W

TO: AA/Director, Johnson Space Flight Center

DA01/Director, Marshall Space Flight Center

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report on the Audit of Environmental Aspects of External Tank

Contract NAS8-36200

Assignment Number A-HA-98-051

Report Number IG-99-051

The subject final report is provided for your use and comments. Please refer to the Results in Brief section for the overall audit results. Our evaluation of your response is incorporated into the body of the report. Your comments on a draft of this report were responsive for recommendation 1 but were nonresponsive for recommendation 2. For recommendation 1, we request that you notify us of the actions taken, including the extent of testing performed to ensure corrective actions are effective. As discussed in the report, we request that the Director, Johnson Space Flight Center, provide comments on recommendation 2 by October 25, 1999. The comments should specify the corrective actions that are planned, ongoing, and completed. All recommendations remain open.

If you have questions concerning the report, please contact Mr. Chester Sipsock, Program Director for Environmental and Financial Management Audits, at (216) 433-8960, or Mr. Rick Lester, Auditor-in-Charge, at (256) 544-1150. We appreciate the courtesies extended to the audit staff. The report distribution is in Appendix E.

[original signed by]

Russell A. Rau

Enclosure

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J/Associate Administrator for Management Systems
M/Associate Administrator for Space Flight
R/Associate Administrator for Aero-Space Technology

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MSFC/SA39/NASA Michoud Resident Manager

MSFC/RS40/Audit Liaison Representative

AUDIT REPORT

ENVIRONMENTAL ASPECTS OF EXTERNAL TANK CONTRACT NAS8-36200

September 24, 1999



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Acronym

FAR Federal Acquisition Regulation

NASA Office of Inspector General

IG-99-051 A-HA-98-051

September 24, 1999

Environmental Aspects of External Tank Contract NAS8-36200

Introduction

The current external tank contract (NAS8-36200) was awarded November 2, 1984, with a total contract award amount through August 31, 2001, of about \$3.6 billion. Under the contract, Lockheed Martin Corporation will produce external tanks at the NASA Michoud Assembly Facility (Michoud), New Orleans, Louisiana, into the year 2001. Although NASA owns Michoud, the contractor runs the facility as a "Government-owned, contractor-operated" operation responsible to NASA management at the Marshall Space Flight Center.

Manufacturing processes at Michoud require the use of toxic and hazardous chemicals. Since 1987, pollution prevention and waste minimization activities at Michoud have significantly reduced toxic pollutants associated with external tank manufacturing processes. However, the production of the external tank for the Space Shuttle still presents potential for environmental impact.

The objective of this audit was to determine whether appropriate clauses governing environmental requirements were included in the Space Shuttle external tank production contract. Details on our scope and methodology are in Appendix A.

Results in Brief

The current external tank contract has not been modified to incorporate the Federal waste reduction program as set forth under Federal Acquisition Regulation (FAR) Part 52.223-10. Consequently, adverse environmental impact may not be minimized and potential recycling benefits cannot be realized.

Background

Martin Marietta, now Lockheed Martin, has been the Space Shuttle external tank contractor since NASA first began producing the tanks at Michoud in 1973. The external tank provides fuel to the Space Shuttle main engines during the vehicle's initial ascent. The Shuttle external tank compartments hold both liquid hydrogen and liquid oxygen. If minute amounts of contaminants, particularly industrial greases, were to remain in any of the external tank compartments, the potential for an explosion would be very high. Trichloroethylene is one of the most effective metal cleaning and degreasing solvents available and has been the preferred NASA degreasing

solvent for the external tank components. However, it is also very toxic to the environment and to all life forms. During the mid 1960's, when a previous NASA contractor was building components for the Apollo Program, 16,000 gallons of trichloroethylene spilled into the groundwater at Michoud. NASA spends about \$2 million annually on environmental activities at Michoud, a large part of which is spent cleaning up the groundwater and soil.

NASA and the contractor have worked to reduce the amount of trichloroethylene contamination at Michoud. Currently, 900 pounds is being released annually into the environment, compared to 200,000 pounds annually as of 1985. Neither the Environmental Protection Agency nor the Louisiana Department of Environmental Quality have noted discrepancies at or assessed fines or penalties to Michoud during the last 5 years. The contractor has managed environmentally hazardous materials so that potential liability from environmental contamination has been effectively minimized. Additional accomplishments by Lockheed Martin at Michoud are presented in management's response to this report (see Appendix C).

Attention to hazardous wastes and associated environmental remediation are major requirements of national environmental policy, but waste reduction, pollution prevention, and use of recycled products are also important requirements. The FAR implements national environmental policy for Federal procurement activities.

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¹ Trichloroethylene is a potent neurotoxin, which is known to cause cancer and reproductive mutations. Severe over-exposure is rapidly fatal. Less severe exposure can result in damage to the liver and kidneys, birth defects, and varying degrees of nervous system damage such as memory loss. Toxic ecological effects include death of animals, birds, fish, and plants. Long-term ecological effects may include shortened lifespan, reproductive problems, cancer, changes in appearance and behavior of animals, and slow growth of plants.

Waste Reduction Program at Michoud

Finding. The Lockheed Martin external tank contract has not been modified to incorporate the FAR waste reduction program contract provision (FAR 52.223-10). Such a provision could help ensure an effective waste reduction program at Michoud. The FAR requires contractors to modify their operations to eliminate or reduce the amount of waste generated and to increase the use of recycled products. Without this program, the Michoud operation may not be environmentally compliant.

Federal Requirements

FAR part 52.223-10 requires contractors to establish a waste reduction program to promote costeffective waste reduction in all operations and facilities covered by the contract (see Appendix B). The program should incorporate waste prevention and recycling into all operations by requiring acquisition of environmentally preferable products and services. Under the program, product specifications would be revised to promote procurement of products that are environmentally preferable or made from recovered materials.

The FAR requirement became effective in October 1997, 13 years after the award of contract NAS8-36200. However, FAR part 23.705² requires that, where economically feasible, existing contracts for contractor operation of Government-owned or leased facilities should be modified to provide for cost-effective waste reduction (see Appendix B). Marshall procurement officials stated that the required contract modification was overlooked due to reassignment of personnel and reductions in the procurement staff.

Waste Reduction Program Practices

Adding the requirement for a waste reduction program would be an important step in ensuring that the contractor pursues environmentally friendly practices. Under the program, the contractor must seek ways to prevent pollution. Where pollution cannot be prevented, the contractor should minimize the adverse environmental impact by recycling waste products. The contractor's purchases and subcontract specifications should favor environmentally preferable items and items made from recycled materials, when economically feasible. The contractor's participation in a waste reduction program would also assist NASA in meeting the Agency's goal of achieving environmental excellence at all its installations.

A Johnson Space Center Shuttle procurement official and the NASA Headquarters Environmental Management Division Director stated that the FAR clause will be incorporated into the Space Flight Operations Contract when the Shuttle contract is modified to include the external tank. The contract modification is scheduled for July 1, 2000. However, consistent with

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²FAR parts 23.705 and 52.223.10 reference Executive Order 12873, which was replaced by Executive Order 13101, on September 14, 1998. Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition," establishes broad-based requirements for Federal agencies to incorporate waste reduction activities in daily operations. Appendix B provides further details on the Executive Order requirements.

FAR part 23.705, contract NAS8-36200 should be modified now, if economically feasible, to include the waste reduction program requirement so that the benefits of the program will be realized at the earliest available opportunity.

Management's Comment on the Finding

Management did not agree that the FAR required the waste reduction program clause if economically feasible in existing contracts because of deletion of the clause in Executive Order 13101. Our evaluation of management's position is in Appendix D.

Recommendations, Management's Response, and Evaluation of Response

1. The Director, Marshall Space Flight Center, should direct the contracting officer for contract NAS8-36200 to determine the economic feasibility of requiring the contractor to establish a waste reduction program at Michoud prior to the consolidation of this contract with the Space Flight Operations Contract. If economically feasible, the contracting officer should add to the existing external tank contract the requirements contained in FAR 52,223-10.

Management's Response. Concur with the recommendation's intent, subject to economic feasibility. Based on a preliminary analysis, management believes it will be feasible to add the FAR clause to the contract. The complete text of management's response is in Appendix C.

Evaluation of Response. The actions planned by management are responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open until management completes its feasibility assessment and takes appropriate action.

2. The Director, Johnson Space Center, should ensure that the requirement for a waste reduction program is included in the July 1, 2000, contract modification.

Management's Response. Concur with the recommendation's intent, subject to economic feasibility. Management suggested consolidating this recommendation with recommendation 1. The consolidated recommendation should state that the Director, Marshall Space Flight Center, should direct the contracting officer for the external tank contract to determine the economic feasibility of incorporating FAR 52.223-10 into the appropriate contract as soon as practical. The external tank production contract is now scheduled to be incorporated into the Space Flight Operations contract on July 1, 2000. More important, however, responsibility for the Michoud Assembly Facility will remain with Marshall. The complete text of management's response is in Appendix C.

Evaluation of Response. We consider management's response to be nonresponsive and the recommendation unresolved, notwithstanding management's concurrence with the intent of the recommendation. The recommendation is directed to the Director, Johnson Space Center, because there is no assurance that the consolidated contract would necessarily include the FAR clause even if Marshall management was to decide that it is economically feasible to include

such a clause in the existing contract. Although management pointed out that administration and support services for the Michoud Assembly Facility will remain with Marshall, the external tank manufacturing contract is expected to become part of the Space Flight Operations contract, which

was awarded by Johnson. Thus, the Director of Johnson ultimately will be responsible for negotiating and administering the new contract. We, therefore, reaffirm our recommendation and request that the Director, Johnson Space Center, provide management's position on recommendation 2.

Appendix A. Objective, Scope and Methodology

Objective

The objective of the audit was to determine whether appropriate Federal environmental requirements were included in contract NAS8-36200. This audit effort resulted from work performed for the "Audit of Selected Contracts for Environmental Compliance," Assignment Number A-HA-98-021.

Scope and Methodology

During the audit, we:

- Reviewed the NASA external tank contract (NAS8-36200) to determine the environmental contract terms that had been incorporated into the contract provisions.
- Reviewed the FAR to determine which environmental clauses must be included in NASA contracts.
- Interviewed the NASA external tank contracting officer to identify FAR environmental clauses that do not apply to the contract.
- Interviewed contractor personnel to determine the extent to which they have accomplished the requirements of the relevant FAR environmental clauses.

Management Controls

We reviewed management controls relative to the inclusion of required environmental contract clauses in contract NAS8-36200. We considered the controls adequate except as discussed in the finding.

Audit Field Work

We performed field work from August 1998 through July 1999. We performed the audit in accordance with generally accepted government auditing standards.

Appendix B. Federal Environmental Requirements

Federal Acquisition Regulation (FAR) Provisions

The following two FAR citations address the requirement for contractors to implement waste reduction efforts in performing contracts that could have an environmental impact.

FAR Paragraph 52.223-10—Waste Reduction Program

As prescribed in 23.706, insert the following clause:

Waste Reduction Program (October 1997)

- (a) Definition. "Waste reduction," as used in this clause, means preventing or decreasing the amount of waste being generated through waste prevention, recycling, or purchasing recycled and environmentally preferable products.
- (b) Consistent with the requirement of Section 701 of Executive Order 12873, the contractor shall establish a program to promote cost-effective waste reduction in all operations and facilities covered by this contract. Any such program shall comply with applicable Federal, State, and local requirements, specifically including Section 6002 of the Resource Conservation and Recovery Act (442 U.S.C. 6901, et seq.) and implementing regulations.

FAR Paragraph 23.705—Application to Government-owned or leased facilities

Pursuant to Executive Order 12873, Section 701, every new contract for contractor operation of a Government-owned or leased facility shall require contractor programs to promote and implement cost-effective waste reduction in performing the contract. In addition, where economically feasible, existing contracts for contractor operation of Government-owned or leased facilities should be modified to provide for cost-effective waste reduction in contractor performance.

Executive Order 13101

This Executive Order replaced Executive Order 12873 and is the basis for FAR 52.223-10, Waste Reduction Program. The effective date of Executive Order 13101 was September 14, 1998. Some key excerpts follow from the Executive Order as they apply to waste reduction programs.

Appendix B

Section 101. Consistent with the demands of efficiency and cost effectiveness, the head of each executive agency shall incorporate waste prevention and recycling in the agency's daily operations and work to increase and expand markets for recovered materials through greater Federal Government preference and demand for such products. It is the national policy to prefer pollution prevention, whenever feasible. Pollution that cannot be prevented should be recycled; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner. Disposal should be employed only as a last resort.

Section 102. Consistent with the policies established by the Office of Federal Procurement Policy Letter 92-4, agencies shall comply with executive branch policies for the acquisition and use of environmentally preferable products and services and implement cost-effective procurement preference programs favoring the purchase of these products and services.

Section 401. Acquisition Planning. Agencies shall consider: elimination of virgin material requirements; use of biobased products; use of recovered materials; reuse of product; life cycle cost; recyclability; use of environmentally preferable products; waste prevention; and ultimate disposal.

Section 501. Specifications, Product Descriptions, and Standards. When developing, reviewing, or revising specifications agencies shall consider recovered materials and any environmentally preferable purchasing criteria developed by the Environmental Protection Agency, and shall ensure the criteria are complied with in developing or revising the standards. Agencies shall report annually to the Federal Environmental Executive on their compliance with this section, for inclusion in the biennial report to the President.

Section 601. Each agency shall establish either a goal for solid waste prevention and a goal for recycling or a goal for solid waste diversion to be achieved by January 1, 2000. Specific goals for increasing use of recycled materials and for increasing use of environmentally preferable products and services shall be established. Progress on these goals shall be reported to the Federal Environmental Executive for inclusion in the biennial report to the President.

Section 705. Each executive agency shall initiate a program to promote cost-effective waste prevention and recycling of reusable materials in all of its facilities.

Appendix C. Management's Response

National Aeronautics and Space Administration

George C. Marshall Space Flight Center Marshall Space Flight Center, AL 35812



Reply to Attn of

DE01

AUG 3 1 1999

TO:

NASA Headquarters

Attn: W/Russell A. Rau

FROM:

DE01/Sidney P. Saucier

SUBJECT:

OIG Draft Report on the Audit of Environmental Aspects of External Tank

Contract NAS8-36200, Assignment No. A-HA-98-051

We have reviewed the subject report and our detailed comments are enclosed. If you have any questions or need additional information regarding our comments, please contact RS40/Andy McMillan at 256-544-9273.

Sidney P. Saucier

Associate Director

Enclosure

MSFC RESPONSE TO THE OIG DRAFT REPORT ON ENVIRONMENTAL ASPECTS OF EXTERNAL TANK CONTRACT NAS8-36200 ASSIGNMENT NO. A-HA-98-051

GENERAL COMMENTS:

We would like to note that during the Office of Inspector General's (OIG) audit, the entire External Tank (ET) Contract (NAS8-36200) was reviewed to determine whether appropriate Federal environmental requirements were included in the contract. The OIG found all controls adequate with the exception of one Federal Acquisition Regulation (FAR) clause (FAR Part 52.223-10). The OIG mistakenly asserts that this clause, which is not included in Lockheed Martin's contract, is required. In fact, inclusion of the clause into existing contracts is discretionary. Neither the contractor nor NASA has violated FAR requirements.

It should be noted that pollution prevention and waste minimization programs required by Federal and State environmental regulations are fully implemented at the Michoud Assembly Facility (MAF). MAF has been very successful and proactive since the contract began. It should also be noted that MAF has received Federal and State awards for pollution prevention accomplishments (3 State Governor's Awards and 1 Environmental Protection Agency (EPA) Award).

SPECIFIC COMMENTS TO THE CONTENT OF THE REPORT:

Page 1, (1st Paragraph (P), 1st Sentence (S)): Delete 1st sentence and replace with "The External Tank (ET) for the NASA Space Shuttle is manufactured at the Michoud Assembly Facility (MAF) in New Orleans, Louisiana. Manufacturing processes require the use of toxic and hazardous chemicals. Since 1987, pollution prevention and waste minimization activities at MAF have reduced toxic pollutants associated with ET manufacturing processes by over 4.3 million pounds. In addition, MAF has received Federal and State awards for pollution prevention accomplishments. However, the production of the external tank for the Space Shuttle still presents potential for environmental impact."

Page 1, (3rd P,): Delete the entire paragraph under the heading "Results in Brief" and replace with "The current external tank contract has not been modified to incorporate the federal waste reduction program as set forth under Federal Acquisition Regulations (FAR) Part 52.223-10. Although inclusion of that clause is not required in existing contracts, the contracting officer should assess the feasibility of including it into the existing contract."

Page 1, (4th P, 3rd through 8th S): Delete 3rd through 8th sentence and replace with "Production operations include the use of hazardous materials and the generation of hazardous and nonhazardous waste with potential impact to the environment.

See OIG Comment in Appendix D Lockheed Martin maintains all required environmental permits for monitoring and disposal of these waste materials."

Page 2, (1st and 2nd P): Delete the whole page and replace with "NASA and the contractor have worked to reduce the quantity and toxicity of the materials and products utilized during the manufacture of the external tank. Trichloroethylene (TCE) usage has decreased from 5000 gallons per tank to 7 gallons per tank. Air emissions of TCE have been reduced from 200,000 pounds annually in 1985 to 900 pounds annually in 1998. Deoxidizing chemicals for tank cleaning operations were substituted to eliminate the use of chromium, thus reducing wastewater toxicity and treatment costs. Blowing agents associated with most insulating foam applications have been replaced to comply with the Ozone Depleting Chemical international agreements and Federal regulations. In total, Lockheed Martin pollution prevention accomplishments have avoided the release of over 4,389,000 pounds of toxic pollutants into the environment based on 1987 EPA Toxic Release Inventory Report data."

"Additionally, Lockheed Martin recycles various waste materials generated during manufacturing and facility operations. Most scrap metals including aluminum-lithium, steel, copper, and lead-acid batteries are recycled. CFC-225 is reclaimed for reuse via an onsite distillation system. Unused SOFI products are sold for non-critical commercial applications. Paper, cardboard, printer toner cartridge, anti-freeze, and fluorescent light bulb recycling programs are in place. Waste solvents and other high BTU value wastes are also contracted for recycling (fuels blending)."

"Both the EPA and the Louisiana Department of Environmental Quality (LDEQ) have acknowledged the Lockheed Martin pollution prevention activities. Louisiana Governor's awards for Pollution Prevention were presented to Lockheed Martin in 1997, 1998, and 1999. An EPA award was received in 1997 for pollution prevention associated with stratospheric ozone protection."

"Neither the EPA nor the LDEQ have noted discrepancies or assessed fines/penalties to MAF during the last 5 years. The contractor has managed environmentally hazardous materials so that potential liability from environmental contamination has been effectively minimized."

Page 3, (1st P): Delete the 1st finding and replace with "The Lockheed Martin external tank contract has not been modified to incorporate the FAR waste reduction program contract provision (FAR 52.223-10). While not required to be added to existing contracts, such a provision could help ensure an effective waste reduction program at Michoud."

Page 3, (4th P, 1st S): Adding the "FAR" requirement for a waste reduction program ...

Page 3, (4th P, 4th S): ...made from recycled materials "where economically feasible."

Page 3, (5th P): Delete the whole paragraph including the portion on page 4 except for the last sentence. In the last sentence, delete "However consistent with FAR Part 23.705" and insert: "If economically feasible," contract NAS8-36200...

Also, a key point of Executive Order (EO) 13101 was not included in the report. That is, the application to existing contracts was deleted in EO 13101 which replaced and superseded EO 12873. Compare Section 7 of the two EO's – EO 12873.

"Sec. 701. Contractor Operated Facilities. Contracts that provide for contractor operation of a Government-owned or leased facility, awarded after the effective date of this order, shall include provisions that obligate the contractor to comply with the requirements of this order within the scope of its operations. In addition, to the extent permitted by law and where economically feasible, existing contracts should be modified." (emphasis added)

versus EO 13101:

"Sec. 701. Contractor Applicability. Contracts that provide for contractor operation of a Government-owned or leased facility and/or contracts that provide for contractor or other support services at Government-owned or operated facilities awarded by executive agencies after the date of this order, shall include provisions that obligate the contractor to comply with the requirements of this order within the scope of its operations."

Note the last sentence was removed.

It is noted while the applicability to existing contracts was deleted by EO 13101, FAR 23.705 does cite the obsolete EO and recommends consideration of including the provision in existing contracts. However, it is by no means a "federally required waste reduction program" for existing contracts. Compare the language for new contracts and existing contracts.

Pursuant to Executive Order 12873, Section 701, every new contract for contractor operation of a Government-owned or leased facility shall require contractor programs to promote and implement cost-effective waste reduction in performing the contract. In addition, where economically feasible, existing contracts for contractor operation of Government-owned or leased facilities should be modified to provide for cost-effective waste reduction in contractor performance.

As can be seen from the cited language "where economically feasible existing contracts should..." does not support the Results in Brief of the audit i.e., "the contractor, Lockheed Martin, does not have a federally required waste reduction program in place at Michoud;" nor the statement that "Although the Federal Acquisition Regulation (FAR) requires such a program, the contracting officer has not modified the contract to incorporate the requirement."

Based on the above, it is recommended that the report be corrected to accurately reflect the regulation and the EO.

RESPONSES TO THE RECOMMENDATIONS:

OIG Recommendation 1: The Director, Marshall Space Flight Center, should direct the contracting officer for contract NAS8-36200 to determine the economic feasibility of requiring the contractor to establish a waste reduction program at Michoud prior to the consolidation of this contract with the Space Flight Operations Contract. If economically feasible, the contracting officer should add to the existing external tank contract the requirements contained in FAR clause 52.223-10.

MSFC Response: Concur with the recommendation's intent. (See MSFC response to Recommendation 2)

OIG Recommendation 2: The Director, Johnson Space Center, should ensure that the requirement for a waste reduction program is included in the April 1, 2000, contract modification.

MSFC Response: Concur with the recommendation's intent, subject to economic feasibility.

The information upon which the IG bases this draft recommendation is outdated and incorrect. The consolidation of ET operations into SFOC is currently slated for July 1, 2000. More importantly, however, responsibility for MAF will remain with MSFC.

We suggest consolidating this recommendation with recommendation 1. The consolidated recommendation should read, "The Director, Marshall Space Flight Center should direct the contracting officer for the External Tank Contract (currently NAS8-36200) to determine the economic feasibility of incorporating FAR 52.223-10 into the appropriate contract as soon as practical."

Based on our preliminary analysis, we believe it will be feasible to add the clause to the contract.

Appendix D. OIG Comments on Management's Response

Marshall management provided the following general comment in its response to the draft report. Our response to the comment follows.

Management's Comment. The Office of Inspector General mistakenly asserts that the clause in FAR Part 52.223-10, which is not included in Lockheed Martin's contract, is required. In fact, inclusion of the clause into existing contracts is discretionary. Neither the contractor nor NASA has violated FAR requirements. The complete text of management's response is in Appendix C.

OIG Comments. Management's statement is based on the fact that the requirement to include the clause in existing contracts was in Executive Order 12873, Section 701; however, the requirement was not included in Executive Order 13101, which became effective September 14, 1998. Additionally, FAR Paragraph 23.705 has not been changed and still contains the statement, "... where economically feasible, existing contracts for contractor operation of Government-owned or leased facilities should be modified to provide for cost-effective waste reduction in contractor performance." Inclusion of the clause was never optional at the discretion of the agency, rather it was, and remains, required, if economically feasible. Until the FAR language is changed, it remains the policy to be followed by NASA contracting officers. Therefore, we continue to affirm our conclusion that NASA is noncompliant with the FAR and that determination of economic feasibility is required.

Management's comments also do not consider that, prior to September 1998, NASA was required by the FAR and Executive Order 12873 to have determined whether it was economically feasible to include the FAR clause in the existing external tank contract. The Agency did not make such a determination. As a result, the original intent of the FAR and the Executive Order was never achieved for this contract. By the time Executive Order 13101 was issued in September 1998, Executive Order 12873 had been in effect for 5 years and the FAR language had been effective for 1 year requiring inclusion of the clause in existing contracts if economically feasible. Therefore, existing contracts should have already been revised at the time Executive Order 13101 was issued. This was not the case for contract NAS8-36200. While we agree that Executive Order 13101 does not specifically require that the waste reduction clause contained in the FAR be considered for existing contracts, the Executive Order does not preclude NASA from making such a determination if it is in the best interests of the Agency and in our view was premised on existing contracts already having been reviewed.

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Appendix E

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Congressional Member

Honorable Pete Sessions, U.S. House of Representatives

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