined that STS NRP security training when specifically defined in a revision of NMI 8610.19 could be more appropriately provided by KSC. The MSFC Security Division will negotiate with the KSC Security Office to effect a change of the SRB Memorandum of Agreement (MOA) accordingly. Target completion date: August 1, 1987.

EVALUATION OF MANAGEMENT RESPONSES

The actions planned by the Center are considered responsive to Recommendations 2 and 3.

2. Security Measures at STS Facilities

The MSFC Security Division had not reviewed the adequacy of either existing STS NRP security measures or industrial security at some NASA and contractor STS facilities, and annual STS NRP security effectiveness and evaluation reviews required by NMI 8610.19 were not yet being performed at all STS facilities. The MSFC Security Officer had recently begun conducting onsite security surveys and had visited two major STS contractor facilities in February and March 1987. However, more such visits to other STS facilities were needed. For example, the MSFC Security Officer stated that as of March 31, 1987, his office had not visited MSFC's contractor-operated SRB refurbishment facility at KSC for onsite monitoring of STS NRP security. There were no firm plans/travel dates established for performance of these activities; however, during our review, the Security Officer announced plans to visit KSC not later than June 30, 1987.

A Security Division visit to MSFC's SRB refurbishment facility at KSC was also required to evaluate the adequacy of compliance with industrial security measures required by NMI 1650.1A, Industrial Security Policies and Procedures, dated February 11, 1986, since MSFC did not release that inspection responsibility (security cognizance) to the Defense Investigative Service (DIS). Under the DOD Industrial Security Program DIS normally provides security cognizance, including security surveys and inspections, at NASA contractor facilities other than those on NASA installations. However, since MSFC Security Division personnel considered the MSFC SRB facility at KSC to be an extension of the MSFC installation, the DD Form 254 which MSFC provided to DIS on NAS 8-36300, specifically retained MSFC responsibility for ". . . industrial security inspection jurisdiction over onsite contractor elements at MSFC and KSC." However, the MSFC Security Division had not inspected industrial security at the Center's SRB refurbishment facility at KSC.

In addition to STS NRP oversight and industrial security inspection responsibilities at the Center's SRB operation at KSC, the MSFC Security Division also had retained responsibility for certain other "internal" security functions (within the boundaries of the SRB operation) while the KSC Security Office generally had responsibility for "external" security functions (outside the boundaries). The responsibilities of MSFC and KSC, respectively, for "internal" and "external" security are addressed by the SRB Memorandum of Agreement (MOA) between the Centers, dated February 5, 1987. The MSFC Security Officer stated he provides several of the

same "internal" security functions for MSFC's SRB operation at KSC as are normally provided to government-owned contractor-operated activities located on the MSFC installation. This situation existed because, as previously stated, MSFC's SRB operation at KSC was considered to be an extension of the MSFC installation although it is located hundreds of miles away.

The additional internal security functions provided by the MSFC Security Division include, but are not limited to, personnel security (for MSFC personnel), physical security (within the boundaries of the SRB activity), as well as two additional NMI 1650.1A Industrial Security Program Cognizant Security Office (CSO) responsibilities retained from DIS: (i) serving as the primary point of contact on all security matters between the Government and the contractor; and (ii) investigating the loss or compromise of classified NASA information in the hands of contractors. Although these two additional CSO responsibilities were not specifically addressed by MSFC's DD Form 254 on NAS 8-36300, both the MSFC Security Officer and DIS personnel stated NASA Security Offices generally perform these CSO duties on NASA installations.

Our limited review of security measures for the MSFC SRB operation at KSC disclosed two areas of concern:

(i) The SRB MOA between MSFC and KSC requires that MSFC provide "security monitors" for (day to day) required internal security. MSFC Shuttle Projects Office personnel at KSC stated that security services, to include such security monitors, were provided by the contractor, USBI-Booster Production Company, Inc. However, they could not identify a specific contractual requirement for provision of such services (NAS 8-36300). The contractor's security manager stated they provided gate guards only for "access control," not security monitors, and that the access control was oriented more toward safety requirements than security.

(ii) The SRB MOA also requires that MSFC prepare a facility security plan for its SRB refurbishment facilities at KSC. However, our review disclosed a facility security plan had not been prepared.

These conditions were not identified and corrected because the facilities had not been visited and subjected to a security review by the MSFC Security Division. KSC is generally responsible only for external security, outside the boundaries/fences, at MSFC's SRB operations at KSC. However, it may be more effective to have onsite KSC security personnel also responsible for internal security, within the boundaries/fences of MSFC's SRB facility to include certain STS NRP and industrial security cognizance functions. MSFC management should determine if the KSC Security Office should also be given responsibility for internal security at MSFC's SRB operation. We recognize that the MSFC Security Division

will continue to monitor security since MSFC funds, personnel, and equipment are utilized on assigned missions at this offsite location.

RECOMMENDATION 4 (MSFC)

MSFC Security Division should perform required onsite reviews and evaluations of the effectiveness of existing security measures at STS facilities for which they are responsible.

MANAGEMENT RESPONSE

The MSFC Security Division has performed NRP surveys at the (1) Rocketdyne Division, Canoga Park, California, and (2) Morton Thiokol facility, Brigham City, Utah. An NRP survey of the USBI facility at KSC is scheduled prior to June 30, 1987. The other STS facilities for which MSFC is responsible will also be surveyed. Target completion date: October 1, 1987.

RECOMMENDATION 5 (MSFC)

MSFC SRB Project Manager, in conjunction with the MSFC Procurement Office and Security Division, should implement appropriate security measures for the SRB facility at KSC. These should include:

- a. Preparation of required facility security plans for each MSFC facility at KSC.
- b. Clarification and contractual coverage of specific responsibilities of the contractor for provision of security services such as security monitoring.

MANAGEMENT RESPONSE

- a. The facility security plans are being developed.
- b. Security monitoring responsibilities will be jointly reviewed by the MSFC SRB Project Manager, Procurement Office, and Security Division. Target completion dates: Subparagraph a., June 30, 1987; subparagraph b., November 1, 1987.

RECOMMENDATION 6 (MSFC)

MSFC Security Division should determine if it would be more appropriate for onsite personnel of the KSC Security Office to have responsibility for internal security of the SRB operations at KSC.

MANAGEMENT RESPONSE

Concur. Target completion date: June 30, 1987.

EVALUATION OF MANAGEMENT RESPONSES

The actions taken and planned by the Center are considered responsive to Recommendations 4, 5, and 6. These actions, to include an initial onsite review of security measures at each MSFC STS facility, would be appropriate even if NASA Headquarters revises NMI 8610.19 to eliminate the requirement for security effectiveness and evaluation reviews after each shuttle flight and annually (see NASA Headquarters' response at Attachment 1).

3. Delegation of the Contracting Officer Security Functions

The MSFC Procurement Office did not always comply with the provisions of the NASA Supplement to the Federal Acquisition Regulation (FAR). NASA/FAR Supplement paragraph 18-42.171 states that when a contract issued by a NASA installation requires contractor performance on another NASA installation, the applicable contracting officer security functions will be delegated to the contracting office of the NASA installation at the place of performance. This delegation is required to assure that all security requirements are effectively accomplished on such contracts. Failure to comply with this requirement may have contributed to the existence of some of the conditions discussed in section two of this report.

NAS 8-36300 is a classified MSFC contract for the refurbishment of STS Solid Rocket Boosters (SRBs) and SRB parachutes. The majority of contract work is required to be performed at KSC. MSFC retained the Contract Administration Office (CAO) security functions over onsite contractor elements at KSC. Since this contract directly supports STS operations, the STS NRP program requirements are also applicable (i.e., personnel security training, facility security, etc.) to the contract.

The MSFC contracting officer for NAS 8-36300 acknowledged that the security functions should have been delegated to either KSC, or to the cognizant DCAS Office. He also stated that during the preliminary coordination between MSFC and KSC on those CAO functions to be delegated, KSC procurement personnel indicated they already had a substantial workload, and were therefore reluctant to accept all the functions MSFC desired to delegate. When MSFC subsequently prepared the Letter of Contract Administration Delegation, General (NASA Form 1430), only 20 selected CAO functions were delegated, and the security functions were omitted. It should also be noted that the NASA Form 1430 for NAS 8-36300 also covered five additional MSFC contracts on the SRB Project. Since these five contracts also required performance at KSC the CAO security functions for them also had not been properly delegated.

The Contract Security Classification Specification (DD Form 254) for NAS 8-36300 stated a Secret facility clearance was required and that the contractor will receive and generate classified documents and material. Since it was anticipated the contractor would have access to classified documents and material, and because the STS NRP Program security requirements are applicable, it is essential that the CAO security functions be effectively performed. Therefore, it will be necessary for MSFC to revise the CAO delegations to include the security functions as required by directives.

RECOMMENDATION 7 (MSFC)

MSFC Procurement Office should review the contract administration office delegations on all MSFC STS NRP related contracts requiring contractor performance on another NASA installation, including those identified by our review, to ensure that security functions are properly delegated.

MANAGEMENT RESPONSE

In discussions between Kenneth Atkins, Director, Office of the Inspector General - MSFC, and H. H. Wilson, Director, Procurement Office, it was agreed that the scope of this recommendation would be limited to NRP contracts. Accordingly, remedial actions will be limited to Space Shuttle element contractors. An immediate review will be made of those contracts specifically identified with the Space Transportation System National Resource Protection Program. This review will include external tank, solid rocket motor, solid rocket booster refurbishment, and space shuttle main engine contractors. Upon determination of security requirements, existing delegations will be discussed with the KSC Procurement Office and changes will be made as appropriate. Target completion date: October 1, 1987.

EVALUATION OF MANAGEMENT RESPONSE

The actions planned are considered responsive to the recommendation.

General Comments

NASA Headquarters and MSFC personnel advised us during our review that implementation of the STS NRP Program had been adversely impacted and delayed due to the Challenger disaster and a reduced level of funding. MSFC personnel stated the lack of manpower to support the STS NRP program had also delayed implementation. We recognize that some of the issues addressed in this audit report may also be attributed in part to these same circumstances. Additionally, it should be pointed out that the KSC-OIG is currently performing a more extensive review of certain aspects of the STS NRP Program, and the results of that audit could also potentially impact the NASA STS NRP Program.

We wish to express our appreciation for the support and cooperation provided by the personnel contacted during our review. Organizations contacted include the MSFC Security Division, Procurement Office, and Shuttle Projects Office (including the MSFC SRB Operations at KSC), as well as the NASA Headquarters Security Office and Director of Shuttle Operations.

D n

Kenneth R. Atkins

Enclosure
As Stated

JL:gp



National Aeronautics and
Space Administration

Washington, D.C.
20546

JUL 13 1987

Reply to Attn of MO

TO: W/Assistant Inspector General for Auditing

FROM: MO/Director, Operations Utilization

SUBJECT: Draft Report on Selected Aspects of the Space Transportation Systems
National Resource Protection (STS NRP) Program, Marshall Space
Flight Center (MSFC), Report No. A-MA-87-007

In response to your request of May 26, 1987, same subject, we have reviewed the subject draft and offer three comments (enclosure #1). In addition, we have initiated a review of NMI 8610.19, "Space Transportation System National Resource Protection," dated: March 31, 1984, (enclosure #3) and have included proposed modifications to this instruction (enclosure #2). The material contained within the two enclosures represents part of the product resulting from our detailed review of physical security.

We appreciate your timely investigation report which will be used to augment our review for implementation of a better overall NRP program for NASA.

If you or your staff require any additional information, please feel free to contact Mr. E. L. (Chuck) Keith tel. 453-2547 of my staff.

Wayne Miller

Enclosures (3)

cc:
M/A. D. Aldrich
R. J. Wisniewski
NIS/W. R. Puffer

Attachment 1

Page 1 of 10

Comments
on the

Draft Report on Selected Aspects of the Space Transportation Systems National Resource Protection (STS NRP) Program, Marshall Space Flight Center (MSFC), Report No. A-MA-87-007.

The change from relying exclusively on the Space Shuttle as the primary space launch system to a mixed fleet system, has reduced the overall vulnerability of maintaining a space launch capability. We are no longer strictly dependent on a single space launch system. NMI 8610.19, "Space Transportation System National Resource Protection," will be modified to reflect this change (enclosure #2).

A review of the security training requirements as stated in NMI 8610.19 concluded that this was an overstatement within the NMI at the time it was written. Normal security training and security awareness program is currently deemed to be satisfactory. However, we do agree that it would be prudent to address security training at a future NRP working panel meeting to assure ourselves that this conclusion is totally valid.

Another item contained within NMI 8610.19, is the requirement for security effectiveness and evaluation reviews after each flight and annually. We have concluded that this is an excessive requirement within the NMI (enclosure #2). Security incident reports combined with the NASA Security Office annual security audits are deemed to satisfy this requirement.

STATUS OF SUPPORT REQUIRED UNDER NMI 8610.19,
"SPACE TRANSPORTATION SYSTEMS NATIONAL RESOURCE PROTECTION,"
Dated: March 31, 1987

Background

This NMI was developed with anticipation that security incidents would significantly increase and the STS threat profile would increase, also. Therefore, we were looking for a dynamic situation and tried to cover all requirements to meet it. The increases did not materialize nor is there any indication that they will. In retrospect, the NMI was excessively stated, and it needs to be updated to reflect our experience base. Specific comments on security effectiveness and evaluation reviews, which were required after each flight and annually, and security training requirements are contained within the following paragraphs.

Definition

Under paragraph 4 of the NMI; "For the purposes of this instructions, the STS is composed of the Space Shuttle, associated upper stages, and related facilities." This needs to be expanded to include Expendable Launch Vehicles (ELV's), Spacelab, etc.

Policy

Under paragraph 5 of the NMI second sentence; "As designated, the STS is a vital element of the United States space program and is the primary space launch system for both United States national security and civil government missions." With the decision for a mixed fleet, the pressure to maintain the survivability of the STS has been somewhat alleviated. However, this in no way should be interpreted as a decrease in providing security protection.

Implementation Guidelines

Under paragraph 6 "National Resource Protection" of the NMI, there are several requirements which need modification. These are detailed under the following subparagraphs along with information of how each requirement was satisfied as appropriate.

1. Under subparagraph "b," an overall STS generic threat spectrum was developed by NASA HQ in 1980. Periodically, the NASA Security Office and the Governmental Affairs Division reviewed current intelligence data to validate the issued generic threat. Since there were no changes, verbal confirmation was made. The stated requirements in the NMI, "... are to be updated annually or as special situations arise...", is not a viable requirement.

2. Under subparagraph "c," the definition for "Category B. Mission Essential Assets" states, "A maximum delay of up to thirty days to restore loss capability ...," was determined to be very unreasonable and probably impossible to implement. This was a joint determination by AF and KSC personnel. Therefore, the thirty days should be six months. This was used by KSC in their NRP plan.
3. Under subparagraph "d," a review of the NRP implementation conducted by Code MO and NIS, strongly indicated good progress. NRP enhancements at KSC, AMES-DFRF and MSFC must continue to be made. At KSC and AMES-DFRF additional manpower has supported "... appropriate security intensification during critical STS operations."
4. Under subparagraph "e," "equivalent levels of protection between NASA field installations and DOD STS functional centers will be implemented," is not easy to judge. A civil facility and a military facility do not have the same threat spectrum. However, some personnel misinterpret this to be the same type of physical security; e.g., dual fences around SLC 6 requires dual fences around PAD's A & B. The real test is whether or not security incidents are being appropriately dealt with. To date we have no data to indicate otherwise.
5. Under subparagraph "f," "security training ..."; we have not identified anything in addition to normal security training and the current security awareness program. The conclusion is that this was an overstatement in this NMI.
6. Under subparagraph "g," "following each STS flight, the adequacy of the security measures/system for protection of the STS resource will be reviewed by each field installation." This requirement anticipated multiple security incidents for each flight that would be significant -- reportable. However, there was only a few reportable incidents and some of these were not flight specific (e.g., thefts of landing aids at Dakar). The joint NASA-AF Incident Reporting Agreement is a much better requirement and it reflects the current situation. Therefore, the NMI requirement needs to be modified.

7. Under subparagraph "h," "a security effectiveness and evaluation review will be conducted annually by each field installation," is again an overstatement within the NMI. The security incident reports followed up by field investigations as appropriate is deemed to be the right approach. The NASA Security Office conducts an annual security audit at each installation which should identify any significant security deficiencies. Therefore, this NMI requirement needs to be modified.

Responsibilities

Under paragraph 7 of the NMI, the responsibilities as delineated are currently accurate with exceptions of any references to security training and Code N's acceptance of NRP responsibility in FY'89.



Management Instruction

NMI 8610.19
Date March 31, 1984

Responsible Office: MO/Shuttle Operations Division

Subject: SPACE TRANSPORTATION SYSTEMS NATIONAL RESOURCE PROTECTION

1. PURPOSE

The purpose of this Instruction is to establish the Space Transportation System (STS) National Resource Protection (NRP) policy and to provide guidance for its implementation in compliance with Presidential Directive No. 42.

2. APPLICABILITY

This Instruction applies to NASA Headquarters and field installations, especially those that are responsible for implementing provisions for the protection of the STS resource.

3. SCOPE

There are two distinct programs involved in STS security: (1) those security measures/systems implemented to protect identifiable segments of the STS resource, and (2) protection of Department of Defense (DOD) classified information. This Instruction is limited to the protection of the STS resource through security measures/systems and/or through additional STS capability.

4. DEFINITION

For the purposes of this Instruction, the STS is composed of the Space Shuttle, associated upper stages, and related facilities

5. POLICY

The STS has been designated a vital national resource because of its unique space exploitation capability and the investment of the nation's resources in its development. As designated, the STS is a vital element of the United States space program and is the primary space launch system for both United States national security and civil government missions. In order to protect this capability, the STS will be afforded the degree of survivability and security protection required for a critical national space resource.

- d. To protect against the potential threat, requirements for security measures and/or additional operational capability will be developed by each field installation. With the approval of NASA Headquarters, additional security and/or operational systems to satisfy the requirements will be designed and implemented. The security measures/systems will be implemented for the duration of the STS program with appropriate security intensification during critical STS operations.
- e. Equivalent levels of protection between NASA field installations and DOD STS functional centers will be implemented. Emphasis in equivalency determination is to be placed on protection of the Space Shuttle and associated upper stages processing, launch and landing complexes at the Kennedy Space Center, Florida, and Vandenberg Air Force Base, California.
- f. Security training for STS program and operations personnel is essential to assure proper awareness and response to STS NRP. All installations with STS operations responsibility will provide training to its personnel both civil and contractor.
- g. Following each STS flight, the adequacy of the security measures/systems for protection of the STS resource will be reviewed by each field installation. Any reportable incidents are to be assessed for possible NRP impacts and any so identified are to be reported to NASA Headquarters.
- h. A security effectiveness and evaluation review will be conducted annually by each field installation. Results of those reviews will be forwarded to NASA Headquarters where an overall assessment of NRP effectiveness will be conducted for possible threat assessment modifications and/or redirection in NRP implementation.

7. RESPONSIBILITIES

a. Background

- (1) As a joint developer/user of the STS, the United States Air Force (USAF) as the DOD agent, shares with NASA the responsibility to protect the STS resource. The USAF will develop and maintain the DOD STS Survivability Plan which will be used as the basis for identifying STS "DOD mission-critical resources" and determine specific ground-threat vulnerabilities applicable to those resources.

March 31, 1984

NMI 8610.19

security systems, assessments and evaluations of security operations, detection of violations and violators and otherwise executing proper security actions for protection of the STS resource at their installations. All field installation reports are to be forwarded to both OSF and the NASA Security Office where a joint review will assess any need for changes in STS program direction.

—
/ JAMES A. ABRAHAMSON
Associate Administrator for
Space Flight

DISTRIBUTION:
SDL 1

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama
35812

Reply to Attn of:

DE01

JUN 1 1987

TO: M-DI/Kenneth R. Atkins

FROM: DE01/J. A. Bethay

SUBJECT: Response to Draft Report on Selected Aspects of the
Space Transportation System National Resource
Protection (STS NRP) Program (A-MA-87-007)

We have reviewed the subject audit report. The Center's
response to the recommendations directed to MSFC are
enclosed.

J. A. Bethay *JB*
Executive Assistant to the Director

Enclosure

**MSFC RESPONSE TO DRAFT REPORT ON SELECTED ASPECTS
OF THE STS NRP PROGRAM**

RECOMMENDATION 2

The MSFC Security Division should implement an STS NRP security training program to include:

- a. Identification of all MSFC personnel (civil service and contractor) who require STS NRP security training.
- b. Maintenance of training records showing who requires the training, who has received the training, and any required refresher/update status information.
- c. Establishment of MSFC STS NRP security training requirements and procedures in accordance with NASA Headquarters defined STS NRP security training criteria (see Recommendation 1). Such security training should address aspects, if any, of the STS NRP which are unique to MSFC.
- d. Establishment of milestones for accomplishing the required training.

MSFC RESPONSE:

Implementation of an STS NRP security training program by the MSFC Security Division is pending issuance of a revised NMI 8610.19 pursuant to Recommendation 1. However, MSFC STS operations and program personnel who require STS NRP security training are being identified.

TARGET COMPLETION DATES: Subparagraph a., July 15, 1987; subparagraphs b., -c., and d., depend on Headquarters issuance of revised NMI.

RECOMMENDATION 3

MSFC Security Division should determine if required STS NRP security training for MSFC personnel (civil service and contractor) stationed at KSC could be more appropriately provided by KSC.

MSFC RESPONSE:

The MSFC Security Division has determined that STS NRP security training when specifically defined in a revision of NMI 8610.19 could be more appropriately provided by KSC. The MSFC Security Division will negotiate with the KSC Security Office to effect a change of the SRB Memorandum of Agreement (MOA) accordingly.

TARGET COMPLETION DATE: August 1, 1987.

Enclosure

Page 2 of 4

RECOMMENDATION 4

MSFC Security Division should perform required onsite reviews and evaluations of the effectiveness of existing security measures at STS facilities for which they are responsible.

MSFC RESPONSE:

The MSFC Security Division has performed NRP surveys at the (1) Rocketdyne Division, Canoga Park, California, and (2) Morton Thiokol facility, Brigham City, Utah. An NRP survey of the USBI facility at KSC is scheduled prior to June 30, 1987. The other STS facilities for which MSFC is responsible will also be surveyed.

TARGET COMPLETION DATE: October 1, 1987.

RECOMMENDATION 5

MSFC SRB Project Manager, in conjunction with the MSFC Procurement Office and Security Division, should implement appropriate security measures for the SRB facility at KSC. These should include:

a. Preparation of required facility security plans for each MSFC facility at KSC.

b. Clarification and contractual coverage of specific responsibilities of the contractor for provision of security services such as security monitoring.

MSFC RESPONSE:

a. The facility security plans are being developed.

b. Security monitoring responsibilities will be jointly reviewed by the MSFC SRB Project Manager, Procurement Office, and Security Division.

TARGET COMPLETION DATES: Subparagraph a., June 30, 1987; subparagraph b., November 1, 1987.

RECOMMENDATION 6

MSFC Security Division should determine if it would be more appropriate for onsite personnel of the KSC Security Office to have responsibility for internal security of the SRB operations at KSC.

MSFC RESPONSE: Concur.

TARGET COMPLETION DATE: June 30, 1987.

RECOMMENDATION 7

MSFC Procurement Office should review the contract administration office delegations on all MSFC contracts requiring contractor performance on another NASA installation, including those identified by our review, to ensure that security functions are properly delegated.

MSFC RESPONSE:

In discussions between Kenneth Atkins, Director, Office of the Inspector General - MSFC, and H. H. Wilson, Director, Procurement Office, it was agreed that the scope of this recommendation would be limited to NRP contracts. Accordingly, remedial actions will be limited to Space Shuttle element contractors. An immediate review will be made of those contracts specifically identified with the Space Transportation System National Resource Protection Program. This review will include external tank, solid rocket motor, solid rocket booster refurbishment, and space shuttle main engine contractors. Upon determination of security requirements, existing delegations will be discussed with the KSC Procurement Office and changes will be made as appropriate.

TARGET COMPLETION DATE: October 1, 1987.

Reply to Attn of:

M-DI: 103-89

March 21, 1989

Thomas G. Fierke
Chief Counsel
Martin Marietta Manned Space Systems
P. O. Box 29304
New Orleans, Louisiana 70189

SUBJECT: Survey Results on Audit of Martin Anomaly
Reporting System, Michoud Assembly Facility,
Marshall Space Flight Center (A-MA-89-002)

The survey review on the subject audit conducted at Martin Marietta Manned Space Systems (MMMSS) has been completed. The objectives of our review were to assess: (a) how well the system identified the existence of problems with purchased hardware which does not conform to contract specifications; (b) the accountability aspects of the system to ensure that all such problems are properly addressed; (c) whether appropriate management levels of both NASA and the contractor are apprised of significant problems in a timely manner; and (d) whether subcontract cost/price adjustments are made when appropriate.

Our review included a review and evaluation of MMMSS procedures for identifying and reporting nonconformance problems with purchased hardware. Selected MARS documentation was analyzed to evaluate the propriety of actions taken to correct defects in hardware. We also analyzed the procedures relative to defective hardware corrected inhouse, and the controls established to ensure that the cost of such rework is recouped from vendors when warranted. In addition, reviews were also conducted relative to hardware identified as scrap on the MARS system, defective Government-Furnished Property (GFP), and problem identification on defects not considered as MARS type problems.

The survey showed that the Martin Anomaly Reporting System is effective in identifying the existence of problems associated with nonconforming hardware and ensures that all problems identified, whether MARS related or not, are properly addressed. The review also showed that prompt actions are being taken to advise the appropriate

vendors/subcontractors of receipt of nonconforming hardware and the disposition of such hardware. Where appropriate, requests are issued for compensation from the vendor for costs incurred to correct hardware nonconformances. In addition, procedures are in effect to ensure that NASA and the contractor are made aware of significant hardware problems in a timely manner.

Based on the results of the survey, no further audit work will be performed and the assignment will be closed. We wish to express our appreciation for the excellent support and cooperation extended by your personnel in accomplishing the survey.

Please call Tom Hassell or me if you have any questions or wish to discuss any aspects of the survey.

for Kenneth R. Atkins

cc: W/AIGA/Mr. Pelletier
SA31/Mr. Smelser
BE01/Mr. Alexander

Office of Inspector General
George C. Marshall Space Flight Center
John C. Stennis Space Center
P O Box 9028
Marshall Space Flight Center AL 35812

Reply to Attn of W: 147-90

April 26, 1990

TO: W/Assistant Inspector General for Auditing
FROM: W/OIG Center Director, MSFC
SUBJECT: Closing Memorandum on Survey of Advanced Launch
System Budget, Stennis Space Center (A-MA-90-005)

1. BACKGROUND

The Advanced Launch System (ALS) Program is a joint DOD/NASA program to design, develop, and operate the next generation of launch vehicles for the nation. The ALS Program goals are to develop a family of launch vehicles which yield a robust, reliable, high-volume/weight responsive capability at a greatly reduced cost per payload pound delivered to low earth orbit. An integral and important early part of the ALS Program is the Advanced Development Program (ADP) that will provide the foundation from which the program definition activities will incorporate and result in more cost effective systems.

The ALS Program is managed by a Joint Program Office headed by an Air Force program manager with a NASA deputy program manager. In the management structure, DOD will manage the systems engineering and integration, vehicle, logistics, and payload module. NASA was assigned management of liquid engine systems and focussed technology efforts, and Marshall Space Flight Center (MSFC) was designated lead center for the ALS program.

DOD initially accepted full funding responsibility for the program with any unique civil requirements, not addressed by the ALS baseline, being funded by NASA. However, this has somewhat changed as a result of the cutbacks in DOD programs, and NASA has agreed to fund certain aspects of the program in order to meet its requirements for a heavy lift launch vehicle. Funding for the Component Test Facility (CTF) to be constructed at Stennis Space Center (SSC) is expected to come from DOD.

The roles and responsibilities of SSC during the ADP include management oversight of ALS ADP propulsion test facility

modifications and construction at SSC, MSFC, and the Air Force Astronautics Laboratory. Additionally, SSC is responsible for the design, construction, activation, and test operation of the SSC CTF for turbopump assembly testing.

In accordance with the ALS Report to Congress, Full Scale Development (FSD) testing of major engine components and subsystems, engine systems, and multiple engine propulsion test articles will be accomplished at SSC upon the approval of the FSD Program.

2. OBJECTIVE

The objective of the review was to identify and evaluate reasons for program slippages and budgetary shortfalls associated with the ALS Program at SSC. Key emphasis was given to problem areas attributable to NASA management of the program; including planning, budgeting, and funding.

3. RESULTS OF SURVEY

Our survey of program slippages and budgetary shortfalls associated with the ALS Program at SSC disclosed information which warrants suspension of the review activities in this area. Budgetary procedures and controls for the program appear adequate and problems relative to construction schedule delays and budget increases for construction of test facilities seem to have been resolved between SSC and program managers at MSFC and Headquarters. The following data summarizes each area reviewed during the survey of the ALS program at SSC.

a. ALS Program Delays at SSC.

Our review of the SSC ALS activities identified two construction delays on the CTF at SSC that occurred since the onset of the program. In both cases, the problems causing the program slippages at SSC were not found to be the result of inadequate funding, but rather a postponement of construction of testing facilities due to a lag in the hardware development phases. In simple terms, it would not be feasible to construct test facilities without available program hardware to be tested on such facilities. As the engine design and development phases of the program were delayed, the requirements for an operable test facility also slipped. These slippages were not identified as being attributable to mismanagement of program resources by SSC officials.

b. ALS Budget Increases for Construction of Test Facilities at SSC.

Our review found that ALS budget increases for construction of the CTF at SSC were largely the result of poor estimating in the preliminary stages of planning and certain stretch-out costs (such as escalation costs) associated with construction schedule delays. Initially the CTF had been planned for operation beginning in FY 92 at a cost of \$40 million. However, due to poor cost estimates by Bechtel Corp. and program hardware slippages, construction cost estimates increased to \$64.7 million with a projected start-up in FY 93. The most recent increase resulted when delays occurred in contracting program hardware (May 89) and funding constraints were placed on the DOD FY 90 program. These factors caused slippages in the scheduled delivery of turbopumps to September 1993. The additional delay of the turbopumps to be tested caused further postponement of construction and increased escalation costs. Present plans are for the CTF to be operational in FY 94 at a construction cost of \$69.7 million.

The significant underestimating of initial construction costs was mostly due to a lack of time needed for proper estimating procedures to be followed. According to the SSC ALS project manager, MSFC ALS officials asked, on very short notice, if the CTF could be built for \$40 million. SSC, in turn, tasked Bechtel Corp. to review the figures and provide a conceptual cost estimate for the CTF. Bechtel came back with the answer that the CTF could be constructed for the \$40 million, but it was later discovered that Bechtel failed to recognize certain base costs involved in the construction effort that could not be proportionately distributed over the number of test cells. A cutback in the proposed number of test cells from nine to three would not reduce certain fixed base cost by the same ratio. One example of this type base cost is the Data Acquisition and Control System that had to be increased from the initial estimate of \$3 million to \$11.5 million.

No program delays at SSC were identified as resulting from the poor initial estimates and the additional funding for the construction effort is not expected to be a problem. ALS program managers at MSFC and Headquarters have indicated that funding for the revised construction estimates would be forthcoming as planned. To obtain reliable estimates for future construction of ALS facilities, MSFC has agreed to provide advance study funds to SSC when previous experiences cannot be used as a basis for cost estimating.

c. Installation Support Funds

SSC has not received any installation support funds (Fund Source III) in support of the ALS Program from Headquarters. These type funds are used to provide the various support requirements (utilities, computer equipment, fire protection, etc.) at SSC. With the increasing requirements from the ALS project placed on the support activities at SSC, a corresponding increase in funding levels for these activities should normally follow.

Fund Source III funds for the ALS Program are derived at NASA Headquarters by assessing a tax (burden) levy on ALS dollars received from DOD. Headquarters is to establish a basis for distribution of these funds. SSC has been informed that coming up with an approved funding distribution basis is causing the delay, but an allocation should soon be made.

The delay in receiving Fund Source III funding has not yet caused any significant problems at SSC, but the requirements for increased support activities will be greater as the ALS project progresses.

d. Operational Cost of the CTF

Getting MSFC and Headquarters to recognize projected costs of test facility operations has also been a problem for SSC. In the FY 88 and FY 89 five year program operating plans, SSC submitted requirements for future operations of the CTF. Neither MSFC nor Headquarters gave this consideration when approving the SSC plan. In both submittals, the projected requirements were disallowed.

MSFC and Headquarters have since recognized these operational costs as a valid requirement and have committed to approving the projections as identified in the FY 90 SSC plan. To date, no funding has been required for test operations for the CTF; therefore, no adverse impact has been recognized at SSC.

4. SUMMARY CONCLUSION

Budgetary shortfalls and schedule delays for the ALS Program have been realized at SSC. However, these concerns were not so much the result of mismanagement on the part SSC, but were realized due to program slippages in the hardware

development stages. In addition, poor construction estimates, caused by conceptual cost estimating and the short timeframe allowed for projecting construction costs of test facilities, were provided in the initial planning stages.

Also, requirements for CTF operation have been recognized by MSFC and Headquarters and commitments have been made to allow for the necessary funding in SSC budget submissions. SSC also has received commitments from Headquarters that installation support funds would soon be forthcoming.

None of the budget concerns have impacted significantly on SSC ALS activity. Under new management at MSFC and Headquarters, previous concerns over the ALS program at SSC have seemingly been resolved. In addition, MSFC has committed to funding advance cost studies for any major construction efforts on which past experience cannot be used as a guideline. Increases in the construction estimates for the CTF have been reviewed by MSFC and Headquarters and recognized as valid requirements for which DOD funding is anticipated. With most concerns having been eliminated, no recommendations appear necessary at this time.

Based on the survey results as discussed above, additional audit effort relative to the SSC ALS Budget is deemed unnecessary and this review is terminated.

Kenneth R. Atkins

National Aeronautics and
Space Administration

NAS

Office of Inspector General
George C. Marshall Space Flight Center
John C. Stennis Space Center
Code: M-DI
Marshall Space Flight Center, AL 35812

A-MA-92-003

Reply to Attn of:

M-DI

December 3, 1993

TO: BC01/H. W. Hallisey
FROM: M-DI/Ned Echerd
SUBJECT: Survey of Advanced X-Ray Astrophysics Facility
(AXAF) A-MA-92-003

The subject survey assignment is being terminated by this office, and no report will be issued. We intend to follow the development of AXAF-1 and will assess the need for future audit work as the project progresses.

If you have any questions, please call Tom Hassell or me at 544-0068.

Ned Echerd

cc:
W/DAIGA
BE01/L. Cucarola

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001



Reply to Attn of: W

FEB 22 1996

TO: S/Associate Administrator for Space Science

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report
Cassini Program Management
Assignment No. A-JP-94-003
Report No. JP-96-001

The NASA Office of Inspector General has completed an audit of Cassini Program Management. Nothing came to our attention to indicate that Cassini program management procedures and practices by NASA and JPL were not adequate for Cassini to meet its launch date in 1997. There were, however, risk areas identified that could affect Cassini's launch. These risk areas are described in the enclosed report.

We discussed a draft of this audit report with your office and with JPL management on January 18, 1996. A written response was received from your office on January 23, 1996. Appropriate changes were made to the report as a result of your input. Additionally, management comments included in your written response showing key activities since our audit work completion were included in the Management Comments section of the report (page 9).

Debra A. Guentzel

Enclosure

CASSINI PROGRAM MANAGEMENT

JET PROPULSION LABORATORY, CALIFORNIA

INTRODUCTION

The NASA Office of Inspector General (OIG) has completed an audit of Cassini program management. Cassini, whose objective is to explore Saturn and its moons, was first funded by Congress in Fiscal Year (FY) 1990 as part of "The Comet Rendezvous Asteroid Flyby (CRAF)/Cassini Program." In 1992, the CRAF program was canceled by Congress to reduce planetary exploration costs. NASA then restructured the Cassini program to reduce estimated development costs from \$1.68 billion to about \$1.46 billion. Total life cycle costs (e.g., development, launch, and operation costs) were also reduced from \$3.79 billion to about \$3.26 billion. The lack of required funding delayed the Cassini launch date by 18 months.

Mission. Cassini is now scheduled to launch in October 1997 aboard a Titan IV/Centaur launch vehicle. An extensive cruise period is required to reach Saturn, during which the spacecraft will fly by Venus (twice), Earth, and Jupiter to gain sufficient velocity to reach its destination. Upon arrival in July 2004, the spacecraft will begin a four-year study of the Saturnian system that will provide intensive, long-term observations of Saturn's atmosphere, rings, magnetic field, and moons. In conjunction with the observations conducted by the spacecraft, the Huygens Probe will be injected into the atmosphere of Saturn's moon Titan. The probe will conduct in-situ physical and chemical analyses of Titan's atmosphere. Further, the Cassini radar will map a significant portion of Titan's surface.

International Participation. Sixteen foreign countries and two U.S. Government agencies are participating in Cassini's development with NASA. The majority of the Cassini spacecraft and ground system is being developed at JPL. The major remaining Cassini components are being externally produced as follows: (1) the Titan IV/Centaur launch vehicle is being purchased by NASA from the Department of Defense (DOD) as part of an existing contract between the Air Force and Lockheed Martin; (2) the radioisotope heater units (RHUs) and radioisotope thermoelectric generators (RTGs) are being procured by

NASA from the Department of Energy; (3) the Huygens Probe is being provided by the European Space Agency (ESA); and (4) the high gain and one of the low gain antennas for the spacecraft are being contributed by the Italian Space Agency (ASI).

Outside Reviews. Since the restructuring of the Cassini program, there have been many outside reviews to provide assurance that the program is making progress in terms of cost, schedule, and technical performance. See Appendix A for additional information on these reviews.

Jet Propulsion Laboratory. The Jet Propulsion Laboratory (JPL) is a Federally Funded Research and Development Center (FFRDC) operated by Caltech under NASA contract NAS7-1260. The laboratory, staffed largely with Caltech employees, is a government-owned installation located in Pasadena, California.

Responsibilities. NASA has assigned JPL the overall program management responsibility for the Cassini program design and development. NASA's Cassini program oversight is provided by the Cassini Program Director and his staff, which are part of NASA Headquarters' Office of Space Science (Code S). This office ensures that the Cassini program is meeting NASA's program objectives.

OBJECTIVES, SCOPE, AND METHODOLOGY

OBJECTIVE

Our objective was to evaluate the adequacy of Cassini program management procedures and practices by NASA and JPL for Cassini to meet its launch date in 1997.

**SCOPE AND
METHODOLOGY**

To evaluate program management, we interviewed key personnel at NASA Headquarters Office of Space Science, NASA Headquarters Launch Vehicles Office, Lewis Research Center, Jet Propulsion Laboratory, and the Air Force Titan IV System Program Office (SPO) located at the Los Angeles Air Force Station. In addition, we reviewed documentation supporting management decisions, practices and procedures for the period 1990 through 1995 that support current and future activities. We reviewed Cassini cost, schedule, and performance indicators, and identified potential risks to the Cassini 1997 launch date. Further, we evaluated the measures being taken to reduce the risks. We also reviewed outside evaluations and reviews of the Cassini program to minimize our duplication of prior reviews.

**MANAGEMENT
CONTROLS REVIEWED**

Significant management controls were reviewed to determine whether cost, schedule, and performance indicators could be relied upon. The controls reviewed included the (1) budget process, (2) engineering change requests (ECR) process, (3) receivables/deliverables (REC/DEL) process, and (4) the monthly and quarterly management review process. See Appendix B for details on those management controls reviewed. No management control weaknesses were identified as a result of the audit.

AUDIT FIELD WORK

Audit field work was conducted from October 1994 through July 1995. The audit was performed in accordance with generally accepted government auditing standards.

OBSERVATIONS AND COMMENTS

OVERALL EVALUATION

Nothing came to our attention to indicate that Cassini program management procedures and practices by NASA and JPL were not adequate for Cassini to meet its launch date in 1997. There were, however, risk areas identified that could affect Cassini's launch. These risks stem largely from areas outside NASA's and JPL's direct management control, but steps are being taken toward solving or eliminating these launch risks. At the time of the audit, the most critical launch risks were related to the launch vehicle, environmental impact, launch approval, foreign deliverables, and launch period.

LAUNCH VEHICLE

NASA is dependent on the Air Force for the Cassini launch vehicle that is still being developed. The Cassini spacecraft is scheduled to use a Titan IV/Centaur launch vehicle to lift it through Earth's atmosphere and onto its flight path. The vehicle consists of two major components, the Titan IV and the Centaur (see Figure 1). The Titan IV is the first stage of the launch vehicle and is necessary to lift Cassini off the ground and to a high enough point for the Centaur to take over. The Titan IV consists of a core vehicle and external solid rocket motors. A solid rocket motor upgrade (SRMU) is planned for Cassini. The Centaur is the upper stage of the launch vehicle and is necessary to move Cassini onto the proper flight path.

Solid Rocket Motor Upgrade. Lockheed Martin is currently upgrading the solid rocket motor for the Air Force. The solid rocket motor (SRM) upgrade has not yet been used and NASA would like the Air Force to have at least one other successful launch, with another payload, before it is used to launch Cassini. There is another SRMU launch scheduled before Cassini but launch schedules are known to change. This upgrade (the SRMU) is designed to increase reliability and performance over the SRM currently in use. The Cassini program is baselined using the solid rocket motor upgrade, but Cassini was designed to be able to use either the SRMU or the SRM. According to officials at the Air Force Titan IV SPO, the SRM assembly line has been closed and the remaining SRM components have all been assigned to other launches. It is technically feasible for Cassini to use the SRM, but it would require exchanging SRMU components with another program for its SRM components at a cost that could be \$100 million. A decision to make a change to use the SRM would be required about 16 months (June 1996) before launch. Cassini program management officials at JPL

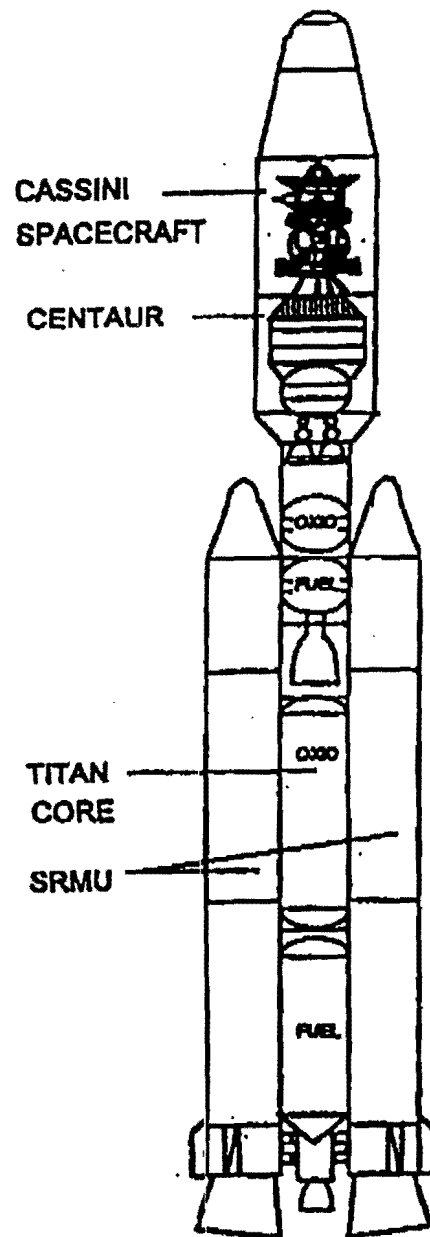


Figure 1 - Titan IV/Centaur Launch Vehicle with Spacecraft

are currently developing a decision package to support a commitment to one of the rocket motors.

Centaur. The assigned Cassini Centaur tank has questionable welds in a critical part of the assembly. The Air Force and its contractor feel that the Centaur tank is satisfactory and have not wanted to switch tanks for Cassini. To assure NASA of the tank's flight worthiness, the Air Force has agreed to conduct additional testing on the tank but cannot have the testing completed quickly enough to keep Cassini's schedule. During May and June 1995, NASA managers formalized their requests to the Air Force that Cassini be assigned a different Centaur tank. The Air Force informed NASA they will switch the Centaur tanks, but NASA would be required to pay the Air Force \$8.6 million--the cost of a replacement tank. The Air Force does not believe it could assign the rejected tank to another customer; therefore, NASA should be responsible to pay for the replacement. NASA is currently negotiating the replacement tank costs with the Air Force.

ENVIRONMENTAL IMPACT

Concerns about impacts to the environment could cause environmental groups to attempt to stop the launch through the courts. Impacts to the environment are determined through a public process under the National Environmental Protection Act. This process includes preparing a draft environmental impact statement (EIS), objectively assessing potential environmental impacts, collecting and responding to comments from the public, and publishing a final EIS. The last step in this process is a record of decision to document the decision to complete the mission. In Cassini's case, the public's comments have been evaluated and responded to and the final EIS will be published in the near future. Legal challenges, if any, could come at any time but are most likely after the publication of the final EIS.

LAUNCH APPROVAL

Safety concerns could cause an outside safety panel to recommend launch disapproval. Launch approval is a critical decision for all launches and is based on how safe the launch and mission are anticipated to be. In the case of a spacecraft like Cassini which has nuclear materials on board, these safety concerns and review requirements are greater. An independent safety review, still to be completed, is being conducted by an Interagency Nuclear Safety Review Panel (INSRP). The launch approval decision, made by the President or his delegatee, will not likely be made until a few

months before launch since the launch request is not scheduled until April 1997. Presently, safety data is still being provided to the INSRP.

FOREIGN DELIVERABLES

The two main foreign deliverables, which have been concerns of NASA and JPL management, are the Huygens Probe, provided by the European Space Agency, and the high gain antenna system, provided by the Italian Space Agency (ASI) (see Figure 2). The probe has not experienced any significant problems but requires close management attention because of its overall importance to the Cassini mission. The probe's mission is to conduct in-situ studies of Titan's atmosphere and surface. These studies cannot be duplicated by instruments on the orbiter.

Several difficulties, however, have occurred with the high gain antenna system. For example, in January 1995 the dynamic test model suffered a structural failure during vibration testing in Italy. Also, paint adhesion problems have occurred with the antenna's main reflector. These two problems have been worked out sufficiently so that the dynamic test model has been shipped to JPL for further testing. An additional concern with the antenna has been the lack of signed contracts between ASI and its contractors. Without signed contracts there is no assurance that the antenna will be completed on time. Recently, the ASI Board of Governors approved the contract language and was due to meet on the financing plan. NASA and JPL management anticipate that the contracts will be signed soon.

LAUNCH PERIOD

Cassini has a critical launch period of nearly six weeks during October and November 1997 due to the fact that Cassini requires a specific alignment of planets in order to use gravity assists. According to the Cassini program office, if the primary launch period is missed, NASA would incur an additional \$188 million in costs if Cassini is launched during December 1997, and \$444 million in costs if launched during March 1999. Additionally, large amounts of science would be lost if either of these two alternative launch periods are used. Consequently, it is essential that the planned program remain intact to meet the critical launch period dates.

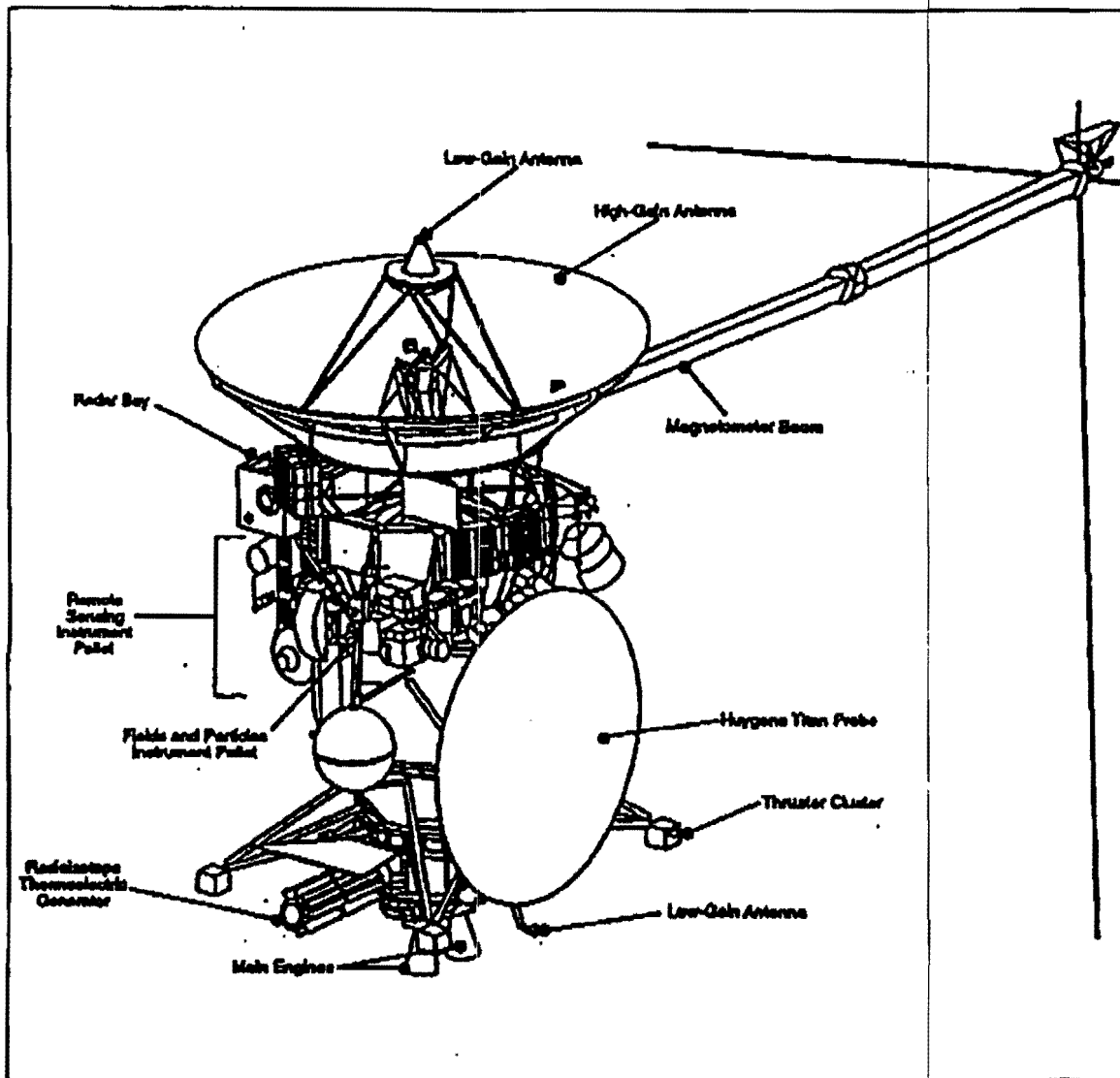


Figure 2 - Cassini Spacecraft

AUDIT COMMENT

NASA Headquarters Office of Space Science should continue to aggressively manage all potential areas of concern and continue to negotiate the additional Centaur costs with the Air Force. Continued effort to manage those concerns should help to minimize the risks to Cassini's launch.

**MANAGEMENT
COMMENTS**

Management concurred with the overall conclusions of the audit. However, they did offer the following comments to update the status of several risk areas identified in this report. These comments generally are based upon events that occurred after we had completed our audit work.

Comment 1. Adds to the first paragraph of the Introduction, page 1. "The mission operations cost was further reduced by creating a new architecture of the missions operation organization and different risk approaches, and later changes which reduced the cost to \$755M during the Recertification Review No. 3 in June 1994. These changes reduced the total life cycle costs to \$2.68 billion."

Comment 2. Refer to Launch Vehicle, Solid Rocket Motor Upgrade, page 4. "After the July 1995 completion of this audit, NASA and JPL agreed to use the Solid Rocket Motor Upgrade (SRMU). Additionally, NASA and JPL with Air Force cooperation are closely monitoring the first Titan IV SRMU launch vehicle's progress and taking management action as appropriate."

Comment 3. Refer to Launch Vehicle, Centaur, page 6. "After the July 1995 completion of this audit, the Air Force agreed to swap Centaur tanks for a cost to NASA of approximately \$900K to cover engineering and administrative costs associated with this change."

Comment 4. Refer to Environmental Impact, page 6. "After the July 1995 completion of this audit, the Final EIS was distributed to the public on July 20, 1995 and the Record of Decision was published on October 20, 1995."

Comment 5. Refer to Foreign Deliverables, page 7. "After the July 1995 completion of this audit, the Italian phase C/D contracts were signed by all parties near the end of September 1995."

JP-96-001

***EVALUATION OF
MANAGEMENT
COMMENTS***

Management Comments are responsive to issues discussed in this report.

JP-96-001

MAJOR CONTRIBUTORS TO THIS REPORT

***JET PROPULSION
LABORATORY***

Roger W. Flann, Audit Manager
Robert L. Williams, Auditor-in-Charge
Jimmy A. Walker, Auditor

Summary of Independent Reviews

Since the restructuring of the Cassini program in 1992, there have been many independent reviews to provide assurance that the program is making adequate progress in terms of cost, schedule, and technical performance. We evaluated these reviews to minimize duplication. The reviews include the following:

- GAO Report, "Space Science: Causes and Impacts of Cutbacks to NASA's Outer Solar System Exploration Missions," December 1993.
- GAO Report, "NASA Budgets: Gap Between Funding Requirements and Projected Budgets Has Been Reopened," May 1995.
- GAO Report, "Cassini Mission: Estimated Launch Costs for NASA's Mission to Saturn," May 1995.
- Cassini Independent Review Board Recertification Task Review Report, Task #1, Mission Robustness, September 1994.
- Cassini Independent Review Board Recertification Task Review Report, Task #2, Cassini-Huygens Reliability, January 1995.
- Cassini Independent Review Board Recertification Task Review Report, Task #3, Mission Operations and Data Analysis Costs, January 1995.
- Independent Annual Review Panel Report, October 1994.
- Independent Annual Review Panel Report, June 1995.

Discussion of Management Controls Reviewed

The following provides a detailed discussion of the management controls reviewed during our audit. We reviewed these management controls to determine whether cost, schedule, and performance indicators could be relied upon. No management control weaknesses were identified as a result of our audit. See the Management Controls Reviewed section of the audit report.

BUDGET

The budget process provides a method for JPL to request funding on a quarterly basis. The funds requests are initiated by the Cassini Resource Manager. Funding is provided in accordance with the funding guidelines as approved in the Program Operating Plan (POP). We traced a judgmental sample of three types of transactions to determine that accounting is consistent with other NASA programs being managed by JPL. We also verified that funds reporting is performed through the JPL institutional accounting processes, independent of the Cassini program.

ENGINEERING CHANGE REQUESTS

The engineering change requests (ECRs) approval process is a Cassini management control to ensure all engineering changes are proper, necessary, and that proper funding is available. We reviewed a sample of ECRs at JPL to determine their adequacy.

RECEIVABLES/ DELIVERABLES

For scheduling, the REC/DEL system is the major management control. It is used to track milestones for any activity where two parties are involved. We reviewed JPL's controls built into the system to assess their adequacy and independently tried to bypass the access controls.

MONTHLY/ QUARTERLY REVIEW

Monthly and quarterly reviews are conducted at all levels of management through the NASA Deputy Associate Administrator for Space Science to monitor progress of the Cassini project with respect to cost, schedule, and performance. Problems are discussed and resolved as a result of the monthly management review meetings. Follow-up on the resolution of problem areas is also discussed in subsequent monthly management reviews until a solution is complete. Further, every six months a project status report is prepared for Congress. We selectively reviewed information contained in the monthly management reviews and compared to other sources of information to judge its reliability and completeness.

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

RECEIVED

JAN 23 1996

ASSISTANT INSPECTOR GENERAL
FOR AERONAUTICS

JAN 28 1996

APPENDIX C



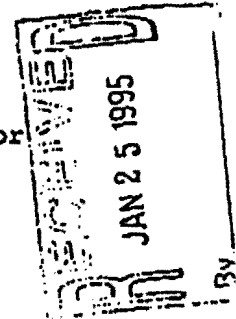
Reply to Attn of:

S

TO: W/Acting Deputy Assistant Inspector General for
Auditing

FROM: S/Associate Administrator for Space Science

SUBJECT: Draft Report on Cassini Program Management
(Assignment No. A-JP-94-003)



In response to your request, we have completed our review of the draft report. Review comments were jointly discussed between Dr. Earle Huckins (Cassini Program Director), Mr. Richard Spehalski (Cassini Program Manager), and Mr. Ronald Draper (Deputy Cassini Program Manager). The comments were relatively minor, and have no real impact on the overall conclusions of the audit. A consolidation of these comments has been transmitted to Mr. Roger Flann, the Audit Manager in the NASA Office of Inspector General at JPL and is enclosed. I do not feel that an exit conference will be required.

Wesley TV Antresb, Jr.

Enclosure

cc:
S/Dr. Huckins
JPL/264-441/Mr. Spehalski
Mr. Draper

C-1

JS-93-006

**AUDIT
REPORT**

**SURVEY OF SPACE SHUTTLE
PAYLOAD OPERATIONS**

JOHNSON SPACE CENTER

March 31, 1993



OFFICE OF INSPECTOR GENERAL



National Aeronautics and
Space Administration

Washington, D.C.
20546

MAR 31 1993

Reply to Airm of W/9959

TO: M/Associate Administrator for Space Flight
BF/Director, Financial Management Division

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report on Survey of Space Shuttle Payload
Operations, Assignment No. A-JS-91-006
Report No. JS-93-006

We have completed a survey of Space Shuttle Payload Operations. Our final report is enclosed. Work on this audit was performed under assignment number A-JS-91-006.

The survey objectives were to: (1) evaluate the methods used for managing and monitoring payload operations; and (2) review billing practices and procedures.

The survey results indicated that NASA is generally managing and monitoring the payload operations adequately. After the Challenger accident, commercial use of the Space Shuttle was significantly restricted. Payloads currently in the Shuttle manifest meet the three criteria in the NASA Authorization Act; therefore, we determined that a detailed audit will not be performed at this time. However, we noted that management actions are needed to ensure: (1) the standard price for reimbursable Shuttle flight services is not understated; and (2) final billings for reimbursable payloads are sent to the customers on a timely basis.

Recommendation 1 deals with the standard price charged for Shuttle flights and is addressed to the Associate Administrator for Space Flight. Recommendation 2 addresses final billings for payload operations and requires corrective action by the NASA Headquarters Financial Management Division.

A discussion draft report was provided to your offices on July 24, 1992. An exit conference was conducted on August 13, 1992. Necessary report changes resulting from the exit conference and the February 11, 1993, conference, were included in the draft report, dated February 12, 1993.

The Headquarters Financial Management Division provided its written response on February 26, 1993. The Office of Space Flight provided its comments to our draft report initially on March 3, 1993; however, the initial comments did not respond to the recommendation. We received a revised response on March 26, 1993. NASA concurred with recommendations 1 and 2. We consider recommendation 1 to be significant. Consequently, we request to be included in the Headquarters concurrence cycle for closing the recommendation.

for Richard J. Pelletier

Enclosure

cc:

JM-1/J. Troupe

JSC-BY/W. Thrower

W/P. Smith

R. Wesolowski

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
I.	DIGEST	1
II.	INTRODUCTION	3
III.	OBJECTIVES AND SCOPE	6
IV.	OBSERVATIONS AND RECOMMENDATIONS	8
	1. Standard Space Shuttle Price for Reimbursable Flight Services is Understated	8
	2. Final Billings for Reimbursable Payloads are Untimely	13
V.	GENERAL COMMENTS	15
EXHIBIT I	Payload Integration Process Overview	
EXHIBIT II	Shuttle Pricing for New Foreign and Commercial Users	
EXHIBIT III	Shuttle Pricing for Commercial Users Comparison of Flight Rate 12 versus 8 Fiscal Year 1988 Dollars in Million "Out-of-Pocket" Cost Policy	
EXHIBIT IV	Shuttle Pricing for Commercial Users Comparison of Flight Rate 12 versus 8 Fiscal Year 1988 Dollars in Million "Full Cost" Policy	
EXHIBIT V	Fixed Payment Schedule	
APPENDIX A	NASA Headquarters Response, Associate Administrator for Office of Space Flight, dated March 26, 1993	A-1
APPENDIX B	NASA Headquarters Response, Financial Management Division, dated February 26, 1993	B-1

ACRONYMS

CPF	Cost Per Flight
CSM	Customer Service Manager
DoD	Department of Defense
FMM	Financial Management Manual
FY	Fiscal Year
GAO	General Accounting Office
HQs	Headquarters
JSC	Johnson Space Center
KSC	Kennedy Space Center
LSA	Launch Service Agreement
NMI	NASA Management Instruction
NSTS	National Space Transportation System
OSF	Office of Space Flight
PIP	Payload Integration Plan
SSP	Space Shuttle Program

SPACE SHUTTLE PAYLOAD OPERATIONS

JOHNSON SPACE CENTER (JSC)

DIGESTIntroduction

The NASA Office of Inspector General has completed a survey of Space Shuttle Payload Operations. Work on this survey was performed under assignment number A-JS-91-006. The survey was conducted in accordance with the authority and responsibility contained in NASA Management Instructions 9910.1A and 1103.27B, dated June 16, 1989, and January 31, 1990, respectively.

The survey objectives were to: (1) evaluate the methods used for managing and monitoring payload operations; and (2) review billing practices and procedures.

Results of Survey

The survey results indicated that, generally, NASA is adequately managing and monitoring the payload operations. Subsequent to the Challenger accident in 1986, Presidential policy and the "NASA Authorization Act, Fiscal Year 1991," significantly restricted commercial and foreign use of the Space Shuttle. Payloads currently in the Shuttle manifest meet the three criteria for flying on the Shuttle: (1) the payload requires the unique capabilities of the Space Shuttle; (2) foreign policy consideration; and (3) National security considerations. Therefore, we determined that a detailed audit will not be performed at this time.

We noted, however, that: (1) the standard price for reimbursable Shuttle flight services is understated and NASA will not recover associated "Out-of-Pocket" estimated costs; and (2) the submissions of final billings to reimbursable customers are untimely. These areas are discussed in the "Observations and Recommendations" section of this report and are summarized in the following paragraphs.

1. Standard Space Shuttle Price for Reimbursable Flight Services is Understated

The \$130 million most recently approved standard service price is understated because it is based on 12 Shuttle flights per year instead of the 8-9 flights expected. Early post-Challenger projections of 12 flights per year did not fully take into account the increase in checkout and processing requirements introduced after the Shuttle accident. Subsequently, NASA Headquarters (HQs) issued a January 1992

news release stating the flight rate had been reduced to eight per year through Fiscal Year (FY) 1996 and nine flights per year thereafter. A reduction in the number of flights per year increases the cost of each flight because fixed and variable costs are allocated to fewer than 12 flights. Therefore, we estimate standard charges should increase to \$139 million under the current "Out-of-Pocket" pricing policy and to \$332 million under the full cost recovery policy. During our review, we found NASA scheduled flights for 14 reimbursable shared payloads for FYs 1994 to 1997. However, NASA management officials provided us updated baseline on February 11, 1993. As of February 3, 1993, NASA has scheduled flights for 11 reimbursable payloads for FYs 1994 to 1997. Of the 11 payloads scheduled, prices for 9 have been contractually established consistent with NASA policy and with inter-agency review. However, two payloads, 1.2 flight equivalents, do not have price commitments. If NASA does not adequately revise the standard price for these payloads, actual reimbursements from non-U.S. Government users will be approximately \$10.8 million "Out-of-Pocket" costs to \$242.4 million "Full Cost" less than NASA's costs. We recommended the NASA Associate Administrator for Space Flight revise the standard price charged to non-Government Shuttle users so that NASA fully recovers associated costs on future Shuttle flights. The Office of Space Flight agreed with the recommendation. (Page 8)

2. Final Billings for Reimbursable Payloads are Untimely

Final billings for reimbursable payloads have not been sent to the customer in accordance with the Financial Management Manual and the Launch Service Agreement. We reviewed three non-U.S. Government payloads and found that final billings for two of the payloads were not sent to the customer until two years after the launch date. Also, as of October 1991, NASA had not sent the final billing to the customer for a payload launched on January 20, 1990. We recommended NASA HQs Financial Management Division ensure final billings for payload operations are sent to the customer as promptly as possible. NASA Headquarters Financial Management Division concurred with our recommendation. (Page 13)

INTRODUCTION

The NASA Office of Inspector General, Johnson Space Center (JSC), has completed a survey of Space Shuttle Payload Operations. The survey was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMIs) 9910.1A and 1103.27B, dated June 16, 1989, and January 31, 1990, respectively.

The Space Shuttle Program (SSP) provides launch services to a wide range of payloads from small hand-held experiments to large laboratories and satellites. For payloads requiring services not available from the traditional launch services provided by expendable launch vehicle, the SSP provides a variety of man-supported services in Space, and the return of the vehicle crew, equipment, and products to Earth.

NMI 8610.12A defines a payload as: "A specific complement of instruments, space equipment, and support hardware carried into space to accomplish a mission or a discrete activity in space." The Space Shuttle offers a wide range of payload accommodations. Payloads are categorized as dedicated, standard, small, and middeck. Additional services and accommodations are also available depending on payload needs and the capabilities available to the SSP. Each category of payload is defined as follows:

- Dedicated Payload: One which requires the total cargo-carrying capability and/or services provided by the Space Shuttle Orbiter to support a single payload.
- Standard Payload: A payload installed in the Orbiter payload bay using standard payload accommodations which are available for up to four per flight and are allocated according to the load factors. The load factor will determine whether its a primary or secondary payload.
- Small Payload: Payload which does not require the full range of standard accommodations.
- Middeck Payload: Payload or experiment requiring pressurized crew compartment accommodations.

Standard services are those Space Shuttle services that are provided to the user as part of the standard Space Shuttle charge. There are two pricing concepts for reimbursable payloads. The first pricing concept is "Out-of-Pocket" costs which includes the cost of supporting commercial customers over and above the Shuttle baseline capability provided for Government launches. This concept includes the materials and services operations elements on a full cost basis, but launch operations and flight operations on an additive or variable

basis. The "Full Cost" pricing concept charges the average cost for each launch, including the materials and services operations elements, launch operations, flight operations, network support, Research and Program Management, and the use fee.

A shared flight is one that is sold to two or more users. These users will pay only a percentage (charge factor) of the dedicated flight price based on launch weight and length. An example of price calculation is shown below.

The greater of:

$$\text{Weight Load Factor} = \frac{\text{Payload Up Weight (Lbs)}}{\text{Shuttle Up-Wt Capability}}$$

or

$$\text{Length Load Factor} = \frac{\text{Payload Length (Ft)}}{\text{Cargo Bay Length}}$$

$$\text{Charge Factor} = \frac{\text{Load Factor}}{0.75}$$

$$\text{Shared Flight Price} = \text{Dedicated Flight Price} \times \text{Charge Factor}$$

The Office of Space Flight (OSF) is responsible for overall management of the SSP. During the period of the review, the Transportation Services Division within OSF handled Shuttle flight scheduling, negotiation and implementation of customer agreements, and financial matters concerning payloads. A Customer Service Manager (CSM) is assigned to: (1) negotiate individual payload agreements; and (2) monitor the efforts of the NASA field Centers responsible for detailed mission planning, payload integration, and launch of the customer's payload.

Several NASA Centers are involved with payload activities, ranging from development of scientific experiments to payload operation during a flight. The SSP Office at JSC manages the development and operation of the Space Shuttle. A Payload Integration Manager is assigned to each customer as the single technical point of contact between the SSP and the customer. The Kennedy Space Center (KSC) is responsible for implementing the activities associated with preparing the Space Shuttle and its payloads for launch, landing, and postflight services. A Launch Site Support Manager is assigned as a single point of contact between the customer and KSC for all launch site support and payload processing activities. Other NASA Centers, such as Goddard and Marshall, may provide support for a specific payload.

The first step in the payload integration process is the customers' submission of a NASA Form 1628, Request for Flight Assignment, to NASA Headquarters (HQs). A Launch Service Agreement (LSA) between the customer and NASA is negotiated by NASA HQs as required. The integration process consists of the development and detailed implementation of a Payload Integration Plan (PIP) and associated documents. The PIP, as referenced in the Launch Services Agreement, is a formal agreement for all of the launch services. Exhibit I describes the activities associated with the payload integration process.

The SSP supports payloads for NASA, NASA sponsored, Department of Defense (DoD), and non-U.S. Government reimbursable customers. After the Challenger accident in 1986, Presidential policy and the "NASA Authorization Act, Fiscal Year 1991," significantly restricted commercial and foreign use of the Space Shuttle. Payloads currently in the Shuttle manifest meet the three criteria for flying on the Shuttle: (1) the payload requires the unique capabilities of the Space Shuttle; (2) foreign policy consideration; and (3) National security considerations.

A discussion draft report was provided to NASA management on July 24, 1992, and an exit conference with NASA Headquarters officials was held on August 6, 1992. Necessary report changes resulting from the exit conference and the February 11, 1993 conference were included in the draft report. NASA Headquarters responses are included as Appendices A and B in this final report.

OBJECTIVES AND SCOPE

The survey objectives were to: (1) evaluate the methods used for managing and monitoring payload operations; and (2) review billing practices and procedures. We also assessed whether NASA is in compliance with the "NASA Authorization Act, Fiscal Year 1991, Section 112, Space Shuttle Use Policy."

The survey focused on non-U.S. Government reimbursable payloads. The scope of the survey included: (1) reviewing the payload integration process; (2) interviewing HQs and JSC management officials to determine their roles and responsibilities for payload operations; (3) reviewing policies and procedures for managing and monitoring the payload operations; (4) reviewing Shuttle pricing for reimbursable payload; and (5) reviewing the billing policies and procedures. The field work was performed from June 1991 through November 1991.

The survey was performed in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances. The primary internal controls reviewed included applicable NASA regulations and provisions in the LSA relating to the billing procedures.

The following significant internal controls were identified and tested for compliance to the extent considered necessary to accomplish the survey objectives.

- Reimbursement for Shuttle services provided to non-U.S. Government Users per National Space Transportation System (NSTS) 07700 Volume XIV, "Space Shuttle System Payload Accommodations."
- Procedures for determining, allocating, and billing costs applicable to reimbursable agreements between NASA and non-U.S. Government customers, including foreign governments as stipulated by the Financial Management Manual (FMM) 9090.
- Policies and procedures for non-U.S. Government users of Shuttle services in accordance with 14 Code of Federal Regulations 1214.102.
- Segregation of duties and final billing reports.
- Financial arrangements provisions in the LSA Article VI in compliance with NMI 8610.8A.
- Payments process in accordance with LSA schedules.

Except for the conditions reported in the "Observations and Recommendations" section, nothing was observed during the survey which indicated that other controls were not effective.

Our survey methodology consisted of discussions with: (1) the CSM for Transportation Services; (2) representatives of NASA HQs Financial Review and Analysis Branch; and (3) JSC's Central Resources Control, Property Accounting, and Reimbursable Branch personnel. Also, we reviewed the Agency Reimbursable Reporting System, JSC's Basic Accounting System, and the final billings and customer payments for three payloads, Spacelab D-1, AUSSAT 1 and 2, and SYNCOM IV.

OBSERVATIONS AND RECOMMENDATIONS

NASA's policies and procedures for managing and monitoring the payload operations are generally adequate. Subsequent to the 1986 Challenger accident, Presidential policy and the NASA Authorization Act, Fiscal Year 1991, significantly restricted the use of the Space Shuttle for commercial payloads. Payloads currently in the Shuttle manifest meet the three criteria for flying on the Shuttle: (1) the payload requires the unique capabilities of the Space Shuttle; (2) foreign policy consideration; and (3) national security consideration.

We noted, however, that: (1) the standard price for reimbursable Shuttle flight services is understated and NASA will not recover actual "Out-of-Pocket" costs; and (2) the submissions of final billings to reimbursable customers are untimely. The specific conditions, their causes, and recommended actions are discussed in the following sections.

1. Standard Space Shuttle Price for Reimbursable Flight Services is Understated

If NASA does not adequately revise the standard price for reimbursable Shuttle flights, actual reimbursements from non-U.S. Government users will be approximately \$10.8 million "Out-of-Pocket" costs to \$242.4 million "Full Cost" less than NASA's costs. The \$130 million most recently approved standard service price is based on 12 Shuttle flights per year. However, early post-Challenger projections did not fully take into account the increase in checkout and processing requirements introduced after the Shuttle accident. NASA HQs issued a January 1992 news release stating the flight rate has been reduced to eight per year through Fiscal Year (FY) 1996 and nine flights per year thereafter. As of February 11, 1991, NASA had scheduled flights for 14 reimbursable shared payloads for FYs 1994 to 1997. Therefore, we estimate the standard charge should be \$139 million under the current "Out-of-Pocket" pricing policy or \$332 million under the full cost recovery policy.

The Space Shuttle pricing policy allows a standard fixed price for a dedicated launch with associated standard services available to all customers, and charges for optional services unique to individual customers. Standard services are those services that the NSTS provides to all customers for transportation of payloads to low-Earth orbit. Specifically, Space Shuttle standard launch services include: (1) launch from KSC; (2) ground operations; (3) five-person flight crew; (4) payload deployment; (5) Orbiter flight planning service; (6) on-orbit payload operations; (7) transmission of limited payload data between the Orbiter and the Mission Control Center;

(8) NASA payload safety reviews; (9) Space Shuttle related training for crewmembers and ground personnel; and (10) integration of approved payloads into cargo manifest and flight schedules.

NASA has established \$130 million (FY 1988 dollars) for a dedicated flight price for reimbursable customers who are eligible under National Space Policy and NASA manifesting rules to use the Shuttle. We believe the \$130 million reimbursable price is significantly understated and NASA will not recover associated "Out-of-Pocket" costs for Shuttle flights.

It has been NASA's pricing policy to charge the standard services for commercial and DoD payloads based on the estimates of the "Out-of-Pocket" costs of Cost Per Flight (CPF). The reimbursable price for Shuttle flight services represents NASA's estimate of the average CPF. Under this "Out-of-Pocket" pricing approach, NASA charges the user for the full average CPF for flight hardware and propellants, and only the variable costs for flight operations and launch operations. The \$130 million standard price was based on a projected rate of 12 flights per year. (See Exhibit II.)

NASA's early post-Challenger projections did not fully take into account the increase in check-out and processing requirements introduced after the Shuttle accident. In December 1991, the General Accounting Office (GAO) issued a report entitled, Space Shuttle: NASA Faces Challenges in its Attempt to Achieve Planned Flight Rates. The GAO report stated: (1) the agency has not achieved its planned flight rate for any year; and (2) the maximum flight rate will be only seven or eight if NASA continues to experience processing delays averaging 45 days.

NASA's response stated: "With regard to flight rates, it is clear that the early post-challenger projections did not fully take into account the increase in checkout and processing requirements introduced after the accident. Since then, understanding the effect of this increase has matured. Encouraged by the accomplishment of eight flights in fiscal year 1991, we feel that the buildup to ten flights a year, as shown in our August 1991 manifest, is a realistic target." In January 1992, NASA HQs issued a news release stating the flight rate had been reduced to eight per year through FY 1996 and nine flights per year thereafter.

We believe the reduction in the projected Shuttle flight rate, from 12 to 8 and 9, requires a calculated increase in the reimbursable price charged to non-Government Shuttle users so that NASA fully recovers "Out-of-Pocket" costs. NASA's CPF assessment submitted with its FY 1993 budget to the Office of Management and Budget indicated the estimated reimbursable Shuttle prices vary inversely with different projected flight rates. In addition, NASA is currently considering the imple-

mentation of a full cost recovery policy for Shuttle payloads. This will require a significant increase in the reimbursable price.

Based on a projected Shuttle flight rate of eight per year, we estimate that the standard charge for reimbursable payload services should be \$139 million under the current "Out-of-Pocket" pricing policy or \$332 million if NASA implements a full cost recovery policy. As of February 1993, the Agency has scheduled 11 reimbursable payloads during FYs 1994 through 1997. They are:

- Spacelab 2 through 7 (price fixed)
- SFU retrieval (price fixed)
- Eureka 2 launch and retrieval (price fixed)
- JFD (price open)
- Spacelab E1 (price open)

Most of the payloads will not be flown on dedicated flights but will be shared payloads with NASA or other commercial customers. We also recognize that of the 11 reimbursable payloads scheduled between FY 1994 and FY 1997, prices for 9 have been contractually established consistent with NASA policy and with inter-agency review. However, 2 payloads, 1.2 flight equivalents, do not have price commitments. If NASA does not adequately revise the standard price for the 2 reimbursable payloads, associated "Out-of-Pocket" costs or "full cost" will exceed related reimbursable receipts from non-Government users by approximately \$10.8 million to \$242.4 million.

We compared the current standard pricing for commercial users, which is based on the "Out-of-Pocket" pricing policy and an annual flight rate of 12, with the "Out-of-Pocket" costs based on the actual annual flight rate of eight. (See Exhibit III.) To be consistent between FYs in our comparison, we performed our computations in FY 1988 dollars. Our calculation of the potential "Out-of-Pocket" costs not recovered is as follows:

SSP PRICING OPTIONS (Flight Rate 8)	\$139 Million
SSP PRICING OPTIONS (Flight Rate 12)	<u>130</u> Million
Potential "Out-of-Pocket" Costs per Flight not Recovered per Flight	\$ 9 Million
	<u>X 1.2</u>
Total Potential "Out-of-Pocket" Costs not Recovered for Four Flights (\$9 Million x 4 flights)	<u>\$ 10.8</u> Million

This "Out-of-Pocket" costs approach included the materials and services operations elements on a full cost basis but included only variable costs for launch operations and flight operations. This pricing policy also excluded network support, research and program management, and the use fee. A contingency cost was included to cover cost increases and/or the reflight scheduling insurance.

NASA is currently considering implementation of a full cost recovery policy for Shuttle payloads because NASA is entering the Space Station era with an increasing number of reimbursable partners. Under the full pricing policy, NASA can recover the marginal costs for the mission as well as any costs which are unique to that mission. NASA's policy is to examine all pricing options and update the standard payload price when it is necessary. We compared the current standard dedicated payload pricing for commercial users, which is based on the "Out-of-Pocket" pricing policy and an annual flight rate of 12, with the full cost recovery policy based on the actual annual flight rate of eight. (See Exhibit IV.) Our calculation of the potential full cost not recovered is as follows:

SSP PRICING OPTIONS (Full Cost Policy) (Flight Rate 8)	<u>\$332</u> Million
SSP PRICING OPTIONS (Out-Of-Pocket Policy) (Flight Rate 12)	<u>130</u> Million
Potential "Full Cost" Not Recovered per Flight	<u>\$202</u> Million
	<u>X 1.2</u>
Total Potential "Full Cost" not Recovered (\$202 Million X 4 Flights)	<u>\$242.4</u> Million

RECOMMENDATION 1

We recommended the NASA Associate Administrator for Space Flight revise the standard price charged to non-Government Shuttle users to: (1) at a minimum, charge \$139 million to recover NASA "Out-of-Pocket" costs; or (2) if a full cost pricing policy is used, revise the price to \$332 million so that NASA recovers full costs on future Shuttle flights.

MANAGEMENT RESPONSE

We concur with the essence of this recommendation. The most recent flight price of \$130 million (FY 88 \$'s) was developed in 1990 and was intended for a specific list of Shuttle customers. This price is no longer being used for new

users. Once a decision is made as to the basis of a new Shuttle price out-of-pocket, full cost, or otherwise, the actual dollar value will be from the most current cost-per-flight information available. The Office of Space Flight normally updates its Shuttle cost-per-flight analysis as part of the annual budget to Congress in January of each year.

EVALUATION OF MANAGEMENT RESPONSE

The Office of Space Flight's actions to ensure the use of the most current cost-per-flight information to recover "out-of-pocket" or "full cost" on future Shuttle flights are responsive to the recommendation.

2. Final Billings for Reimbursable Payloads are Untimely

Final billings for reimbursable payloads have not been sent to the customers in a timely manner as required by the LSA and the FMM. The billings were not sent primarily because the performing Centers had not yet submitted their final cost information to Headquarters. Delays in sending final bills to customers results in NASA not receiving their money in a timely manner, and increases the cost of Government borrowing.

LSA Article VI, 17. "Final Billing," requires that NASA send a final billing to the customer as promptly as possible (approximately 12 months) after completion of the last service provided for each payload launch. Each final billing includes a retroactive escalation adjustment of all previous escalated payments for the particular payload launch using the appropriate value of the Bureau of Labor Statistics Index. The final billing also addresses any difference between the estimates of governmental costs included in progress payments to date and the actual costs incurred by NASA.

The launch price is paid to NASA according to the fixed payment schedule. At the time of payment, the portion of the launch price that is fixed in base year dollars is then escalated to current dollars using the Bureau of Labor Statistics Index. Generally speaking, optional services are paid for at the time the service is performed. (See Exhibit V, Fixed Payment Schedule.)

FMM 9090-11 c. established guidelines applicable to reimbursable agreements with non-U.S. Government customers for other than expendable launch vehicle services. According to FMM 9090-11 c. (1) (e), the performing installation is required to identify the final cost data as of the "final billing" and include a copy of the reconciliation of the final cost report to the installation records. Several NASA Centers are involved with activities in support of NSTS customers. NASA HQs is responsible for: (1) consolidating the final cost data from the performing Centers; (2) reconciling the data with the Reimbursable Obligation and Cost Reporting System; and (3) sending the final billing to the customer.

We reviewed three non-U.S. Government payloads and found that final billings for two of the payloads were not sent to the customer until two years after the launch date. As of October 1991, NASA had completed only one non-U.S. Government reimbursable payload since the Challenger accident in 1986. SYNCOM IV - 5 was launched in January 1990, and NASA had not sent the final billing to the customer because the performing Centers had not submitted their final cost to NASA HQs for the final billing. Other reasons for late billing include the early stage of the Shuttle reimbursable program, the associated learning curve, and the initial backlog of 44 bills at the time of our review.

We believe NASA should promptly send the final billing to the customer after completion of the last service provided for each payload launch.

RECOMMENDATION 2

We recommended NASA HQs Financial Management Division ensure final billings for payload operations are sent to the customer within 12 months after the completion of the final service.

MANAGEMENT RESPONSE

We agree with your recommendation that we should final bill within 12 months of completion of the last service provided for each payload launch. The comments included in the report stating that we have not billed customers for 2 years after the launch date are, therefore, not relevant and do not support the revised recommendation. Services are furnished to customers after the date of launch; until these have been completed, the 12-month period does not start. We are in the process of improving our procedures by establishing a definitive date that can be used for the start of the 12-month period.

We have two further comments. The last sentence of the first paragraph on page 21 is incorrect. The bulk of these agreements are for a fixed price which is deposited in advance by non-Federal customers, delays in final billing do not, therefore, significantly impact the cost of Federal borrowing. For the same reason, the last sentence of the third paragraph is misleading, optional services are also paid in advance by non-Federal customers.

EVALUATION OF MANAGEMENT RESPONSE

The actions taken and planned by the Headquarters Financial Management Division are responsive to the recommendation.

We recognize that the bulk of the launch service agreements are for a fixed price which is deposited in advance by non-Federal customers. However, each final billing includes a retroactive escalation adjustment of all previous escalated payments for the particular payload launch.

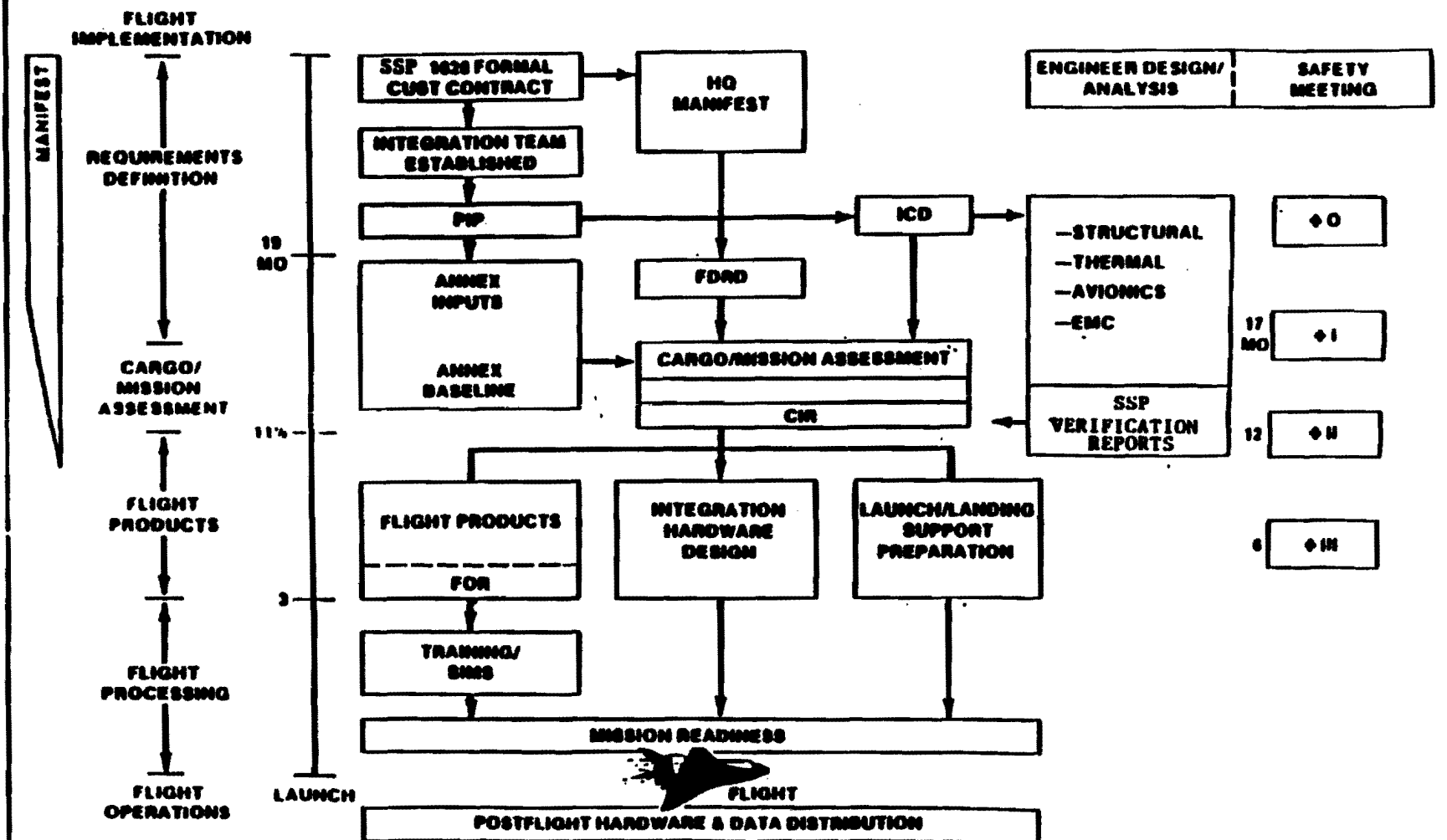
GENERAL COMMENTS

During our survey, we noted that NASA had not fully complied with the "NASA Authorization Act, Fiscal Year 1991, Section 112." The Act required NASA to submit a report to Congress: (1) setting forth a plan for implementing the Space Shuttle Use Policy; and (2) certifying that payloads scheduled to be launched on the Space Shuttle for the next four years are consistent with the use policy. The policy required the Administrator to submit the report and the certification within six months after the date of enactment of the Act. The Act was enacted on November 16, 1990, NASA submitted the report and certification on October 31, 1991. The NASA Administrator should ensure that the certification is submitted annually on a timely basis as required by the Act.

We also noted that NASA was not timely in revising its outdated 1977 policies on reimbursement for Shuttle services provided to non-U.S. Government users. NASA revised these policies and consolidated into NMI 8610.8A, "General Provisions Regarding Space Shuttle Flights of Cargo-Bay Payloads for Non-U.S. Government Reimbursable Customers," on December 31, 1991. NASA management officials acknowledged that the delay of the revision was as a result of various deviations from NMI 8610.8, "Reimbursement for Shuttle Services Provided to non-U.S. Government Users," and NMI 8610.9, "Reimbursement for Shuttle Services Provided to Civil U.S. Government and Foreign Users Who Have Made Substantial Investment in the STS Program." The NASA Administrator should ensure the policies and procedures are updated in a timely manner to provide the future reimbursable customers general provisions regarding Space Shuttle flights of cargo-bay payloads.

We appreciate the courtesy, assistance, and cooperation extended by NASA HQs and JSC personnel contacted during our review.

PAYLOAD INTEGRATION PROCESS OVERVIEW



SHUTTLE PRICING FOR NEW FOREIGN AND COMMERCIAL USERS FY88 \$ IN MILLIONS

	FY91 Congressional Budget	
Flights	12	
Flight Operations	9.4	Additive Cost
Launch Operations	9.0	Additive Cost
Propellants	1.6	Full cost
Solid Rocket Booster	19.5	Full Cost
Solid Rocket Motor	14.5	Full Cost
External Tank	10.6	Full Cost
SSME	8.5	Full Cost
Orbiter/GFE	12.9	Full Cost
Contract Admin.	1.2	Full Cost
<hr/>		
Shuttle Operations	126.2	
RAMP	0.0	
Network Support	0.0	
<hr/>		
Cost per Flight (FY88\$)	126.2	
Contingency	2.0	
<hr/>		
Price (FY88\$)	130.0	"Out of Pocket" Price

The \$130M price is based on the "Out-of Pocket" approach that charges the user for the full average cost per flight for flight hardware and propellants, and only the variable costs for flight operations and launch operations.

The \$110M price was based on the cost per flight data generated from the FY89 Budget. It was based on a higher flight rate than what was assumed in the FY91 Budget. This is the primary reason for the difference between the \$130M and \$110M prices.

The \$130M price was proposed to the OMB (and informally approved) in March, 1990, as the baseline price for all future reimbursable customers who are eligible under the National Space Policy.

The enclosed letter explains why NASA decided to use the \$110M price for Spacehab.

10/09/91

National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

EXHIBIT II
Page 2 of 3

March 12, 1990

Mr. Robert E. Grady
Associate Director
for Natural Resources,
Energy and Science
Office of Management
and Budget
Washington, DC 20503

Dear Bob:

We are currently in the process of completing the RFP for obtaining payload space onboard a pressurized Shuttle augmentation module. One prospective proposer, SPACELAB, Inc., has already received a Shuttle launch price of \$110 million (FY 1988 dollars) for a full Shuttle flight. This price was arrived at after extensive interagency review and Congressional involvement. We believe that in order to issue a complete RFP and enable us to conduct an expedited evaluation, it is necessary to provide potential proposers, other than SPACELAB, Inc., with a Shuttle launch price. This information would be best communicated by including it in the RFP itself, which is scheduled for release on March 28, 1990. Since transportation costs will constitute a major cost element for any bidder, it will be difficult, if not impossible, to calculate risks and address issues of financial viability in the absence of such information.

We propose to use a price of \$130 million (FY 1988 dollars) in the RFP. This price recovers NASA's out-of-pocket costs and is consistent with President Bush's objective of fostering commercial space activity. The differential between the \$110 million price for SPACELAB, Inc. and the \$130 million figure for other proposers is justified, in our judgment, by the fact that SPACELAB came to NASA during a previous pricing period and was the first firm to develop and invest in a commercial concept suited to the requirements NASA is now seeking to satisfy. In short, the differential is a reasonable benefit flowing from SPACELAB's creativity and initiative. We also propose to establish \$130 million (FY 1988 dollars) as the baseline price for future reimbursable customers who are eligible under National Space Policy and NASA manifesting rules to use the Shuttle. Enclosure 1 describes how the \$130 million per flight price was derived and compares it with the DOD-type ("barter") price and with a full cost recovery approach.

2

Finally, I would like to turn to the question of launch prices for a set of reimbursable payloads which are already manifested on the Shuttle. These payloads fall into two groups and are listed in Enclosure 3. The first group involves two companies, Geostar, Inc. and Space Systems, Inc. (SSI), with six payloads (three each) scheduled to be launched under Space System Development Agreements (SSDA's). Both SSDA's were signed prior to the Challenger accident and contain language which gives Geostar and SSI "most favored customer" status with respect to Shuttle launch price. Given these agreements, and as a matter of equity, I believe that the \$110 million SPACEMAN price is the proper standard to apply to these six launches and propose to inform Geostar and SSI accordingly. With regard to the other payloads listed in Enclosure 3, I propose to price them using the new \$130 million baseline figure.

We have reached a point where we urgently need to agree on a pricing policy so that a number of Shuttle users, many of whom have waited a long time, can complete their financial planning. I feel that the approach outlined in this letter is fair to all concerned. For your information, I am also enclosing as Enclosure 3, answers to some questions you raised in response to an earlier NASA letter proposing a \$130 million Shuttle price.

Sincerely,

James R. Thompson, Jr.
Deputy Administrator

Enclosures

SHUTTLE PRICING FOR COMMERCIAL USERS
COMPARISON OF FLIGHT RATE 12 VERSES 8
FISCAL YEAR 1988 DOLLARS IN MILLION
"OUT-OF-POCKET" COST POLICY

	STS PRICING OPTIONS OUT-OF-POCKET	STS PRICING OPTIONS OUT-OF-POCKET
	<hr/>	<hr/>
FLIGHTS (1YR - FY 94)	12	8
FLIGHT OPERATIONS	9.4	3.9
LAUNCH OPERATIONS	9.0	5.7
PROPELLANTS	1.6	0.9
SOLID ROCKET BOOSTER	18.5	15.2
SOLID ROCKET MOTOR	34.5	40.2
EXTERNAL TANK	30.6	38.1
SPACE SHUTTLE MAIN ENGINE	8.5	12.6
ORBITER/GFE	12.9	16.8
CONTRACT ADMINISTRATION	1.2	2.2
SHUTTLE OPERATIONS	<hr/> 126.2	<hr/> 135.6
R&PM	0.0	0.0
NETWORK SUPPORT	0.0	0.0
COST PER FLIGHT (FY 88\$)	<hr/> 126.2	<hr/> 135.6
CONTINGENCY	3.8	3.6
PRICE	<hr/> 130.0	<hr/> 139.2
	=====	=====

SHUTTLE PRICING FOR COMMERCIAL USERS
COMPARISON OF FLIGHT RATE 12 VERSES 8
FISCAL YEAR 1988 DOLLARS IN MILLION
"FULL COST" POLICY

	STS PRICING OPTIONS OUT-OF-POCKET	STS PRICING OPTIONS "FULL COST"
	<hr/>	<hr/>
FLIGHTS (1YR - FY 94)	12	8
FLIGHT OPERATIONS	9.4	70.1
LAUNCH OPERATIONS	9.0	79.9
PROPELLANTS	1.6	1.7
SOLID ROCKET BOOSTER	18.5	16.4
SOLID ROCKET MOTOR	34.5	43.3
EXTERNAL TANK	30.6	41.0
SPACE SHUTTLE MAIN ENGINE	8.5	13.6
ORBITER/GFE	12.9	18.1
CONTRACT ADMINISTRATION	1.2	2.3
SHUTTLE OPERATIONS	<hr/> 126.2	<hr/> 286.4
R&PM	0.0	35.9
NETWORK SUPPORT	0.0	5.8
COST PER FLIGHT (FY 88\$)	<hr/> 126.2	<hr/> 328.1
CONTINGENCY	3.8	3.9
PRICE	<hr/> 130.0	<hr/> 332.0
	=====	=====

FIXED PAYMENT SCHEDULE

Contract Initiation (Months Before Launch)	Payment Due (Months Before Launch)					Total Payment (%)
	33	24	10	12	6	3

Nominal Schedule	33	24	10	12	6	3	
33 or More	10	10	15	25	25	15	100
24-32 Months	0	21	15	25	25	15	101
18-23 Months	0	0	30	25	25	15	103
12-17 Months	0	0	0	67	25	15	107
6-11 Months	0	0	0	0	90	15	113
3-5 Months	0	0	0	0	0	122	122



National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX A

MAR 26 1993

Reply to Attn of

MB

TO: W/Assistant Inspector General for Auditing

FROM: M/Associate Administrator for Space Flight

SUBJECT: Comments to Draft Report on Survey of Space Shuttle Payload Operations,
Assignment No. A-JS-91-006

We feel the title of the subject report is misleading. The report's focus is on Space Shuttle pricing and billing procedures. The report does not concern itself with Space Shuttle payload operations. Payload operations is a distinct activity in which the Office of Space Flight is deeply involved, but which is not the content of the subject report.

Secondly, in reference to NASA's revision of the Shuttle reimbursement policy NMI 8610.8A, the report, on page 24 under "General Comments," states that "NASA management officials acknowledge that the delay of the revision was a result of various deviations from NMI 8610.8, and NMI 8610.9." We would like to clarify that NASA's revision was due to changes in the Space Shuttle program which were not reflected in the existing NMI. The following is our response to Recommendation 1:

Recommendation 1

We recommend the NASA Associate Administrator for Space Flight reassess and appropriately revise the standard price charged to non-Government Shuttle users to: (1) at a minimum, charge \$139 million to recover NASA "out-of-pocket" costs; or (2) if a full cost pricing policy is used, revise the price to \$332 million so that NASA recovers full costs on future Shuttle flights.

Management Response

We concur with the essence of this recommendation. The most recent flight price of \$130 million (FY 88 \$'s) was developed in 1990 and was intended for a specific list of Shuttle customers. This price is no longer being used for new users. Once a decision is made as to the basis of a new Shuttle price out-of-pocket, full cost, or otherwise, the actual dollar value will be from the most current cost-per-flight information available. The Office of Space Flight normally updates its Shuttle cost-per-flight analysis as part of the annual budget to Congress in January of each year.

For additional information, please call Pat McCracken at (202) 358-1608.

Jeremiah W. Pearson III



National Aeronautics and
Space Administration

Washington, D.C.
20546

APPENDIX B

FEB 26 1993

Reply to Attn of: BFR

TO: W/Assistant Inspector General for Auditing
FROM: B/Deputy Chief Financial Officer
SUBJECT: Comments on Draft Report Survey of Space Shuttle
Operations A-JS-91-006

This memorandum responds to your request for our review and comments on your February 18, 1993, draft report. Since we understand that Recommendation 1 will be addressed by the Associate Administrator for Space Flight, we restrict our comments to Recommendation 2 concerning late billings.

Thank you for reflecting our comments on the previous, July 24, 1992, draft. As your revised draft indicates, we took longer than desirable to make final billings for several reasons: the early stage of the Shuttle reimbursable program, the associated learning curve, and the initial backlog of 44 bills. We agree with your recommendation that we should final bill within 12 months of completion of the last service provided for each payload launch. The comments included in the report stating that we have not billed customers for 2 years after the launch date are, therefore, not relevant and do not support the revised recommendation. Services are furnished to customers after the date of the launch; until these have been completed, the 12-month period does not start. We are in the process of improving our procedures by establishing a definitive date that can be used for the start of the 12-month period.

We have two further comments. The last sentence of the first paragraph on page 21 is incorrect. The bulk of these agreements are for a fixed price which is deposited in advance by non-Federal customers, delays in final billing do not, therefore, significantly impact the cost of Federal borrowing. For the same reason, the last sentence of the third paragraph is misleading, optional services are also paid in advance by non-Federal customers.

If you have any questions about these comments, please call Herb Nickens at 358-1030.

Richard J. Powell |

NASA-JSC

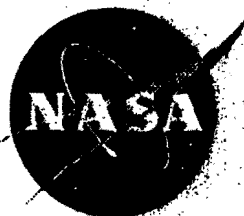
JS-94-002

**AUDIT
REPORT**

EXTENDED DURATION ORBITERS

JOHNSON SPACE CENTER

DECEMBER 28, 1993



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General

Johnson Space Center
Houston, TX 77058



Reply to Attn of:
W

December 28, 1993

TO: Johnson Space Center
Attn: AA/Acting Director

FROM: W-JS/OIG Center Director

SUBJECT: Audit of Extended Duration Orbiters
Assignment No. A-JS-93-002
Report No. JS-94-002

We have completed an audit of the Extended Duration Orbiters (EDOs). Our final report is enclosed. Work on this audit was performed under assignment number A-JS-93-002.

The audit objectives were to review the management of the EDO program and evaluate whether the program was effectively implemented. Specifically we reviewed and evaluated Johnson Space Center's (JSC's):

- Justification and planned utilization of EDO and Long Duration Orbiter (LDO) capability;
- EDO modification performance; and
- Use of 1987 no-year appropriations in the EDO program.

We found that JSC has not effectively managed elements of the EDO program. Significant cost growth and schedule slippage of the Waste Collection System and Regenerative Carbon Dioxide Removal System occurred under the EDO program. The cost growth and schedule slippage occurred because contract management and subcontract management guidelines set forth in the Federal Acquisition Regulations, Office of Management and Budget Circular A-109, and NASA Handbook 9501.2 were not followed. As a result, NASA incurred additional costs and EDO projects were not completed in a timely manner. Additional management actions were needed to provide adequate oversight of subcontract management. JSC has identified future EDO and LDO requirements and initiated plans to establish LDO capability by Fiscal Year 1997. Our review also disclosed JSC's use of the 1987 no-year appropriations was consistent with the guidelines directing their use.

A discussion draft report was provided to JSC management on October 14, 1993, and an exit conference was conducted on October 28, 1993. Necessary report changes resulting from the exit conference were included in the draft report dated November 5, 1993. The Center provided a written response on December 6, 1993, that is included as Appendix A to this final report.

JSC concurred with all five of the report's recommendations and has implemented corrective actions. We consider JSC's corrective actions, detailed in Appendix A, responsive to the recommendations. The recommendations are, therefore, considered closed with the issuance of this final report.

W. Preston Smith

Enclosure

cc:

HQs-W/K. Corcoran

JSC-BY/G. Martinez

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	5
OBJECTIVES, SCOPE, AND METHODOLOGY	7
OBSERVATIONS AND RECOMMENDATIONS	9
GENERAL COMMENTS	21
APPENDIX A - JSC Response, dated December 6, 1993	A-1

ACRONYMS

DDT&E	Design, Development, Testing and Evaluation
ECLSS	Environmental Control Life Support System
EDO	Extended Duration Orbiter
FAR	Federal Acquisition Regulation
FY	Fiscal Year
GAO	General Accounting Office
JSC	Johnson Space Center
LDO	Long Duration Orbiter
NSTS	National Space Transportation System
OMB	Office of Management and Budget
OV	Orbiter Vehicle
PDR	Preliminary Design Review
PRSD	Power Reactant Storage and Distribution
RCRS	Regenerative Carbon Dioxide Removal System
RID	Review Item Dispositions
WCS	Waste Collection System

EXTENDED DURATION ORBITERS

JOHNSON SPACE CENTER, TEXAS

EXECUTIVE SUMMARY

INTRODUCTION

The Office of Inspector General has completed an audit of the Extended Duration Orbiter (EDO) modifications managed by Rockwell International Company under contracts NAS9-14000 and NAS9-17800. EDO vehicles are modified to enable Orbiter flights of 10 days or greater without resupply or resource transfer from another spacecraft. The EDO program was established to provide longer on-orbit laboratory time for microgravity and space life science experiments, and to support the building of the Space Station.

OBJECTIVES

The overall objective was to review the management of the EDO program and evaluate whether the program was effectively implemented. Specifically, we reviewed and evaluated Johnson Space Center's (JSC's):

- EDO modification performance;
- use of 1987 no-year appropriations in the EDO program; and
- justification for and planned utilization of the EDO and Long Duration Orbiter (LDO).

Results of Audit

Overall JSC has not effectively managed the waste collection system (WCS) and regenerative carbon dioxide removal system (RCRS) elements of the EDO program. As a result, NASA incurred additional costs and these EDO projects were not completed in a timely manner. Our review disclosed JSC's use of the 1987 no-year appropriations was consistent with the guidelines directing their use. JSC has identified future EDO and LDO requirements and initiated plans to establish LDO capability by Fiscal Year (FY) 1997. The details of our

observations are discussed in the "Observation and Recommendations" section of the report and are summarized in the following paragraphs.

Inadequate Subcontract Management. JSC's contract management and oversight of the WCS and RCRS were inadequate and resulted in significant cost growth and schedule slippage. The Federal Acquisition Regulation, Office of Management and Budget Circular A-109, and NASA Handbook 9501.2B set forth policies and guidelines for effective contract management and administration. The WCS, initially estimated to cost \$8.2 million, actually cost \$23.4 million, and the RCRS initial cost estimate of \$11.6 million escalated to \$27.3 million.

Recommendations

1. We recommended JSC's Program Managers clearly define technical requirements and ensure the prime contractors understand those technical requirements.
2. We recommended JSC's Director of Procurement strengthen the procedures for definitization of change orders and negotiations within 180 days from issuance.
3. We recommended JSC's Director of Procurement implement not-to-exceed estimated costs by bilateral agreement for the entire scope of work on change orders and separate the negotiation of cost for design, development, testing, and evaluation (DDT&E) from production.
4. We recommended JSC's Director of Procurement require separate change order accounting for the undefinitized contract activity.
5. We recommended JSC's Director of Procurement require special surveillance of subcontracts in addition to requesting supporting contract administration for high-risk or critical systems or subsystems.

JSC concurred with all five of the report's recommendations and has taken corrective actions. We consider JSC's corrective actions, detailed in Appendix A, responsive to the recommendations.

Use of 1987 No-year Appropriation for EDO Modifications. NASA expended \$50.7 million of the 1987 Orbiter Vehicle (OV) 105 no-year appropriations for EDO modifications for the WCS and the RCRS. The FY 1987 Appropriation Act provided \$2.1 billion for a replacement Orbiter, designated as OV-105. In its report, "Financial Management, NASA's Financial Reports Are Based on Unreliable Data," the General Accounting Office expressed concerns that 1987 no-year appropriations were improperly used to fund modifications to an existing Shuttle, OV-102. We found, however, that the 1987 no-year appropriation funding expended for DDT&E of the WCS and RCRS represented new technology and was correctly charged to OV-105.

(THIS PAGE INTENTIONALLY LEFT BLANK)

INTRODUCTION

The Extended Duration Orbiter (EDO) program was established to provide longer on-orbit laboratory time for microgravity and space life science experiments, and to support the building of Space Station Freedom. The EDO program was authorized and initially funded by Congress in February 1989. This authorization allowed the National Space Transportation System (NSTS) to implement the EDO program and proceed with hardware design and production by incorporating 16-day EDO modifications into Orbiter Vehicle (OV) 102. NSTS directives also authorized construction of a 16-day EDO cryogenic pallet and incorporated 28-day EDO modifications into OV-105 prior to its delivery. The cryogenic pallet is the structure that holds the additional tanks that provide power for the fuel cells.

The EDO is a Space Shuttle Orbiter that has been modified to stay in orbit for missions that last more than 10 days. The modified capability requirements for a 16-day mission apply to the environmental control life support system (ECLSS), the crew systems, and the power reactant storage and distribution (PRSD) system. Systems being upgraded or modified for the ECLSS were the regenerative carbon dioxide removal system (RCRS), the improved waste collection system (WCS), and the nitrogen supply system. Crew systems changes are in the area of crew habitation and stowage. In addition, the PRSD was modified to contain additional tanks. EDO capability expanded beyond 16 days is commonly referred to as 28-day Long Duration Orbiter (LDO) and 30-day LDO.

A discussion draft report was provided to Johnson Space Center (JSC) management on October 14, 1993, and an exit conference was conducted on October 28, 1993. Necessary report changes resulting from the exit conference were included in the draft report dated November 5, 1993.

The Center provided a written response on December 6, 1993, that is included, in part, in Appendix A to this final report. The Center's response included attachments too voluminous to forward with this report. Copies of the attachments may be obtained from our office upon request.

We consider JSC's corrective actions, detailed in Appendix A, responsive to the recommendations. The recommendations are, therefore, considered closed with the issuance of this final report.

OBJECTIVES, SCOPE, AND METHODOLOGY

OBJECTIVES

The overall objective was to review the management of the EDO program and evaluate whether the program was effectively implemented. Specifically, we reviewed and evaluated JSC's:

- EDO modification performance;
- use of 1987 no-year appropriations in the EDO program; and
- justification for and planned utilization of the EDO and LDO.

SCOPE AND METHODOLOGY

We reviewed the planning, procurement, and management of the EDO program. Interviews and discussions were held with the program manager, program budget officials, procurement officials, technical managers, General Accounting Office (GAO) auditors, and contractor representatives. A field visit was also made to the Rockwell facility at Downey, California. We reviewed and evaluated the mission statement and program objectives, system integration plan, modification and negotiation memoranda, variances between projected and actual costs reported by the contractor, and Rockwell's oversight of sub-contract management.

INTERNAL CONTROLS REVIEWED

We identified and assessed the significant internal controls associated with our audit objectives. The primary internal controls reviewed included Federal Acquisition Regulations (FAR), Office of Management and Budget (OMB) Circular A-109, and NSTS Manual 07700, Vol. IV. We also reviewed the following internal controls to the extent necessary to accomplish the audit objectives:

- Procedures for contract administration in accordance with FAR Part 42;
- Procedures for initiating and monitoring contract modifications in accordance with FAR Part 43;

- Procedures for subcontracting in accordance with FAR Part 44; and
- Configuration management requirements under NSTS 07700 Vol. IV.

Except as noted in the "Observations and Recommendations" section, the internal controls tested during the audit were considered generally satisfactory.

**AUDIT FIELD
WORK**

Audit field work was conducted from October 15, 1992, through May 31, 1993, at JSC. The audit was performed in accordance with generally accepted Government auditing standards, and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances.

OBSERVATIONS AND RECOMMENDATIONS

OVERALL EVALUATION

Overall, JSC has not effectively managed the WCS and RCRS elements of the EDO program. Significant cost growth and schedule slippage occurred while performing modifications to the WCS and RCRS under the EDO program. This occurred because contract management and subcontract management guidelines set forth in the FAR, OMB Circular, and NASA Handbook were not followed. As a result, additional management actions are needed to provide adequate oversight of subcontract management. We found JSC's use of the 1987 no-year appropriations consistent with the guidelines directing their use. JSC has provided justification and planned utilization of EDO capability. Future EDO and LDO requirements have been identified and plans have been initiated to establish LDO capability by Fiscal Year (FY) 1997.

After completion of the audit field work, JSC took action to improve the contract change order process. These process improvements address the audit recommendations and will be presented in the management response to each recommendation.

Inadequate Subcontract Management

JSC's contract management and oversight of the WCS and RCRS were inadequate and resulted in significant cost growth and schedule slippage. The FAR, OMB Circular A-109, and NASA Handbook 9501.2B set forth policies and guidelines for effective contract management and administration. These guidelines, however, were not followed. As a result, NASA's technical direction, contract modifications, price and cost analysis, and cost growth were not effectively managed. Special surveillance, though available, was not employed to monitor the subcontractor's progress. Consequently, the WCS, initially estimated to cost \$8.2 million, actually cost \$23.4 million, and the RCRS estimated cost of \$11.6 million escalated to \$27.3 million.

- a. **TECHNICAL DIRECTION** The prime contractor gave inadequate technical direction to the subcontractor as evidenced by several

review item dispositions (RIDs). RIDs are problems that have been identified needing correction. The Preliminary Design Review (PDR) on the WCS held November 7-9, 1989, surfaced a number of RIDs and development issues as a result of inadequate technical direction. Due to design problems and schedule slippage, NASA was unable to install the WCS unit on OV-102 as initially planned. Although NASA planned to produce four units, only one development/qualification unit was actually produced and it was installed on OV-105. The PDR, held November 7-9, 1989, identified the following development issues:

- requirements for turnaround testing were not identified;
- preliminary design and schedule for the detailed test objective urine separator were not covered;
- anthropometric analyses, or mockup of the WCS for usage and maintenance, were not addressed;
- no redundant DC power was identified for system control resulting in over 20 single point electrical failures which could require the crew to use the completely manual backup mode; and
- simpler design was needed or an alternative to incorporate a manual mode which could utilize a powered compactor drive.

Likewise, PDR on the RCRS held on November 14-16, 1989, also surfaced some development issues. JSC later determined that the RCRS would not be ready for delivery when the OV-105 was delivered in April 1991. Some of the issues raised during the PDR were:

- total projected weight exceeded the 250 pounds procurement specification maximum;
- information used to model the vacuum vent was inaccurate which affected the bed sizing and estimated performance; and

-- many of the subcontractor processing specifications and procedures called out on RCRS drawings had not been provided to the prime contractor for review.

The FAR provides guidance for the evaluation of technical direction. FAR 44.202-2(a)(11), Considerations, states: "The contracting officer responsible for consent shall review the request and supporting data and consider the following.... Has the contractor adequately and reasonably translated prime contract technical requirements into subcontract requirements?"

The inadequate technical definition of the work to be performed adversely impacted the price and cost analysis of the WCS and RCRS proposals submitted by the subcontractor. It also contributed to the cost of revisions or changes that were made. In addition, separation of the contracted effort for Design, Development, Testing, and Evaluation (DDT&E) from production would have provided more visibility and allowed reassessment of project design.

- b. CONTRACT MODIFICATIONS JSC's management and oversight of change orders were inadequate. The change orders for the OV-105 and OV-102 were not definitized on a timely basis. The authority to proceed on the EDO modifications was given to the contractor in May 1988 and the change order for the WCS was issued on June 23, 1988. The change order for the RCRS was transferred to the OV-105 contract on October 12, 1989. Although the change orders had been issued, the prime contractor and subcontractor did not negotiate these modifications until June 1990. Furthermore, JSC did not negotiate the change orders and include them in modifications to the NAS9-14000 and NAS9-17800 contracts until November 4, 1990, and February 25, 1992, respectively.

The guidance under FAR 43.204(b), Definitization, states: "Contracting officers shall negotiate equitable adjustments resulting from change orders in the shortest practicable time." Also, "Contracting offices and contract administration

offices, as appropriate, shall establish suspense systems adequate to ensure accurate identification and prompt definitization of unpriced change orders."

JSC has not established written policies or procedures that would ensure prompt definitization of change orders, but rather had set a goal of 225 days from issuance to definitization of change orders. However, the change orders for the WCS and the RCRS were not definitized within that timeframe. Untimely definitization of change orders under this cost-reimbursement contract did not give the contractor adequate incentive to contain costs.

- c. PRICE AND COST ANALYSIS The initial estimated cost for the improved WCS presented to JSC between June 1988 and March 1989 by the prime contractor and subcontractor was \$8.2 million for DDT&E and production of a development unit, a qualification unit, and two flight units. Some design changes identified by JSC between March and December 1989 were estimated to cost an additional \$1.5 million. These changes were:

- three pounds per hour vacuum source;
- urine monitoring system support capability;
- enhanced slug flow capacity;
- additional wet trash transport airflow;
- additional urine check valve to baseline design to meet redundancy requirement; and
- downlink instrumentation.

By March 1990, the cost estimate had grown to \$16.6 million. In December 1990, an assessment of the WCS revealed that the cost estimate had reached \$23.4 million. The JSC Program Manager issued the direction to stop work on the qualification unit and two flight units due to the escalating cost estimate. As a result, only the development unit, tested as a qualification/flight unit, and parts were delivered.

The initial estimated cost for the RCRS presented in October 1989 by the prime contractor and subcontractor was \$11.6 million for DDT&E and production of a development unit, a qualification unit, and two flight units. Some design changes resulting from the PDR in November 1989 added about \$7.7 million, bringing the total cost estimate to \$19.3 million. The prime contractor and JSC later validated the subcontractor's estimated costs. More design changes were identified and by March 1991, the cost estimate was \$25 million. One year later, in March 1992, the cost estimate had escalated to \$27.3 million. One pre-declared development/qualification unit, two flight units, and one spare unit were delivered.

The prime contractor stated that the subcontractor did not perform a thorough analysis of the proposals for the WCS or the RCRS before submission to NASA. However, direction is given in several sections of the FAR that the prime contractor and the contracting officer retain significant responsibility for review of the proposals submitted. Specifically, the FAR provides in sections 15.806.1, 35.007(f) and (g), and 35.008(e), respectively, the guidance that:

- the prime contractor is responsible for conducting appropriate price and cost analysis before awarding any subcontract;
- the contracting officer shall consider, as appropriate, subcontracting practices, and any other significant evaluation criteria (e.g., unrealistically low estimates in proposals for cost-reimbursement contracts), and the contracting officer should ensure that each prospective offeror fully understands the details of the work, especially the Government interpretation of the work statement; and
- it is important to evaluate a proposed contractor's cost or price estimate, not only to determine whether the estimate is reasonable but also to provide valuable insight into the

offeror's understanding of the project, perception of risks, and ability to organize and perform the work.

The guidance under FAR 43.102(b), states: "Contract modifications, including changes that could be issued unilaterally, shall be priced before their execution if this can be done without adversely affecting the interest of the Government. If a significant cost increase could result from a contract modification and time does not permit negotiation of a price, at least a maximum price shall be negotiated unless impractical."

The Government and the prime contractor have primary responsibility for determining whether the subcontractor's cost proposals appear adequate for the work to be performed. A not-to-exceed estimated cost by bilateral agreement for the entire scope of work to be performed provides an incentive for the offeror to provide accurate cost estimates. Additionally, cost estimates could be more accurate if they are broken down between DDT&E and production.

- d. COST GROWTH The subcontractor reported to the prime contractor an estimated cost of \$15,986,000 for the WCS for the period ended November 30, 1990. The prime contractor, however, reported to JSC the estimated cost at completion of \$12,710,000, a difference of \$3,816,000. Likewise, the subcontractor had reported the estimate at completion as \$14,050,000 for the RCRS. The prime contractor reported the RCRS estimate at completion to JSC as \$11,719,000, a difference of \$2,332,000. The prime contractor did not inform JSC of the projected cost overrun while these costs were being validated, which caused delay in reporting the actual cost overrun.

The prime contractor stated that the overrun identified for the WCS in November 1990 was not anticipated. Our review of the records revealed that significant cost growth had occurred during the previous year. The prime contractor took no action to contain costs until approximately \$6 million growth was identified in November 1990.

The FAR provides the following guidance for the reporting of cost overruns. Specifically, FAR 42.302(a)(15), Contract Administration Functions, states: "Timely notification by the contractor of any anticipated overrun or underrun of the estimated cost under cost-reimbursement contracts is required."

Timely notification by the contractor of any anticipated overrun alerts the Government to the situation and allows management time to start looking at alternatives to curve the overrun. Moreover, JSC did not require that the contractor account for and report change orders separately even though changes were accounted for separately in the Master Change Records by the contractor. Additionally, change order accounting would provide the Government insight into the contractor's or subcontractor's cost performance on individual changes and facilitate oversight and control.

- e. SPECIAL SURVEILLANCE We believe that the inadequate subcontract management, technical direction, price and cost analysis, and numerous contract modifications and cost growth provided a strong case for special surveillance. Although the subcontractor that delivered the WCS and RCRS was not under special surveillance, four other subcontractors had been placed under special surveillance as of July 25, 1988. The prime contractor for the four other subcontracts was required to get consent from the contracting officer for amendments definitizing change orders and other work content additions and deletions.

The FAR provides the following guidance for subcontract administration. FAR 44.202-2(b) states: "Particularly careful and thorough consideration is necessary when subcontracts are proposed on a cost-reimbursement basis." FAR 44.205 also states: "...contracting officers may select subcontracts requiring extraordinary Government surveillance for special surveillance by specifying the selected subcontracts in the prime contract schedule."

According to NASA Handbook 9501.2B, paragraph 301.4.c.(3), "Copies of the subcontractor's cost reports may be required by NASA with the prime contractor's report." Therefore, the subcontractor's cost reports could have been required to come to JSC with the prime contractor's reports. Subcontract monitoring through special surveillance strengthens early identification of those changes which have high potential for growth.

RECOMMENDATION 1

We recommended that JSC's Program Managers clearly define technical requirements and ensure the prime contractors understand those technical requirements.

Management Response

We concur with the recommendation. The Headquarters' Contract Change Policy and the JSC Contract Change Policy Implementation Plan shown in attachments 3 and 4, require Procurement personnel to utilize pre-change study efforts or engineering change proposals to scope, define, negotiate and definitize effort prior to its being contractually directed. This will ensure clarity of requirements, for it is required that the work be fully discussed and understood prior to issuance of the authority to proceed. An early key to this new process is that prior to issuance of a Configuration Control Board (CCB) directive, the proposed change will be reviewed by a team of procurement, technical, program resources, and contractor personnel to ensure that the work requirements set forth are clear and detailed. Technical requirements are specifically addressed in section a. of attachment 3, and further defined by the JSC implementation plan (attachment 4). An example of a supplemental agreement which provides clear technical requirements as evidenced by the signature of both the contracting officer and the contractor representative is shown as attachment 6.

RECOMMENDATION 2

We recommended that JSC's Director of Procurement strengthen the procedures for definitization of change orders and negotiations within 180 days from issuance.

Management Response

We concur with the recommendation. The Headquarters' Contract Change Policy shown as attachment 3 identifies a goal of definitizing all undefinitized contractual actions (UCA's) within 180 days as stated in paragraph c. JSC's implementation policy shown as attachment 4 includes detailed reported requirements while iterating this 180-day goal. Charts depicting improved performance by the Space Shuttle Procurement Division are shown as attachment 7.

RECOMMENDATION 3

We recommended that JSC's Director of Procurement implement not-to-exceed estimated costs by bilateral agreement for the entire scope of work on change orders. Ideally, JSC should separate the negotiation of cost for DDT&E from production.

Management Response

We concur with the recommendation. The JSC Contract Change Policy Implementation Plan shown as attachment 4 implements bilateral not-to-exceed requirements for the entire scope of work for undefinitized contractual actions as shown under section 3.0. The use of pre-change studies and engineering change proposals increase the planning and clarity of work requirements. The new policy emphasizes clear, all-inclusive statement-of-work requirements. To this point, practical separation of design, development, testing, and evaluation (DDT&E) from production will be utilized. While completed prior to issuance of the new Implementation Plan, the statement of work for the new Multifunctional Electronic Display Subsystem procurement within the Space Shuttle Procurement Division is a good example of separation of DDT&E from production (see attachment 8). In addition, an example of a change order requiring a not-to-exceed limitation is shown as attachment 9.

RECOMMENDATION 4

We recommended that JSC's Director of Procurement require separate change order accounting for the undefinitized contract activity.

Management Response

We concur with the recommendation. The JSC Contract Change Policy Implementation Plan (attachment 4) specifically states in paragraph 2.0, section e.: "UCA's shall have separate change order accounting or equivalent cost

visibility sufficient to track and report actual costs expended to date prior to definitization." An example of a change order requiring separate change order accounting is shown as attachment 10.

RECOMMENDATION 5

We recommended that JSC's Director of Procurement require special surveillance of subcontracts in addition to requesting supporting contract administration for high-risk or critical systems or subsystems.

Management Response

We concur with the recommendation. Special subcontract surveillance is performed on a case-by-case basis. As stated in the audit report, such designation of special surveillance has been used in the past and will continue to be used. To help make such decisions as well as to improve overall subcontract management, the Space Shuttle Procurement Division developed and published a Subcontract Management document, dated October 1992, which provides the Division a set of standard requirements and procedures on subcontract management topics. The manual describes the policy and process on Subcontract Consent, Advance Notification, Contractor's Purchasing System Review Deficiency Monitoring, and Subcontract Monitoring. Special surveillance is discussed in section 2.4.5. The manual grew out of a Total Quality Management (TQM) effort, and the TQM team was presented a monetary award for its work. This manual is shown as attachment 11.

**Evaluation of
Management's
Responses**

The actions taken by JSC are responsive to recommendations 1, 2, 3, 4, and 5.

*Use of 1987 No-year
Appropriation for
EDO Modifications*

NASA has expended \$50.7 million of the 1987 no-year Orbiter production appropriation for EDO modifications. The FY 1987 Appropriation Act provided \$2.1 billion for the replacement Orbiter, designated as OV-105 which was the source of the 1987 no-year appropriation. The WCS accounted for \$23.4 million, including DDT&E and the RCRS for \$27.3 million. Only the DDT&E and production costs for the RCRS unit installed on OV-105 was charged to 1987 no-year OV-105 appropriation. GAO expressed concerns that this appropriation was improperly used to fund OV-102 modifications. Production cost incurred for the RCRS unit installed on OV-102 was correctly charged to the appropriation funding OV-102 and Orbiter fleet operations.

In a report entitled "Financial Management - NASA's Financial Reports Are Based on Unreliable Data," dated October 1992, GAO stated that JSC had "improperly charged the \$2.1 billion 1987 no-year appropriation for Orbiter production by at least \$13.4 million, including \$1 million for upgrading the waste collection system (toilet) for an existing Shuttle, the Columbia--Orbiter Vehicle (OV)-102, and about \$12.4 million in costs to upgrade a carbon dioxide removal system in the Extended Duration Orbiter program." GAO referred this issue to our office for further review to determine whether the expenditures were proper.

GAO's position was that use of 1987 no-year appropriation for operations and maintenance costs was improper because the statute dealing with appropriated funds, 31 U.S.C. 1301(a), restricted use of the no-year appropriation to OV-105 Orbiter production costs. JSC officials, however, stated that the WCS and RCRS represented new technology designed to provide EDO capability. Therefore, DDT&E costs were considered appropriate Orbiter production costs because OV-105 was the primary beneficiary of the new technology.

We believe that JSC's use of the no-year Orbiter production appropriation was consistent with the 1987 Appropriation Act and NASA's policy statement directing fund use. The joint policy statement from the Associate Administrator of Space Flight and NASA Comptroller for the

expenditure of replacement funds provided the guidance for fund use. Design effort due to obsolescence, technology improvement hardware, or safety that could be incorporated into OV-105 was charged to the OV-105 contract. The 1987 no-year appropriation funding expended for the DDT&E of the WCS and RCRS represented new technology for OV-105 with collateral benefit to OV-102 and the rest of the fleet. Although NASA initially planned to produce several WCSs, only one unit was actually produced and flight tested on OV-105. Therefore, the total \$23.4 million expended for the WCS effort was in support of the unit installed on OV-105.

GENERAL COMMENTS

We greatly appreciate the courtesy, assistance, and cooperation extended by the JSC and contractor personnel during our review.

Lyndon B. Johnson Space Center
Houston, Texas
77058

APPENDIX A

Reply to Attn of

BY/93-115

DEC 1 1993

TO: W-JS/Director, Center Office of Inspector General
FROM: AB/Acting Director
SUBJECT: Management Response to OIG's Audit of Extended Duration Orbiter,
Johnson Space Center, A-JS-93-002

Enclosed is JSC's management response to the draft audit report in which we concur with all five recommendations. Data were provided before the exit conference, showing that corrective actions had been made by NASA and JSC regarding contract change orders following the audit field work which was conducted October 1992 through May 1993. These corrective actions have been put in place and are working effectively. Subsequently, closure documentation to substantiate these actions also is enclosed. With your acceptance and acknowledgment of these actions in the final report, the recommendations and the audit will be considered closed.

We acknowledge the positive finding contained in the audit report that JSC's use of the no-year Orbiter production appropriation was consistent with the 1987 Appropriation Act and NASA's policy statement directing fund use. We would also like to acknowledge the followup discussion with your office a few days following the exit conference to clarify certain issues, assumptions, and inferences. Although the discussion resulted in little change to the draft report, it did result in a better understanding by all parties. If you have any questions, please contact Pat Ritterhouse at 483-4220.

Paul J. Weitz 

Enclosure

cc:
BB/R. E. Easley
BC/R. K. Gish
VA/D. M. Germany
HQ/JMC/J. Kiefer

Management Response to OIG's Audit of Extended Duration Orbiter,
Johnson Space Center, A-JS-93-002

Auditor's Findings

"JSC's contract management and oversight of the WCS and RCRS were inadequate and resulted in significant cost growth and schedule slippage. The FAR, OMB Circular A-109, and NASA Handbook 9501.2B set forth policies and guidelines for effective contract management and administration. These guidelines, however, were not followed. As a result, NASA's technical direction, contract modifications, price and cost analysis, and cost growth were not effectively managed. Special surveillance, though available, was not employed to monitor the subcontractor's progress.

JSC Comments

Since contract and subcontract administration were determined to be a material weakness within NASA, several procurement improvements involving definitization of change orders were implemented by NASA and JSC. JSC established a Process Action Team (PAT) to evaluate and recommend process improvements designed to ensure the timely definitization of undefinitized contractual actions. A final report for the PAT was issued September 1993 (attachment 1). The report addressed general/systemic areas for improvement, defined specific areas for improvement, and recommended solutions. The report was distributed throughout JSC and to all JSC Procurement personnel, who were asked to implement its recommendations as shown by the letter from the Director of Procurement, dated September 16, 1993, (attachment 2).

In addition, NASA Headquarters issued a letter dated August 10, 1993, co-signed by the Associate Administrators for Space Flight and Procurement, with new policy regarding contract changes effective October 1993 (attachment 3). Following issuance of the Headquarters' policy, JSC wrote a Contract Change Policy Implementation Plan providing further guidance, which was distributed to JSC procurement and senior staff on September 28, 1993, (attachment 4) and to contractor personnel on October 21, 1993, (attachment 5). Information contained in these attachments is further discussed below in response to each of the recommendations.

Recommendation 1

"We recommend JSC's Program Managers clearly define technical requirements and ensure the prime contractors understand those technical requirements."

JSC Comments

We concur with the recommendation. The Headquarters' Contract Change Policy and the JSC Contract Change Policy Implementation Plan shown in attachments 3 and 4, require Procurement personnel to utilize pre-change study efforts or engineering change proposals to scope, define, negotiate and definitize effort prior to its being contractually directed. This will ensure clarity of requirements, for it is required that the work be fully discussed and

understood prior to issuance of the authority to proceed. An early key to this new process is that prior to issuance of a Configuration Control Board (CCB) directive, the proposed change will be reviewed by a team of procurement, technical, program resources, and contractor personnel to ensure that the work requirements set forth are clear and detailed. Technical requirements are specifically addressed in section a. of attachment 3, and further defined by the JSC implementation plan (attachment 4). An example of a supplemental agreement which provides clear technical requirements as evidenced by the signature of both the contracting officer and the contractor representative is shown as attachment 6.

Recommendation 2

"We recommend JSC's Director of Procurement strengthen the procedures for definitization of change orders and negotiations within 180 days from issuance."

JSC Comments

We concur with the recommendation. The Headquarters' Contract Change Policy shown as attachment 3 identifies a goal of definitizing all undefinitized contractual actions (UCA's) within 180 days as stated in paragraph c. JSC's implementation policy shown as attachment 4 includes detailed reported requirements while iterating this 180-day goal. Charts depicting improved performance by the Space Shuttle Procurement Division are shown as attachment 7.

Recommendation 3

"We recommend JSC's Director of Procurement implement not-to-exceed estimated costs by bilateral agreement for the entire scope of work on change orders. Ideally, JSC should separate the negotiation of cost for DDT&E from production."

JSC Comments

We concur with the recommendation. The JSC Contract Change Policy Implementation Plan shown as attachment 4 implements bilateral not-to-exceed requirements for the entire scope of work for undefinitized contractual actions as shown under section 3.0. The use of pre-change studies and engineering change proposals increase the planning and clarity of work requirements. The new policy emphasizes clear, all-inclusive statement-of-work requirements. To this point, practical separation of design, development, testing, and evaluation (DDT&E) from production will be utilized. While completed prior to issuance of the new Implementation Plan, the statement of work for the new Multifunctional Electronic Display Subsystem procurement within the Space Shuttle Procurement Division is a good example of separation of DDT&E from production (see attachment 8). In addition, an example of a change order requiring a not-to-exceed limitation is shown as attachment 9.

Recommendation 4

"We recommend JSC's Director of Procurement require separate change order accounting for the undefinitized contract activity."

JSC Comments

We concur with the recommendation. The JSC Contract Change Policy Implementation Plan (attachment 4) specifically states in paragraph 2.0, section e.: "UCA's shall have separate change order accounting or equivalent cost visibility sufficient to track and report actual costs expended to date prior to definitization." An example of a change order requiring separate change order accounting is shown as attachment 10.

Recommendation 5

"We recommend JSC's Director of Procurement require special surveillance of subcontracts in addition to requesting supporting contract administration for high-risk or critical systems or subsystems."

JSC Comments

We concur with the recommendation. Special subcontract surveillance is performed on a case-by-case basis. As stated in the audit report, such designation of special surveillance has been used in the past and will continue to be used. To help make such decisions as well as to improve overall subcontract management, the Space Shuttle Procurement Division developed and published a Subcontract Management document, dated October 1992, which provides the Division a set of standard requirements and procedures on subcontract management topics. The manual describes the policy and process on Subcontract Consent, Advance Notification, Contractor's Purchasing System Review Deficiency Monitoring, and Subcontract Monitoring. Special surveillance is discussed in section 2.4.5. The manual grew out of a Total Quality Management (TQM) effort, and the TQM team was presented a monetary award for its work. This manual is shown as attachment 11.

National Aeronautics and
Space Administration

Office of Inspector General

P.O. Box 21066

John F. Kennedy Space Center

Kennedy Space Center, FL 32815



Reply to Attn of: W/KSC-OIG/AKE92003.051

August 6, 1993

TO: CD/Director, KSC

FROM: W/OIG Center Director, KSC

SUBJECT: Final Report
Acquisition of Orbiter Spares
Assignment No. A-KE-92-003
Report No. KE-93-005

The NASA Office of Inspector General (OIG) has completed an audit of the Acquisition of Orbiter Spares at Kennedy Space Center, Florida. The objectives of the audit were to determine whether procurement policies, procedures, and practices (1) comply with applicable laws and regulations, (2) provide internal controls to prevent wasteful practices, and (3) promote maximum competition for the acquisition of orbiter spares.

The audit showed that procurement policies, procedures, and practices for the acquisition of orbiter spares were generally effective. We noted that controls relative to compliance with applicable laws and regulations, prevention of wasteful practices, and maximizing competition could be improved.

The ~~OIG~~ is satisfied with the actions planned and completed by KSC and ~~considers~~ recommendations 1, 2, and 3 closed.

~~Lenny~~ L. Van Camp

Enclosure

cc:
JM-1/J. Troupe
W/R. Raspen, HQ (2 copies)
KSC/HM/J. Jennings
HM-ICO/E. Hopkins (20 copies)
EX/G. English



TABLE OF CONTENTS

	PAGE
DIGEST	1
INTRODUCTION	5
OBJECTIVES, SCOPE, and METHODOLOGY	7
OBSERVATIONS AND RECOMMENDATIONS	9
1. Competition Should Be Increased	9
2. Direct Buy Program Can Be Improved	15
3. Formal Controls For Updating Procurement Requirements Should Be Evaluated	19
OTHER OBSERVATIONS	21
GENERAL COMMENT	23
APPENDIX A - KSC RESPONSE TO RECOMMENDATIONS	A-1



August 6, 1993

ACQUISITION OF ORBITER SPARES**JOHN F. KENNEDY SPACE CENTER, FLORIDA****DIGEST**

INTRODUCTION

The NASA Office of Inspector General has completed an audit of the Acquisition of Orbiter Spares at Kennedy Space Center (KSC). The objectives of our audit were to determine whether procurement policies, procedures, and practices (1) comply with applicable laws and regulations, (2) provide internal controls to prevent wasteful practices, and (3) promote maximum competition for the acquisition of orbiter spares.

The scope of the audit included an evaluation of procurement policies, procedures, and practices as they pertain to the objectives stated above. Our audit was limited to the acquisition of orbiter spares as defined in NAS10-11500, Orbiter Logistics Operations Contract, with major concentration on High Value procurements. Our audit scope also included related procurement activities such as skill retention procurements, the Direct Buy program, and screening of Federal supply sources.

RESULTS OF AUDIT

Our review showed that procurement policies, procedures, and practices for the acquisition of orbiter spares are generally effective. We noted that controls relative to compliance with applicable laws and regulations, prevention of wasteful practices, and maximizing competition could be improved. We believe that innovative approaches to future skill retention procurements should be explored. The orbiter logistics contractor (Contractor) and KSC are commended for positive actions taken with Provisioning Order procedures.

**COMPETITION SHOULD
BE INCREASED**

Since contract inception, the Contractor has awarded over \$103 million in orbiter spare acquisitions. Of this amount, less than \$5.5 million or 5 percent was competed. Contractor personnel noted schedule and economic factors for this occurring. The schedule factor could be eliminated through a proactive procurement approach which we believe will lead to increased competition and program savings. The Contractor notes that for every dollar shifted from non-competitive to competitive procurements, up to 25 percent can be saved from the purchase price. We recommended that KSC, in coordination with the Contractor, implement a proactive approach to planned procurements which ensures that all viable candidates for competition are fully considered. KSC stated that the Shuttle Logistics Project Management Directorate will develop a procedure to ensure that all viable candidates for competition are fully considered. (Page 9)

**DIRECT BUY
PROGRAM CAN BE
IMPROVED**

The Direct Buy Program can be improved by streamlining the approval process. The current process includes cost analysis, technical evaluations, and board approvals, which we believe may be duplicative. As a result, program costs are increased and savings are lost through a delay in direct buy procurements. We believe that the various board review and approvals contributed to the Program's current condition. Streamlining the process through a Total Quality Management (TQM) initiative should reduce program delays and increase savings. We recommended that KSC, in coordination with Johnson Space Center (JSC) and the Contractor, view the Program approval process as a TQM initiative. KSC stated that an informal team consisting of KSC, JSC, and Contractor personnel evaluated the direct buy process. KSC also stated that KSC and contractor personnel reviewed Program procedures controlled by KSC in an effort to identify duplicative tasks and inefficient procedures. KSC noted that the approval process has been streamlined through various delegations and that the candidate backlog is being reduced. (Page 15)

**FORMAL CONTROLS
FOR UPDATING
PROCUREMENT
REQUIREMENTS
SHOULD BE
EVALUATED**

Formal controls for updating procurement requirements, recently developed by the Contractor, should be evaluated. During the course of the audit, we noted that the Contractor did not have a formal system in place for assuring that changes in procurement requirements were identified and disseminated to appropriate contractor personnel. This resulted in a loss of assurance that subcontracts comply with all applicable procurement requirements and that orbiter logistic contract provisions are being met. As a result of our audit, the Contractor took immediate action and developed formal controls. We recommended that KSC (1) verify that the recently developed procedures were adopted and implemented and (2) assess the effectiveness of these procedures. KSC stated that the procedures had been adopted and implemented. KSC also stated that the effectiveness of these procedures will be assessed by KSC during the upcoming semiannual purchasing system review. (Page 19)

THIS PAGE IS LEFT INTENTIONALLY BLANK

INTRODUCTION

The Office of Inspector General has completed an audit of the Acquisition of Orbiter Spares at Kennedy Space Center (KSC). The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions 9910.1A and 1103.27A, dated June 16, 1989, and January 31, 1990, respectively.

The primary mission for KSC includes the preparation and launch of space vehicles and their associated payloads. This mission is accomplished by four prime contractors, which include the shuttle processing contractor, payload ground operations contractor, base operations contractor, and orbiter logistics contractor.

The Orbiter Logistics Operations contract, NAS10-11500, expires on September 30, 1994. The Scope of Work includes acquisition of orbiter spares, parts repair, Space Shuttle program support, depot operations, Ground Support Equipment support, and Thermal Protection System Backshop support.

Orbiter spare procurements are categorized as either High or Low Value depending on dollar value. Procurements whose unit/extended cost is more than \$100,000 are categorized as High Value. Accordingly, those equal to or under \$100,000 are categorized as Low Value. A significant portion of orbiter spare purchases, both Low and High Value, are purchased from the original equipment manufacturers.

NASA Management Instruction 5900.1, "NASA Spare Parts Acquisition Policy," establishes uniform policy for the acquisition and provisioning of NASA spare parts. Procurement guidance is also set forth in Federal Acquisition Regulations (FAR), the NASA Supplement to the FAR, other NASA and KSC directives, and the logistics contract.

The draft report was submitted to KSC on June 7, 1993, and the Center's response was received on July 12, 1993. The comments were responsive to the intent of the recommendations and identified positive actions planned and taken. The Center's comments are included verbatim following each recommendation with additional audit comments. The complete KSC response is attached as Appendix A.

OBJECTIVES, SCOPE, AND METHODOLOGY

OBJECTIVES

The purpose of our audit was to determine whether procurement policies, procedures, and practices (1) comply with applicable laws and regulations, (2) provide internal controls to prevent wasteful practices, and (3) promote maximum competition for the acquisition of orbiter spares.

SCOPE

The scope of the audit included an evaluation of procurement policies, procedures, and practices as they pertain to the objectives stated above. Our audit was limited to the acquisition of orbiter spares as defined in NAS10-11500, Orbiter Logistics Operations Contract, with major concentration on High Value procurements. Our audit scope also included related activities such as skill retention procurements, the Direct Buy program, and screening of Federal supply sources. We were not able to assess cost reasonableness for Low Value procurements due to a lack of historical documentation.

METHODOLOGY

Our audit included an examination of pertinent NASA, Kennedy Space Center (KSC), and Orbiter Logistics Contractor directives and discussions with KSC and Contractor personnel. Documentation on file from 1988 through October 1992 was reviewed.

The audit was conducted in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records and documentation as were considered necessary in the circumstances. The audit field work was completed during the period of March through October 1992.

Significant internal controls in the following areas were reviewed.

- o Compliance with applicable procurement laws and regulations
- o Competition maximization

- o Negotiation preparation and performance
- o Skill retention procurements
- o Direct Buy Program
- o Screening of Federal supply sources
- o Provisioning Order procedures

Sufficient tests of all control areas were performed to assure that the controls were effectively implemented. Further tests were performed on those controls described in the Observations and Recommendations section.

OBSERVATIONS AND RECOMMENDATIONS

Our review showed that procurement policies, procedures, and practices for the acquisition of orbiter spares are generally effective. We noted that controls relative to compliance with applicable laws and regulations, prevention of wasteful practices, and maximizing competition could be improved. We believe that innovative approaches to future skill retention procurements should be explored. Kennedy Space Center (KSC) and the orbiter logistics contractor (Contractor) have taken commendable positive actions relative to Provisioning Order procedures by using more accurate data for negotiation purposes.

Our review included assessing the Contractor's negotiation preparation and performance controls. Those controls provide reasonable assurance that negotiated subcontract values result in an equitable price for the Government and the subcontractor. Our review included 12 High Value procurements whose total value exceeded \$19 million. None of those procurements were competed. Our review showed that the Contractor's negotiation preparation and performance controls were generally effective and no excess profits were noted.

**1. COMPETITION
SHOULD BE
INCREASED**

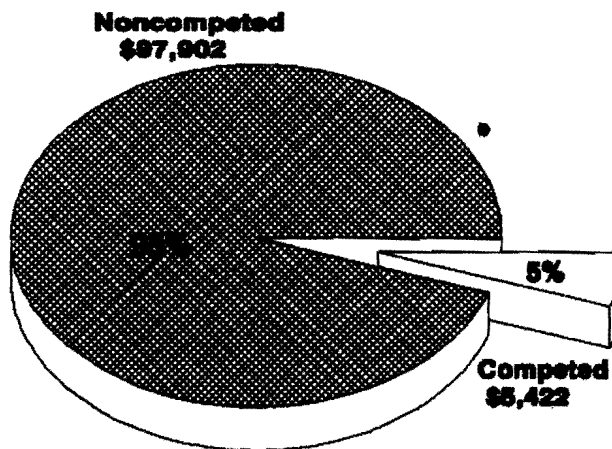
Since contract inception, the Contractor has awarded over \$103 million in orbiter spare acquisitions. Of this amount, less than \$5.5 million or 5 percent was competed. Contractor personnel noted schedule and economic factors for this occurring. The schedule factor could be eliminated through a proactive procurement approach which we believe will lead to increased competition and program savings. The Contractor notes that for every dollar shifted from non-competitive to competitive procurements, up to 25 percent can be saved from the purchase price.

The orbiter logistics contract (Contract) lists special contract requirements, one of which is NASA Management Instruction (NMI) 5900.1, "NASA Spare Parts Acquisition

Policy." The NMI 5900.1 encourages competitive procurement, particularly of replenishment spares, to the maximum extent possible. The NMI 5900.1 also notes that any purchases of spare parts for replenishment, whether accomplished by NASA or a contractor, ". . . must comply independently with the principles concerning full and open competition."

Various procurement directives call for the creation of a competition advocacy program whose primary goal is increased competition. These include the Federal Acquisition Regulation, Subpart 6.5 - "Competition Advocates"; NMI 1210.2C, "NASA Competition Advocacy Program"; and the Kennedy Management Instruction 1210.2B, "NASA Competition Advocacy Program." The Contractor established a Competition Advocacy Program and Committee to meet the requirements set forth in these directives.

During the period October 1, 1988, to July 31, 1992, the Contractor awarded \$103,324,116 in orbiter spare procurements. The \$103,324,116 consists of \$76,863,845 in High Value procurements and \$26,460,271 in Low Value procurements. It should be noted that none of the High Value procurements were competed. Of the \$103,324,116 awarded, only \$5,422,006 or 5 percent of the total procurements was competed as shown below.



(Thousands)

Schedule and economic factors were cited in a Contractor memo dated October 31, 1991, as reasons for not developing alternative sources. The memo stated:

The majority of these vendors have been the source of these parts and materials since the start of the DDT&E (Design, Development, Test and Evaluation) program. As the original equipment manufacturer, they have the expertise and skills necessary to manufacture and deliver, as well as having the necessary facilities, tools and equipment. To develop alternative sources at this time is not feasible from both an economic and schedule viewpoint. The schedule required to seek alternate sources, obtain proposals, evaluate proposals, and qualify the alternate vendor would not normally support need dates.

Based upon the rationale listed above, it is requested that the vendors on the Approved Source List be considered the sole source vendor for the procurement of the parts and the material.

This position was recently reaffirmed in a Contractor memo dated September 30, 1992. Interviews of Contractor personnel confirmed that schedule was a key factor for not developing alternative sources. Economic factors, such as complex nature of the part, certification requirements, and proprietary data, prevent other source development within these time periods.

Along with the above factors, it should also be noted that KSC does not have complete control for developing alternative sources. KSC is required to use vendors that are on the Approved Source List. Johnson Space Center (JSC) must approve any new sources before they are added to that List. JSC bases its decision on several factors, including cost and technical issues.

While KSC may determine that it is beneficial to compete a procurement, KSC cannot compete that procurement unless JSC certifies an alternative source. Therefore, developing alternative sources is not under KSC's control since they do not have authority to certify alternative sources.

Although developing alternative sources may not be under KSC's direct control, we believe that KSC can take a proactive approach for planned procurements. This approach involves determining whether other sources can be developed before the logistical need is identified. A preliminary review should be made to identify likely candidates. Next, cost and technical analysis should be made to determine whether feasible alternative sources exist for these parts. Finally, those candidates should be submitted to JSC for their review and approval. Initial reviews should be directed toward parts which promise the highest potential for success.

Our review of planned procurements for Fiscal Years '94 through '99 shows that alternative sources may exist. For example, KSC and the Contractor are expecting to purchase 400 tires at a cost in excess of \$3 million during this period. KSC personnel noted several obstacles which would have to be overcome before alternative sources could be developed. Those include certifying new sources, Phase A and B agreements, indemnification, proprietary data, testing and inspection, and storage. Although these obstacles present a challenge for developing alternative sources, we believe that an analysis should be made and a determination made whether alternative sources for these parts exist.

Developing other sources can lead to cost savings. For example, a Contractor directive, Corporate Material Guideline 1.07, Cost Improvement Plans, notes that for every dollar shifted from non-competitive procurements to competitive procurements, up to 25 percent can be saved from the purchase price.

Developing alternative sources will not always result in program savings. For example, a manufacturer of navigational aids,

known as TACAN's, stated they would no longer make this part and KSC and the Contractor had to develop an alternative source. Certification costs exceeded \$2.6 million. The first TACAN was delivered in May 1990 at a negotiated cost of \$170,000 per unit. KSC projects a need of 7 to 9 TACAN's for Fiscal Years '96 through '98. Allocation of the certification costs increases per unit cost by almost \$300,000 which clearly shows that savings did not result from developing this new source.

While full competition may never be obtained, we believe the level of competition can be increased by a proactive approach to planned procurements. Economic factors and JSC's role must be considered in implementing that approach. Initially, that approach should be directed to developing alternative sources for those parts with the highest potential for success.

RECOMMENDATION 1:

Kennedy Space Center should, in coordination with the Contractor, implement a proactive approach, as discussed above, to planned procurements which ensures that all viable candidates for competition are fully considered.

**Management
Response**

Concur. The KSC Shuttle Logistics Project Management Directorate (TL) plans to develop a procedure to ensure all viable candidates for competition are fully considered. The procedure is planned as follows: TL will identify potential candidates; TL will direct Rockwell to prepare a Technical Evaluation and Cost Analysis for potential candidates; TL will assess the feasibility of candidates for competition; feasible candidates will be forwarded to JSC for approval of competition; approved candidates will be assessed against TL budget requirements to determine cost effectiveness; cost effective candidates will be competed. Formal establishment of this procedure is scheduled to be completed by December 4, 1993.

**Evaluation of
Management's
Response**

The action planned by KSC is responsive to the recommendation.

THIS PAGE IS LEFT INTENTIONALLY BLANK

2. **DIRECT BUY
PROGRAM CAN BE
IMPROVED**

The Direct Buy Program can be improved by streamlining the approval process. The current process includes cost analysis, technical evaluations, and board approvals, which we believe may be duplicative. As a result, program costs are increased and savings are lost through a delay in direct buy procurements. We believe that the various board reviews and approvals contributed to the Program's current condition. Streamlining the process through a Total Quality Management (TQM) initiative should reduce program delays and increase savings.

NASA Management Instruction (NMI) 5900.1 establishes a uniform policy for the acquisition and provisioning of NASA spare parts. Section 4, "Policy," states that breakout or direct buy is encouraged to the maximum extent possible. The same directive broadly defines "breakout" as a "direct purchase . . . from the actual manufacturer or another source closer to the actual manufacturer than the prime contractor."

NASA Office of Inspector General Audit Report A-JP-88-003, "Audit of Rockwell Direct Buy Program," reported that the previous Shuttle Program Spares Contract, NAS 9-14000, did not comply with NMI 5900.1, "NASA Spare Parts Acquisition Policy." As a result, the Contractor was directed to implement a Direct Buy Program by Amendment 63 to the Contract. The Contractor and KSC jointly developed a program, outlined in Program Bulletin No. 1, which incorporated guidance from NMI 5900.1 and recommendations contained in the OIG report. Subsequently, the Contractor developed an internal directive, Launch Support Implementing Instruction (LSII) 6-36, to meet the Johnson Space Center's (JSC's) concern for more involvement in the approval process. LSII 6-36 describes functional responsibilities for implementing the Direct Buy Program along with flowcharting the review process.

The Direct Buy review process involves four segments: Initial identification of a candidate, technical evaluation, cost analysis, and Board approvals. Initially, potential candidates are identified from items submitted to the Contractor's Funding

Authorization Review Board (FARB). Next, a preliminary analysis is performed to determine whether the item is already purchased directly.

The second segment involves a technical analysis which determines whether the supplier adds any value to the item. Value added is defined, in LSII 6-36, as enhancing the part, subassembly, or subsystem by adding or including a necessary and significant service or function.

The next segment, cost analysis, is performed if it was determined that the supplier added no value to the part or that the Contractor could perform the tasks and responsibilities previously assumed by the supplier while maintaining product integrity. Cost analysis determines whether buying directly is cost effective.

The final segment includes the various board reviews and approvals. Those boards include: (1) Engineering Review Board, consisting of Downey, California, contractor design personnel; (2) Program Management Review Board, which includes the Logistics Program Director; (3) Logistics Control Board, which includes KSC and JSC personnel; (4) Configuration Control Board headed by the Manager, Orbiter and GFE Projects, at JSC; and (5) Orbiter Engineering Board, consisting solely of JSC personnel. It should be noted that the board membership includes personnel from four different locations, which increases coordination responsibilities.

As of September 30, 1992, 936 candidates were considered by the FARB. Of these, 907 or 97 percent did not meet initial requirements and were not reviewed further. The remaining 29 candidates consisted of 16 that were either in the review process or awaiting review, 8 that were approved, and 5 that were disapproved. Our review disclosed that the average candidate processing time is over 7 months. Processing starts when Logistics recommends that the candidate be considered and ends when final authorization is made. Candidate processing time periods range from 4 to 11 months.

Two undesirable effects result from the current approval process. First, program savings are lost due to the candidate backlog, which prevents early realization of savings. The current backlog is eight. A backlog is defined as those candidates who have not been initially screened by Logistics personnel and are awaiting review. Second, costs are increased due to the duplicative efforts by both the Direct Buy Program coordinator in preparing for board reviews and by the Boards for time spent in review and approvals.

We believe that the time needed to process candidates can be shortened by streamlining the process. Streamlining, for example, would include reviewing Board composition and the number of Board approvals to determine whether the reviews could be accomplished with less than four different groups or with fewer boards. The composition and number of boards suggests possible duplicative efforts.

RECOMMENDATION 2:

Kennedy Space Center should, in coordination with Johnson Space Center and the Contractor, view the Direct Buy Program approval process as a TQM initiative. Consideration should be given to reevaluating program policies, procedures, and practices to address program direction, candidate review processes, and cost effectiveness.

**Management
Response**

Concur. An informal team consisting of KSC, JSC, and Rockwell evaluated the direct buy process. Rockwell and NASA KSC reviewed the Direct Buy program procedures controlled by KSC in an effort to identify duplicative tasks and inefficient procedures. Efforts to maximize parallel task accomplishment in all phases of the candidate approval process are being implemented. Review board processing will also be focused on compression of schedules through effective precoordination efforts. The existing backlog of candidates is being effectively retired through increased man-hour allocations and multiple candidate reviews. Additionally, JSC Manager, Orbiter and GFE Projects (VA), assisted in streamlining the approval process through formal delegation of the Logistics Control Board Directive dispositioning authority to JSC Manager, Orbiter Engineering Office (VE). The delegation of the Configuration Control Board approval

authority to the level of Orbiter Engineering Review Board will eliminate one major processing task for direct buy evaluations. With these actions, Recommendation 2 is considered closed.

***Evaluation of
Management's
Response***

The actions taken by KSC are responsive to the recommendation.

3. **FORMAL CONTROLS
FOR UPDATING
PROCUREMENT
REQUIREMENTS
SHOULD BE
EVALUATED**

Formal controls for updating procurement requirements, recently developed by the Contractor, should be evaluated. During the course of the audit, we noted that the Contractor did not have a formal system in place for assuring that changes in procurement requirements were identified and disseminated to appropriate contractor personnel. This resulted in a loss of assurance that subcontracts comply with all applicable procurement requirements and that orbiter logistic contract provisions are being met. As a result of our audit, the Contractor took immediate action and developed formal controls.

The Federal Acquisition Regulation (FAR) and the related NASA FAR Supplement set forth requirements which should be incorporated in subcontracts awarded by a prime contractor on behalf of the Government. These requirements are incorporated in the subcontracts through "flowdown" provisions. For example, those "flowdown" provisions require that Certified Cost or Pricing Data be obtained from sub-contractors when the \$500,000 threshold is exceeded.

The orbiter logistics contract describes various procurement directives which the Contractor must meet. For example, the Contract requires KSC Contracting Officer approval for procurements that exceed \$100,000. These directives are included in the contract to protect the Government's interests.

The Contractor established formal controls for updating procurement requirements. During the audit, we advised the Contractor that formal controls would provide reasonable assurance that subcontracts comply with all applicable procurement requirements. We also noted two examples where formal controls would have eliminated any confusion regarding subcontract language or procurement directives. As a result of our discussions, the Contractor created Material Manual Procedure 3.02-FO titled "Updating Procurement Requirements." This procedure, dated February 24, 1993, is in the draft stage so it is uncertain whether the procedure has

been formally adopted. Therefore, we could not verify that the procedure has been effectively implemented.

RECOMMENDATION 3: Kennedy Space Center should:

- Verify that the procedure has been adopted and implemented.
- Assess its effectiveness.

**Management
Response**

Concur. The Rockwell Florida Operations Material Manual Procedure 3.02.8-FO, titled "Updating Procurement Requirements", was issued April 19, 1993, and has been implemented within the Rockwell Material Department. The effectiveness of this procedure will be verified during the upcoming semiannual purchasing system review performed by the KSC Shuttle Contract Office Logistics Branch (OP-SCO-2). The review will be completed by December 31, 1993.

**Evaluation of
Management's
Response**

The action planned by KSC is responsive to the recommendation.

OTHER OBSERVATIONS

Our audit disclosed two procurement practices which we believe should be brought to your attention. These involve skill retention procurements and Provisioning Order negotiations.

First, an opportunity exists for certain skill retention procurements to be approached innovatively. The Orbiter Logistics Contract requires that certain skills be retained by subcontractor employees. Previously, those skills were retained through parts fabrication, studies, training, or retaining facility space. Planned procurements are broader in nature and include parts fabrication, failure analysis, studies, manual preparations, repair certification, training, and delivery and storage of materials.

Procurements that do not involve parts fabrication provide an opportunity for innovative approaches which limit overhead and/or labor costs. For example, material delivery and storage procurements may not involve engineering or manufacturing overhead elements. Accordingly, those procurements might exclude overhead costs for those elements. Other procurements, such as studies and manual preparations, could limit overhead costs to administrative and clerical functions. Another approach may be to pay only labor and related fringe benefit costs for specific employees whose skills are to be retained. This approach would involve minimal regard for a product and could be accomplished through the use of consultant fees, retainers, or stipends. The skill retention requirement could be balanced against the need for any resulting product.

In conclusion, it appears beneficial that certain skill retention procurements be approached with a different perspective. Namely, that innovative approaches, as outlined above, be considered to retain those skills at the lowest, effective cost to the Government.

Second, our audit disclosed a procurement practice which we believe warrants commendation. That practice involves the use of Requests for Proposals (RFP) instead of Rough Order of Magnitudes when negotiating Provisioning Orders with the orbiter logistics contractor. Recent adoption of this practice led to several benefits, including eliminating definitization schedule problems, creating better negotiation data, reducing disclosures, and lessening the chance of contract overruns. We believe the use of RFP's when procuring spares provides a greater degree of procurement effectiveness.

GENERAL COMMENT

The NASA Office of Inspector General staff members associated with this review express their appreciation to the NASA Headquarters, Kennedy Space Center, and contractor personnel contacted for their courtesy, assistance, and cooperation.



John F. Kennedy Space Center
Kennedy Space Center, Florida 32899

JUL 12 1993

Reply to Attn of

HM-ICO-074-93

TO: W/OIG Center Director, KSC

FROM: CD/Director, KSC

SUBJECT: Draft Report on the Audit of the Acquisition of
Orbiter Spares, Kennedy Space Center, A-KE-92-003

KSC management has reviewed the subject draft report. KSC
concurs with all three recommendations.

Based on actions coordinated by the KSC Shuttle Logistics
Project Management Directorate (TL); Recommendation 2 is
considered closed. Recommendations 1 and 3 will have
corrective actions completed by the cognizant KSC Directorates.
Specific comments are enclosed.

Robert L. Crippen

Enclosure



**DRAFT OIG REPORT ON THE ACQUISITION OF ORBITER SPARES
A-KE-92-003**

RECOMMENDATION 1

Kennedy Space Center should, in coordination with the Contractor, implement a proactive approach to planned procurements which ensures that all viable candidates for competition are fully considered.

KSC RESPONSE

Concur. The KSC Shuttle Logistics Project Management Directorate (TL) plans to develop a procedure to ensure all viable candidates for competition are fully considered. The procedure is planned as follows: TL will identify potential candidates; TL will direct Rockwell to prepare a Technical Evaluation and Cost Analysis for potential candidates; TL will assess the feasibility of candidates for competition; feasible candidates will be forwarded to JSC for approval of competition; approved candidates will be assessed against TL budget requirements to determine cost effectiveness; cost effective candidates will be competed. Formal establishment of this procedure is scheduled to be completed by December 4, 1993.

RECOMMENDATION 2

Kennedy Space Center should, in coordination with Johnson Space Center and the Contractor, view the Direct Buy program approval process as a TQM initiative. Consideration should be given to reevaluating program policies, procedures, and practices to address program direction, candidate review processes, and cost effectiveness.

KSC RESPONSE

Concur. An informal team consisting of KSC, JSC, and Rockwell evaluated the direct buy process. Rockwell and NASA KSC reviewed the Direct Buy program procedures controlled by KSC in an effort to identify duplicative tasks and inefficient procedures. Efforts to maximize parallel task accomplishment in all phases of the candidate approval process are being implemented. Review board processing will also be focused on compression of schedules through effective precoordination efforts. The existing backlog of candidates is being effectively retired through increased man-hour allocations and multiple candidate reviews. Additionally, JSC Manager, Orbiter and GFE Projects (VA), assisted in streamlining the approval process through formal delegation of the Logistics Control Board Directive dispositioning authority to JSC Manager, Orbiter Engineering Office (VE). The delegation of the

Configuration Control Board approval authority to the level of Orbiter Engineering Review Board will eliminate one major processing task for direct buy evaluations. With these actions, Recommendation 2 is considered closed.

RECOMMENDATION 3

Kennedy Space Center should: 1) Verify that the Contractor procedure "Updating Procurement Requirements", has been adopted and implemented; 2) Assess its effectiveness.

KSC RESPONSE

Concur. The Rockwell Florida Operations Material Manual Procedure 3.02.8-FO, titled "Updating Procurement Requirements", was issued April 19, 1993, and has been implemented within the Rockwell Material Department. The effectiveness of this procedure will be verified during the upcoming semiannual purchasing system review performed by the KSC Shuttle Contract Office Logistics Branch (OP-SCO-2). The review will be completed by December 31, 1993.

KE-95-008

AUDIT REPORT

SELECTED SECURITY RISKS TO THE SPACE SHUTTLE AND CREW

KENNEDY SPACE CENTER, FLORIDA

March 20, 1995



OFFICE OF INSPECTOR GENERAL



Reply to Attn of:

W

TO: M/Associate Administrator for Space Flight

FROM: W/Deputy Assistant Inspector General for Auditing

**SUBJECT: Final Audit Report on Selected Security Risks to the Space Shuttle and Crew
Assignment No. A-KE-93-009, A-KE-94-012
Report No. KE-95-008**

The NASA Office of Inspector General has completed an audit of "Selected Security Risks to the Space Shuttle and Crew" at the Kennedy Space Center. The objective of the audit was to evaluate Agency oversight of SPACEHAB Commercial Middeck Augmentation Module (CMAM) payload procedures to ensure protection of the space shuttle and astronaut crew.

The audit determined that some commercial payloads flown under the SPACEHAB CMAM project pose security vulnerabilities to the space shuttle and crew. Specifically, sealed or self-contained payloads are not subject to KSC's usual integration process. Consequently, the level of security that exists for shuttle payloads, which are fully integrated by NASA, are not present for SPACEHAB commercial payloads. We recommended that SPACEHAB integration procedures be evaluated to ensure that security risks to the space shuttle and crew are minimized.

A written response was received from the Office of Space Flight on January 19, 1995. Management's comments have been incorporated, in part, into the final report and are attached, as a whole, as Appendix A to the report.

If you have any questions or need additional information, please contact Robert Wesolowski, Director, Audit Field Operations Division, or me at 358-1232.

Robert F. Raspen

Enclosure

cc:
JMC/P. Chait
W/L. Van Camp

(This page is intentionally left blank)

Table of Contents

Acronyms	i
Introduction	1
Objective, Scope, and Methodology	3
Observation and Recommendation	4
Security Risks to the Space Shuttle and Crew Have Not Been Assessed	4
Recommendation	6
Management's Response	6
Evaluation of Management's Response	7
General Comment	8
Appendix A	A-1

(This page is intentionally left blank)

ACRONYMS

CMAM	Commercial Middeck Augmentation Module
JSC	Johnson Space Center
KSC	Kennedy Space Center
NHB	NASA Handbook
NMI	NASA Management Instruction
NRP	NASA Resource Protection
SPPF	SPACEHAB Payload Processing Facility
SSDA	Space Systems Development Agreement

(This page is intentionally left blank)

INTRODUCTION

The Office of Inspector General has completed an audit of Selected Security Risks to the Space Shuttle and Crew. The audit was performed in accordance with the authority and responsibility contained in NASA Management Instructions (NMI's) 9910.1B and 1103.27A, dated September 7, 1994, and January 31, 1990, respectively.

The Draft Report was issued on December 5, 1994. Management's response was received on January 23, 1995. Comments have been incorporated in the report and the response, in whole, is included as Appendix A of the report.

BACKGROUND

The National Aeronautics and Space Act of 1958 directs NASA to "seek and encourage to the maximum extent possible, the fullest commercial use of space." In accordance with this Act, NASA developed the Space Systems Development Agreement (SSDA) designed for first entrants in new space industry ventures. The SSDA is a special launch services agreement between NASA and a private entity.

In August 1988, NASA entered into an SSDA with SPACEHAB, Incorporated (SPACEHAB). Under the terms of this agreement, NASA provides transportation and associated services for launching SPACEHAB's middeck augmentation modules into orbit using the space shuttle. The modules are pressurized to support man-tended experiments for scientific and industrial uses. Each module may be configured with lockers and/or racks for support of a variety of experiments. Approximately 50 lockers can be accommodated in each module.

Subsequent to the SSDA, NASA entered into a contract (NAS9-18371) with SPACEHAB for lease and integration services for 200 lockers to be flown over six flights on the shuttle. During an audit of the SPACEHAB Commercial Middeck Augmentation Module (CMAM) Project, we identified a condition which warrants management's attention. This condition concerns security risks to the space shuttle and its astronaut crew. Based on discussions with NASA officials, it was determined that this matter

should be addressed in a report separate from the
SPACEHAB CMAM Project report.

Objective, Scope, and Methodology

OBJECTIVE

The objective of the audit was to evaluate Agency oversight of CMAM payload procedures to ensure protection of the space shuttle and astronaut crew.

SCOPE

The audit scope was limited to those procedures for processing CMAM payloads. Specifically, the scope included reviews of the policies, procedures, and actual practices for integrating the CMAM and associated payloads into the shuttle. Although we did not audit other entities' payload processing procedures, the vulnerabilities identified with SPACEHAB payloads may apply to other non-NASA payloads flown on the space shuttle.

METHODOLOGY

The audit included (1) discussions with NASA Headquarters, Johnson Space Center (JSC), Kennedy Space Center (KSC), and contractor personnel and (2) examinations of Agency and contractor records and selected internal controls related to the audit objective.

The audit was conducted in accordance with generally accepted Government auditing standards and included such examinations and tests of applicable records, documentation, and internal controls as deemed necessary in the circumstances.

INTERNAL CONTROLS REVIEWED

Internal controls for the safeguarding of Agency assets were reviewed during the audit. We identified a need to strengthen the controls in place to ensure proper safeguarding of assets for the CMAM project. The controls in this area are discussed in detail in the Observation and Recommendation section of this report

AUDIT FIELD WORK

Audit field work was conducted during the period of April 1993 to May 1994. Most of the field work was performed at KSC, Florida. However, field visits were conducted to NASA Headquarters, Washington, DC; JSC, Houston, Texas; and the SPACEHAB Payload Processing Facility (SPPF), Cape Canaveral, Florida.

Observation and Recommendation

SECURITY RISKS TO THE SPACE SHUTTLE AND CREW HAVE NOT BEEN ASSESSED

Some commercial payloads flown under the CMAM project pose potential vulnerabilities to the space shuttle and its crew. Specifically, sealed or self-contained payloads and payloads that require direct delivery to the shuttle just prior to launch are not subject to KSC's usual integration process. Although safety reviews are in place for these payloads, security reviews are not. These reviews are not in place because the security vulnerabilities associated with flying these commercial payloads (i.e., those which are not initiated, integrated, and managed by a NASA or other U.S. Government program) have not been assessed. As a result, NASA does not have reasonable assurance that the lowest feasible risk from intentional harm has been provided.

NMI 1600.2, the "NASA Security Program," states that NASA resources such as the space shuttle will be protected against loss, theft, vandalism, espionage, sabotage, and other threats or acts of violence. The NMI further states that mission essential resources will be protected consistent with the National Resource Protection (NRP) Program as described in the "NASA Security Handbook," NASA Handbook (NHB) 1620.3C.

The NHB states that it is NASA's policy to provide reasonable and affordable protection within acceptable risks to those vital NRP Program resources for which the Agency is responsible. These unique resources, which support Agency and national goals, cannot be reasonably replaced; therefore, they will be protected as critical or essential NASA resources.

In addition, NHB 1620.3C provides for development of an NRP Program plan consisting of security enhancements, prioritized and supported by a budget plan. Preparation of the plan will include vulnerability assessments conducted for each NRP Program asset. We found that such assessments have not been performed to evaluate risks under the CMAM project.

Safety Reviews Performed in Lieu of Security Reviews

NASA has performed reviews to address risks of unintentional harm to the shuttle or crew. The CMAM payload and Ground Support Equipment design and operations must comply with NASA requirements contained within the various safety policy requirements, handbooks, and agreements. Payload compliance with the safety requirements is assessed by the Space Shuttle

Program through four phases of flight and ground safety reviews and safety certification. These mechanisms require full disclosure of payloads (i.e., experiments) throughout the integration process. NASA relies on these safety mechanisms, rather than security measures, to gain assurance that experiments do not pose a threat to the shuttle or crew.

***Physical Inspection
Of Payloads Not
Required***

While CMAM payloads are required to comply with NASA's directives, the safety panel evaluations are designed to identify unintentional acts of harm to the shuttle and crew. These evaluations are limited to documentation reviews and do not require physical inspection of the payload contents. Consequently, there is no assurance that actual payload contents are consistent with the documented disclosure.

Although not required by the safety panel, NASA representatives, including the flight crew, perform walk-through inspections of some experiments at the SPPF prior to delivery at KSC. However, these inspections are limited to the experiments which are available at the SPPF during the flight crew's pre-launch activities. These inspections are intended to ensure safety of the crew and consistency of the experiments with written descriptions, instructions, and training provided to the astronaut crew. For example, these inspections provide an opportunity to perform a sharp edges inspection to protect against damage to astronaut flight suits while in orbit.

***Experiments Not
Subject to Inspection***

Some of the experiments, however, are not subject to the walk-through inspections. Specifically, there are two types of experiments which may not be inspected prior to launch. These are (1) sealed or self-contained experiments and (2) late-access experiments. The integration process for each of these types of experiments places NASA at risk.

Sealed or self-contained experiments are those that are integrated, sealed, and delivered to the SPPF independently by the commercial customer. Commercial customers may request that the CMAM locker be shipped directly to the customer from the SPPF. The customer can then integrate their experiment directly into the locker, seal the locker, and return it to the SPPF. Once the sealed locker is returned, SPACEHAB does not open it or physically inspect its contents, nor does SPACEHAB reserve the right to examine these experiments at any time. Consequently, these sealed or self-contained lockers are not physically inspected prior to launch.

In addition to the risks associated with sealed or self-contained experiments, "late access" experiments may also pose a threat to the space shuttle and crew. Experiments delivered directly to the launch pad just prior to launch are known as "late access" payloads. Late access may be necessary because of the experiment's unique nature (e.g., live animals, or the experiment was not available for integration at the SPPF). Because these experiments are delivered directly to the shuttle, there is no physical inspection of these experiments prior to launch. Consequently, a party predisposed to commit an intentional act of harm could expose the shuttle or crew to potential danger through the use of a late access payload.

Late access experiments were flown on CMAM flights 1 and 2. In each case, there was no physical inspection of these experiments. Physical inspections are necessary to minimize the risk of intentional or unintentional harm to the shuttle or crew.

Conclusion

Because the CMAM project is a private sector venture intended to provide commercial access to the shuttle, NASA is not directly involved in the integration of experiments into the CMAM. The CMAM experiments are processed and integrated by SPACEHAB and its prime contractor. Consequently, the levels of security that exist for shuttle payloads which are fully integrated by NASA may not be present in CMAM payloads. We believe this condition poses additional risks to the space shuttle and its crew.

RECOMMENDATION

The Associate Administrator, Office of Space Flight, should evaluate the CMAM integration procedures and initiate any additional measures (i.e., physical inspections of late access payloads) needed to ensure the lowest feasible level of risk has been achieved for the shuttle and crew.

Management's Response

Although the Security risks associated with the CMAM project have not been separately and formally addressed, it is our position that the risks from these payloads are not significantly different from those associated with other payloads which we fly. Some components for all payloads are not inspectable; items are not torn apart to verify that their contents are consistent with documentation. The IG's concern about "late access" payloads is overstated and really pertains to whether or not payloads are sealed. Further, with the decision to use SPACEHAB in support of the Shuttle/Mir program, the chances of there being any truly commercial payloads flown in the SPACEHAB module are nil. In

***Evaluation of
Management's
Responses***

summary, the Office of Space Flight believes that although there may be security risks associated with flying commercial payloads, these risks are unavoidable.

OSF's response indicates that the SPACEHAB payloads are similar to other commercial payloads and, therefore, constitute the same unavoidable risks to the space shuttle and crew. However, we believe there are unique vulnerabilities associated with SPACEHAB commercial payloads. For example, there are no procedures for verification of SPACEHAB payloads. While we do not advocate "tearing down" payloads, we do believe the ability or right to verify contents should be retained by NASA through any appropriate means. Consequently, we do not believe our concerns were overstated.

Although the OSF now dismisses the potential for future commercial payloads, our concerns were based on continual assertions by NASA and SPACEHAB that commercial customers were forthcoming. While there are no commercial payloads currently scheduled for the SPACEHAB modules, we continue to have concerns with the potential for intentional harm to the space shuttle and crew. However, based on OSF's acceptance of these security risks, no further action by NASA is required.

GENERAL COMMENT

The NASA Office of Inspector General staff members associated with is review express their appreciation to NASA Headquarters, Johnson Space Center, Kennedy Space Center, and contractor personnel contacted for their courtesy, assistance, and cooperation.

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001



RECEIVED

JAN 17 1995

JAN 19 1995

Reply to Attn of:

MO

TO: W/Deputy Assistant Inspector General for Audit

FROM: M/Associate Administrator for Space Flight

SUBJECT: Response to Draft Audit Report on Selected Security
Risks to Space Shuttle and Crew
Assignment No. A-KE-94-012

After reviewing the subject draft audit report, we are providing the following written comments.

1. Although the security risks associated with the CMAM project have not been separately and formally addressed, it is our position that the risks from these payloads (all of which were developed under NASA sponsorship as part of the Centers for the Commercial Development of Space program) are not significantly different from those associated with other payloads which we fly.
2. As with all payloads, as stated in the draft audit report, the payload safety process protects against unintentional problems but does not function as a security review. Although the term "sealed payloads" may sound ominous, there are at least components for essentially all payloads which are to all intents and purposes not inspectable. These range all the way from individual "black boxes" to whole payloads like the recently flown Christa-Spas payload from ESA; we do not tear these items apart to verify that their contents are consistent with the documentation.
3. We believe that the concern about "late access" payloads is overstated. Most late access payloads by their very nature are integrated at KSC before they are installed. In any case the concerns about "late access" payloads really pertain to whether or not they are "sealed."
4. With the decision to use the Spacehab modules to provide logistics in the Shuttle/Mir program, the chances of there being any truly commercial payloads flown in the Spacehab module are nil. All payloads flown using the Spacehab module are almost certainly going to remain NASA sponsored (as in CMAM) or sponsored by another space agency such as ESA.

5. As they have in the past, the Shuttle program and the Security Office at KSC will continue to address payload security on a case-by-case basis when circumstances indicate.

In summary, the Office of Space Flight believes that although there may be security risks associated with flying payloads, these risks are unavoidable. Furthermore, we believe that the risks associated with flying CMAM payloads using the Spacehab module are not significantly different from those associated with other payloads.

J. Wayne Littles

**AUDIT
REPORT**

LE-93-004

**AUDIT OF LERC 50TH
ANNIVERSARY EXPENDITURES**

**LEWIS RESEARCH CENTER
APRIL 16, 1993**



National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

Office of Inspector General
Lewis Research Center
Cleveland, Ohio 44135

Reply to Attn of:

0160

April 16, 1993

TO: 0100/Director

FROM: 0160/OIG Center Director, LeRC

SUBJECT: Final Report on Audit of LeRC 50th Anniversary
Expenditures
Report No. LE-93-004

INTRODUCTION

During the "Exchange Fund" 1/ audit (Assignment No. A-LE-92-008), the NASA Office of Inspector General (OIG) identified questionable expenditures involving the Lewis Research Center's (LeRC's) 50th Anniversary celebration. Because the issue was outside the stated scope and objectives of that audit, the OIG initiated an Audit of LeRC 50th Anniversary Expenditures (Assignment No. A-LE-93-002) and is reporting separately on those expenditures. This audit was conducted under the authority contained in NASA Management Instructions 1103.27 and 9910.1, (as revised), and in accordance with generally accepted Government auditing standards.

LeRC celebrated its 50th Anniversary with a wide range of events. The celebration was carefully planned to increase national and international exposure for LeRC programs and activities. A project manager was assigned to provide overall direction; financial support was obtained from appropriated, non-appropriated, and private industry funding sources; and, events were planned to allow Center employee, contractor, industry, and public involvement. The final events were completed October 25, 1991.

OBJECTIVE AND SCOPE

The audit objectives were to determine if disbursements from fiscal years (FYs) 1991 and 1992 Research and Program

- 1/ The NASA LeRC Exchange is a non-appropriated fund activity established to promote and operate activities that contribute to the efficiency, welfare, and morale of Center employees.

Management (R&PM) appropriations to pay for 50th Anniversary activities were: (1) consistent with the funding authority; and (2) properly justified and approved.

All audit work was performed at LeRC during the period June 1992 through February 1993. The work included reviewing applicable funding authorizations and agency budgetary policies; interviewing project, financial management, procurement, and other personnel; and, performing limited tests of internal controls and financial transactions. In addition, the issues in this report were discussed with the OIG Attorney-Advisor to ensure proper interpretation of appropriation law. This review included only matters related to the use of R&PM funds appropriated during FYs 1991 and 1992 for anniversary-related events.

RESULTS OF AUDIT

While LeRC's 50 years of operation was a significant milestone, approximately \$36,700 of FYs 1991 and 1992 appropriated R&PM funds were improperly expended on entertainment. These expenditures were not authorized by Congress or otherwise approved by the proper NASA officials. The improper expenditures occurred because the internal controls at the Center were not effective. As a result, public laws governing use of appropriated funds were violated and legitimate R&PM activities at the Center were negatively impacted.

NASA receives funding to carry out its overall mission and individual programs and projects from annual Congressional appropriations. The annual appropriation bills (which are public law), and the accompanying Congressional committee reports, establish the amounts and specific purposes for which the funding can be used. Congress allocates the funding by major categories called appropriations. One NASA appropriation--R&PM--funds civil service salaries and expenses, operating facilities, and direct support of research and development activities.

Appropriated funds cannot be used for purposes other than for which they were specifically authorized and intended. According to the "Principles of Federal Appropriations Law," Second Edition, Vol. I, dated July 1991, using appropriated funds for entertainment (including food and drink, receptions, banquets, music, and recreational facilities) for either Government or non-Government personnel is prohibited, unless specifically authorized by the appropriation. The principles specifically state:

"Just as the entertainment of Government personnel is generally unauthorized, the entertainment of non-Government personnel is equally impermissible. The basic rule is the same regardless of who is being fed or entertained: Appropriated funds are not available for entertainment."

including free food, except under specific statutory authority."

Comptroller General decisions have identified limited exceptions to the general prohibition of spending appropriated funds for entertainment. The primary exceptions relate to entertainment or refreshments for formal incentive awards programs or activities directly related to accomplishing the agency's mission. However, the OIG does not believe that either exception applies to the questioned 50th Anniversary expenditures.

NASA's appropriations for FYs 1991 and 1992 did not contain specific authorization for entertainment and gift expenses for LeRC's 50th Anniversary events. However, the appropriations did contain \$35,000 each year for the Administrator's extraordinary expenses. If 50th Anniversary events had been authorized as extraordinary expenses, either the Administrator, or a designee, was required to specifically approve the expenditure of these funds. Such approval was neither requested nor obtained.

As of May 31, 1992, LeRC had disbursed \$287,306 of FYs 1991 and 1992 R&PM funds to support the 50th Anniversary. Our review focused on payments for 14 large purchase orders accounting for \$233,750 (81 percent) of the funds disbursed for anniversary events. Six of the purchase orders included \$36,719 of expenditures that involved funds either spent directly on entertainment, or used to reimburse the LeRC Exchange Fund for entertainment.

QUESTIONED PURCHASE ORDERS

<u>Purchase Order</u>	<u>Description</u>	<u>Amount Questioned</u>
T23506R	Decorations for Dinner/ Dance, Including Lighting and Table Centerpieces	\$15,300 *
T23543	Banquet, Dance Floor Decorating	12,500
75557R	Food (Luncheon/ Refreshments), Decorations, Misc.	5,654
23167R	Musicians for Dinner/ Dance	1,650
79536A	Hot Buffet and Other Catered Food	1,233
23294R	Reception (Coffee, Pastries, Fruit)	382

	Total	\$36,719 =====

* Disbursements for Purchase Order T23506R totalled \$23,850; however, \$8,550 of the expenditure used to procure permanent exhibits is not being questioned.

The remaining eight purchase orders were for disbursements of \$188,481 made consistent with authorized R&PM expenditures.

Of the questioned costs, \$29,450 (80 percent) were for expenditures associated with the 50th Anniversary Dinner Dance held at the International Exposition (I-X) Center on October 19, 1991, an event closed to the public. According to the Project Manager's files, the planned audience was limited to LeRC employees and contractors, other NASA personnel, political leaders, and employees and contractors from other Government agencies. If the general public had been invited, the Dinner Dance might have been justifiable as an educational event to disseminate information concerning the activities of the Center. However, that was not the case, because all 270 people attending the event were LeRC employees, contractors, and their guests.

The unauthorized transactions occurred because controls intended to prevent such a situation were not effective. First, the Office of the Comptroller requested that the Budget Office (Code 0210) review and approve all anniversary transactions, regardless of dollar value, because of their "sensitivity." Normally, only orders of \$50,000 and higher would be reviewed by the Budget Office. While a budget analyst reviewed and approved all the purchase requests for the anniversary events except one, the OIG does not believe that the requests for the questioned costs were critically scrutinized. For example, the purchase requests were not disapproved or referred for higher level review, although the impropriety of purchases such as food and decorations for a luncheon should have been obvious.

Second, LeRC purchasing procedures require the purchase order initiator to completely and accurately describe the service or item requested. Two purchase orders did not meet this requirement.

- Order T23543 for a Dinner/Dance was described as "Space at the International Exposition Center."
- Order T79536A for food was described as "Miscellaneous Supplies."

Proper descriptions would have assisted identifying these as unallowable R&PM expenditures. However, by not providing specific and accurate descriptions of the services/items being requested on purchase orders, the Project Manager who initiated the orders circumvented established controls intended to preclude invalid or questionable purchases. In addition, the documentation in some cases was not sufficiently descriptive to give the certifying officer a reasonable basis to assess the appropriateness of the proposed expenditures.

Third, a certifying officer is responsible for assuring the legality of the proposed payments under the appropriation or fund involved. According to the NASA Financial Management Manual, certifying officers should ensure that any doubtful questions of law are resolved, prior to certifying a voucher for payment. The certifying officer approving payments for the anniversary events did not critically review each order before certifying them for payment. In some cases, as mentioned above, the documentation provided was insufficient for the certifying officer to make an informed decision. In those instances where the documentation provided was adequate, such as the request to pay for a band (i.e., entertainment), the certifying officer should have disapproved the request and not certified it for payment. The Financial Management Manual states that certifying officers are accountable for any illegal, improper, or incorrect payment and may be required to make good to the United States the amount of such payments.

An additional problem associated with the Dinner Dance was that an apparently illegal contract was entered into between LeRC and the I-X Center. The Federal Acquisition Regulation Subpart 1.6 states that "Contracts may be entered into and signed on behalf of the Government only by contracting officers." Although the Project Manager for the 50th Anniversary events was not a warranted contracting officer, he signed a contract stating, "...\$12,500 shall be paid out of NASA appropriated funds by means of a NASA Lewis purchase order to be placed with said NASA Lewis Exchange by the NASA Lewis Research Center in the near future."

According to LeRC officials, the Project Manager signed the contract on the advice of the LeRC legal office and there was no intent to commit Center appropriated funds. On reviewing the available documentation, the OIG did not find any evidence that the Exchange either intended or authorized the Project Manager to be its agent. The Exchange is not empowered to spend appropriated funds, and it cannot create an agency permitting someone else to do so. LeRC officials acknowledge that the contract was poorly worded and subject to misinterpretation because the Project Manager had no authority to obligate appropriated funds.

RECOMMENDATION 1

LeRC should ensure that the U.S. Treasury is reimbursed \$36,719 which represents the value of anniversary expenses improperly paid from the R&PM Appropriation.

MANAGEMENT RESPONSE

Concur. The U.S. Treasury will be reimbursed in the amount of \$36,719.

EVALUATION OF MANAGEMENT RESPONSE

LeRC's proposed action is responsive to this recommendation. Reimbursing the U.S. Treasury from non-appropriated funds will correct the improper expenditures that occurred.

RECOMMENDATION 2

LeRC should strengthen existing purchase order review and approval procedures to ensure that purchase descriptions sufficiently describe the goods and services being procured to permit a thorough review and analysis by both management officials and certifying officers. At a minimum, LeRC should ensure that:

- initiators of purchase requests, such as the Project Manager of the 50th Anniversary, fully and accurately

describe all items and services sought to be purchased.

- budget analysts responsible for approving purchase orders (1) return or amend and document before approval any incomplete (including non-descriptive) orders and (2) critically review orders designated "sensitive."
- certifying officers, prior to certifying vouchers for payment, verify the legality of proposed payments under the appropriation or fund involved; and, if a doubtful question of law exists, resolve the question either with assistance available within NASA or by requesting a decision from the Comptroller General.

MANAGEMENT RESPONSE

Concur. Those who erred in the instant case will be counseled regarding their responsibilities for fully and accurately describing and reviewing purchase requests.

EVALUATION OF MANAGEMENT RESPONSE

LeRC's proposed action is responsive to this recommendation. The staff's competence and adherence to procedures when preparing, reviewing, and approving purchase requests is critical to the effective operation of the internal controls over expenditures of appropriated funds.

RECOMMENDATION 3

The LeRC Center Director should direct the Chief Counsel to critically review all contracts entered into by LeRC employees who, either acting on their own behalf or as an agent of the LeRC Exchange Fund, are using monies provided by or through the Exchange Fund. At a minimum, the Chief Counsel should ensure that any contracts do not obligate Government appropriated funds.

MANAGEMENT RESPONSE

Concur. The LeRC Chief Counsel will be directed to review all contracts utilizing Exchange funds.

EVALUATION OF MANAGEMENT RESPONSE

LeRC's proposed action is responsive to this recommendation. Instructions to ensure a legal review of all contracts will help prevent improper or illegal contracts for which the Center could be criticized.

Because of the sensitive nature of the improper expenditures, we are requesting to be in the concurrence cycle for all of the recommendations.

We appreciate the courtesy, assistance, and cooperation extended by LeRC personnel contacted during this review.

Chester A. Sipsock

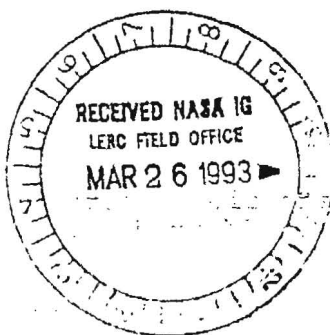
Enclosure

Appendix A - LeRC's response dated March 26, 1993



National Aeronautics and
Space Administration

Lewis Research Center
Cleveland, Ohio
44135



MAR 26 1993

Reply to Attn of 0100

TO: 0160/OIG Center Director, LeRC
FROM: 0100/Associate Director
SUBJECT: Draft Report on Audit of LeRC 50th Anniversary
Expenditures (A-LE-93-002)

Thank you for the opportunity to review and respond to your draft report on the LeRC 50th Anniversary Expenditures (A-LE-93-002). Our response to each of the three recommendations follow:

OIG Recommendation #1:

LeRC should ensure that the U. S. Treasury is reimbursed \$36,719 which represents the value of anniversary expenses improperly paid from the R&PM Appropriation.

LeRC Response:

Concur. The U. S. Treasury will be reimbursed in the amount of \$36,719.

OIG Recommendation #2:

LeRC should strengthen existing purchase order review and approval procedures to ensure the purchase descriptions sufficiently describe the goods and services being procured to permit a thorough review and analysis by both management officials and certifying officers. At a minimum, LeRC should ensure that:

- Initiators of purchase requests, such as the Project Manager of the 50th Anniversary, fully and accurately describe all items and services sought to be purchased.
- Budget analysts responsible for approving purchase orders (1) return or amend and document before approval any incomplete (including non-descriptive) orders, and (2) critically review orders designated "sensitive".

- 2
- Certifying officers, prior to certifying vouchers for payment, verify the legality of proposed payments under the appropriation or fund involved; and, if a doubtful question of law exists, resolve the question either with assistance available within NASA or by requesting a decision from the Comptroller General.

LeRC Response:

Concur. Those who erred in the instant case will be counseled regarding their responsibilities for fully and accurately describing and reviewing purchase requests.

IG Recommendation #3:

The LeRC Center Director should direct the General Counsel to critically review all contracts entered into by LeRC employees who, either acting on their own behalf or as an agent of the LeRC Exchange Fund, are using monies provided by or through the Exchange Fund. At a minimum, the Chief Counsel should ensure that any contracts do not purport to obligate Government appropriated funds.

LeRC Response:

Concur. The LeRC Chief Counsel will be directed to review all contracts utilizing Exchange funds.

Joseph A. Saggio