

Audit



Report

OFFICE OF THE INSPECTOR GENERAL

TITAN IV REQUIREMENTS

Report No. 94-089

April 21, 1994

Department of Defense

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Acronyms

FYDP	Future Years Defense Program
IV&V	Independent Verification and Validation
OSD	Office of the Secretary of Defense
RFP	Request for Proposal
SLAG	Space Launch Advisory Group
SPO	System Program Office
SRM	Solid Rocket Motor
SRMU	Solid Rocket Motor Upgrade



**INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-2884**



April 21, 1994

**MEMORANDUM FOR ASSISTANT SECRETARY OF THE AIR FORCE
(FINANCIAL MANAGEMENT AND COMPTROLLER)**

SUBJECT: Audit Report on Titan IV Requirements (Report No. 94-089)

We are providing this audit report for your review and comments. It discusses requirements for the Titan IV expendable launch vehicle and for independent validation and verification of critical computer resources. Comments on a draft of this report were considered in preparing this final report.

DoD Directive 7650.3 requires that audit recommendations be resolved promptly. Therefore, we request that the Department of the Air Force provide comments on the unresolved recommendation and potential monetary benefits by June 21, 1994.

The courtesies extended to the audit staff are appreciated. If you have any questions on this audit, please contact Mr. Charles Santoni, Program Director, at (703) 692-3390 (DSN 222-3390) or Mr. Lloyd O'Daniel, Project Manager, at (703) 692-2878 (DSN 222-2878). Copies of this report will be distributed to the organizations listed in Appendix C.

Robert J. Lieberman
Assistant Inspector General
for Auditing

cc:

Under Secretary of Defense for Acquisition and Technology
Comptroller of the Department of Defense
Assistant Secretary of Defense (Command, Control,
Communications and Intelligence)



Office of the Inspector General, DoD

Report No. 94-089
(Project No. 2RC-0070)

April 21, 1994

TITAN IV REQUIREMENTS

EXECUTIVE SUMMARY

Introduction. The Titan IV program began in February 1985 as an unmanned launch vehicle system to assure DoD access to space. The Titan IV consists of a core vehicle; two solid rocket motors (a shipset) attached to the core vehicle to provide the initial stage of boost during liftoff; and, if needed to obtain a desired orbit, an upper stage booster. A contract was awarded to Martin Marietta Astronautics Group for 10 vehicles, including the Centaur upper stage booster. After the 1986 space shuttle disaster and the Titan 34D launch failure, the Titan IV program was expanded to include additional launch vehicles, upper stage boosters, and an upgrade to the solid rocket motor. The Titan IV contract is valued at about \$10 billion for 41 launch vehicles, to include 26 solid rocket motors (SRMs) and 15 solid rocket motor upgrade (SRMU) shipsets, 15 Centaurs, and 3 launch pads.

Objectives. The objective of the audit was to evaluate the requirements for Titan IV launch vehicles to support classified and unclassified systems. The audit determined whether requisite system specifications and needs were efficiently and effectively incorporated in contracting for the development and production of the launch vehicles. In addition, the audit evaluated issues related to independent verification and validation (IV&V) of critical computer resources. The audit also evaluated the effectiveness of coordination between the Titan IV Program Office and supported users and the adequacy of applicable internal controls.

Audit Results. The Air Force's plan to expedite procurement of additional Titan IVs, Centaurs, and SRMUs in FY 1995 is premature and therefore unnecessarily risky. The 41 Titan IVs, 15 Centaurs and 15 SRMUs currently under contract can adequately satisfy the launch requirements listed in the Titan IV Mission Model through at least calendar year 2002. The planned acquisition will result in vehicle deliveries at least 3 full years before they are currently scheduled for launch. Requirements for Titan IV and associated components are uncertain due to changes in threat and longer lasting on-orbit satellites. When finalized, requirement changes could result in satellite programs being downsized, eliminated, or launched on less costly launch vehicles. Further, the SRMU, an essential component of the Titan IV, has not been fully developed.

During the survey phase of the audit, we determined that the objective concerning the incorporation of the requisite system specifications and needs into launch vehicle contracts was covered by prior audits (see Prior Audits and Other Reviews in Part I of the report). Our evaluation of the issues related to IV&V of critical computer resources revealed no reportable conditions (see Other Matters of Interest in Part I of the report).

Internal Controls. We evaluated the internal controls associated with the coordination between the Titan IV Program Office and the users and determined that the internal controls were adequate in that we did not identify any material deficiencies. The portion of the DoD Internal Management Control Program we reviewed was effectively implemented. Details on the controls assessed are in Part I of the report.

Potential Benefits of Audit. The unnecessarily expedited procurement of Titan IV launch vehicles, Centaurs, and SRMUs could result in the premature expenditure of approximately \$1.8 billion in funds (Missile Procurement, Air Force, and a classified appropriation) programmed for FY 1995 through FY 2000 that could be put to better use if additional launch vehicles are not acquired (Appendix A).

Summary of Recommendation. We recommended that the Assistant Secretary of the Air Force (Acquisition) delay the proposed follow-on acquisition of Titan IVs, Centaurs, and SRMUs until the space investment strategy and the space launch "road map" have been completed; the resulting satellite and launch vehicle architectures have been determined; the future requirement for Titan IVs, Centaurs, and SRMUs have been reassessed; and the uncertainties surrounding the development of the SRMUs have been resolved.

Management Comments. The Air Force concurred with the audit conclusions and recommendation. The Defense Acquisition Executive is reviewing Air Force plans to delay the follow-on procurement. The delay will allow completion of a number of studies and reviews, including the space launch "road map." The Air Force plans for a "bridge" between the existing 41-vehicle program and the follow-on program because the Air Force is concerned about a gap in Titan IV production. The "bridge" is expected to cost about \$350 million. A full discussion of management comments is in Part II of the report, and the complete text of those comments is in Part IV.

Audit Response. Although the Department of the Air Force concurred in the finding and recommendation, the comments are not fully responsive. The Air Force presumes that a Titan IV production capability will have to be maintained to meet future requirements and has not indicated what adjustments will be made in the amounts currently programmed for the follow-on acquisition. We request that the Air Force respond to the unresolved issues discussed at the end of the finding in Part II of the report.

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Part I - Introduction

Background

The Titan IV is an unmanned, expendable launch vehicle that complements the space shuttle and ensures access to space for payloads that are critical to national security. The Titan IV consists of a core vehicle, a pair (shipset) of solid rocket motors (SRMs) attached to the core vehicle to provide the initial stage of boost during liftoff, and, if needed to obtain a desired orbit, an upper stage booster. Two types of upper stage boosters are used with the Titan IV, the Government-furnished inertial upper stage and the Centaur.

In February 1985, the Air Force contracted with Martin Marietta Corporation for the development, production, and launch of 10 Titan IV launch vehicles and 10 Centaur upper stage boosters. The estimated cost of the program was \$21 billion with a production rate of two vehicles per year.

After the 1986 space shuttle *Challenger* disaster and the Titan 34D launch failure, the Air Force concluded that the SRM needed to be upgraded to increase reliability and performance. As a result, the contract was modified in October 1987 to include the development and production of 15 solid rocket motor upgrade (SRMU) shipsets.

The Titan IV contract was again modified in December 1987 to include 13 additional launch vehicles and in December 1989 to include 18 additional launch vehicles and 5 Centaurs. The Titan IV production rate increased to 10 vehicles per year. The current Titan IV program is valued at about \$10 billion and consists of 41 Titan IV vehicles, which include 15 Centaur upper stage boosters, 26 SRM and 15 SRMU shipsets, and 3 launch pads.

Objectives

The audit objective was to evaluate the requirements for Titan IV launch vehicles to support classified and unclassified systems. Although the audit was also to determine whether requisite system specifications and needs were efficiently and effectively incorporated in contracting for the development and production of the launch vehicles, the survey phase of the audit showed that objective had been covered in prior audits (see Prior Audits and Other Reviews).

During the audit, we examined issues related to the independent verification and validation (IV&V) of critical computer resources. The results of our review of IV&V procedures are discussed in Other Matters of Interest.

We also evaluated the effectiveness of coordination between the Titan IV System Program Office (SPO) and supported users and the adequacy of the Titan IV program's internal controls.

Scope and Methodology

We reviewed data, dated from February 1985 through March 1993, relating to the Titan IV program. We reviewed the Space Launch Mission Model to identify requirements and proposed launch dates of Titan IV launch vehicles. Also, we visited Titan IV users listed in the Space Launch Mission Model to review their launch schedule. Further, we reviewed the status of the Centaur and SRMU development efforts.

We identified the contractors performing IV&V and determined their tasking for classified and unclassified users. In addition, we examined the Request for Proposal (RFP) submitted by the Air Force Space and Missile Systems Center for Production Slowdown II and plans for the proposed follow-on buy of Titan IV vehicles. We did not rely on computer-processed data for our audit conclusions.

We performed this program audit of the Titan IV program from September 1992 through April 1993 in accordance with auditing standards issued by the Comptroller General of the United States as implemented by the Inspector General, DoD. Accordingly, we included such tests of internal controls as were considered necessary. See Appendix B for a list of the organizations visited or contacted.

Internal Controls

As part of the review of the Titan IV program, we evaluated the coordination between the Titan IV SPO and the users. Also, we compared the user needs, the budget, and intelligence policy incorporated in the Space Launch Mission Model to actual user requirements. We determined that the internal controls were adequate and found no material deficiencies.

Prior Audits and Other Reviews

Inspector General, DoD.

Report No. 93-073, "Acquisition of the Titan IV Program," March 23, 1993, recommended that the requirement for the Centaur Processing Building be eliminated, resources be provided for component breakout review, and obligations for propellants be adjusted to reference Operation and Maintenance funds. Management stated that it intended to continue construction of the Centaur Processing Building, that it will conduct component breakout in accordance with the Defense Federal Acquisition Regulation Supplement, and that it had initiated action on the obligations for propellants.

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Report No. 93-053, "Missile Procurement Appropriations, Air Force," February 12, 1993, concluded that FYs 1987 and 1988 Air Force missile procurement appropriations were deficient and that legislative relief was needed. The missile procurement appropriations for the Titan IV program were in violation of the Anti-Deficiency Act by \$21.1 million for FY 1987 and by \$24.4 million for FY 1988. The report recommended that the deficiencies be investigated and legislation be proposed to allow funding for the program while the problem was being resolved. As of the time of our current audit, the deficiencies were under investigation.

Report No. 92-132, "Quick-Reaction Report on the Management of the Titan IV Solid Rocket Motor Upgrade (SRMU) Subcontract," September 2, 1992, stated that the fixed price subcontract with Hercules Corporation did not contribute to the unsatisfactory progress of the SRMU program. The report also stated that a written acquisition plan did not exist for the SRMU program and that the financing strategy was not viable or equitable. The report recommended that the Air Force monitor recovery of SRMU development costs and consider restructuring the Titan IV contract to preserve continuity of SRMU development. Management disputed certain facts in the report and stated further action was dependent on submission of a Titan IV restructure proposal. Subsequently, the 1993 Defense Appropriation Act (the Act) required that the Air Force enter into a supplemental agreement with the subcontractor by March 1, 1993, to award up to \$350 million to help cover costs associated with the subcontractor's financial difficulties. Congress directed the Air Force to redirect funds from other programs to settle that obligation. However, congressional approval is necessary to reprogram funds. The Act did not include sanctions if the deadline was not met.

Report No. 92-064, "Titan IV Program," March 31, 1992, stated that progress payments for the Titan IV contract were made from a predetermined sequence of appropriations rather than from appropriations that reflected the type of work performed. The report recommended the implementation of procedures within DoD that would result in the proper use of appropriated funds. The Comptroller of the Department of Defense and the Director of Defense Procurement agreed to issue more detailed instructions to payment offices so that funds integrity can be maintained.

General Accounting Office.

Report No. NSIAD 91-271, (Office of the Secretary of Defense [OSD] Case No. 8794), "Titan IV Launch Vehicle, Restructured Program Could Reduce FY 1992 Funding Needs," September 1991, described the effect of Titan IV program delays and uncertainties on funding for the program. The Air Force planned to slow down production to correspond with the slowdown in the launch schedule. The General Accounting Office report contained matters for congressional consideration, but no recommendations. During our current audit, the Air Force submitted a request for proposal to the contractor to slow down production from 5.5 to 3 vehicles per year. According to the Program Element Monitor, as of April 2, 1993, Martin Marietta Astronautics Group (Martin Marietta) had submitted a partial proposal for the proposed slowdown.

Report No. NSIAD 90-113, (OSD Case No. 8214), "Space Launch Cost Increases and Schedule Delays in the Air Force's Titan IV Program," May 1990, described the program's evolution, cost, schedule estimates, and contract status. The report contains information in the areas of program cost and contract price increases as well as schedule delays. No recommendations were made.

Report No. NSIAD 88-160, (OSD Case No. 7590), "DoD Acquisition Programs, Status of Selected Systems," June 1988, concluded that launch capability dates had slipped and that the inertial upper stage configuration fell short of performance requirements. Although funding shortfalls existed, program officials maintained that the Titan IV program is a high priority, and therefore, will receive funding. The report contains no findings or recommendations.

Other Matter of Interest

Independent Verification and Validation (IV&V). IV&V is the testing of mission-critical software and an important aspect in mission success, because of the complexity of integrating the launch vehicle with the payload. The payloads are fragile and expensive, and the Air Force and the users want the added assurance of mission success that IV&V provides.

IV&V tasks are divided into three levels: review, verification, and validation. A review is an analysis of data books or flight analysis plans. A verification is a spot check of an item using either a self-developed or a provided tool (simulations and computer models). Validation is a complete reanalysis of an item using a self-developed tool and is the most comprehensive level of effort.

When the Air Force contracted with Martin Marietta for the Titan IV in 1985, the contract included a clause to have IV&V performed on the individual launch vehicles. The clause stated that Martin Marietta was to have an independent analysis of "all flight critical airborne software and vehicle loads."

In accordance with the contract clause, Martin Marietta contracted with five companies for the IV&V of the Titan IV. Selection was based on the technical capability, staffing availability, schedule commitment, independence, security, flexibility, and business administration practices of the companies. Each company offered a unique experience or tool. The companies performed IV&V tasks for different aspects of the Titan IV.

In addition to the IV&V subcontractors, another contractor, The Aerospace Corporation (Aerospace), provided technical support to the Air Force. Aerospace primarily performed general system engineering and integration tasks for the Air Force. For the Titan IV program, Aerospace performed limited IV&V efforts in addition to providing technical support. Aerospace was the

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only contractor examining items that the Air Force presumed should be analyzed, but did not consider mission-critical (the basis on which the Martin Marietta subcontractors analyzed items).

Classified users contracted with Paramax Systems Corporation (Paramax) to perform IV&V tasks explicitly for the user. Paramax verified the vehicle from a different perspective than the five Martin Marietta subcontractors and Aerospace. Paramax has been involved in the targeting and launch of Titan vehicles from the West Coast for the last 20 years and has the expertise to perform an independent and dependable analysis of the vehicle. In addition, Paramax used a software program that emulated the flight guidance system. The software enabled Paramax to independently verify the launch day software configuration and the mission trajectory.

Each of the Martin Marietta subcontractors was performing different tasks based on their expertise. Paramax performed IV&V on satellite systems that was unique to classified users. We concluded that the tasks of the Martin Marietta subcontractors and Paramax did not overlap.

Representatives from Martin Marietta, Titan IV program officials, and users stated that the level of IV&V would be reduced as the number of missions flown increased. They also noted that IV&V cannot be totally eliminated because the payloads and the required orbits will be different for each mission; therefore, slight variances in the flight software for each mission would still need to be tested.

Part II - Finding and Recommendation

Follow-on Titan IV Acquisition

In November 1992, the Titan IV System Program Office (SPO) submitted a Request for Proposal (RFP) to Martin Marietta to reduce the production rate for Titan IVs from 5.5 to 3 vehicles per year. The RFP also informed the contractor that a follow-on buy of Titan IVs would occur in FY 1995. The Air Force's plan to procure additional Titan IVs, which also included additional Centaurs and SRMUs, in FY 1995 was premature. The SRMU, which is an essential component of the Titan IV, has yet to be fully developed. Further, requirements for Titan IVs are not firm because of changes in threat and the potential for budget cuts in satellite programs. Also, on-orbit satellites are lasting longer, and smaller and less expensive launch vehicles are being considered for some satellite programs currently showing requirements for Titan IVs. As a result, the follow-on buy could result in premature and potentially unnecessary expenditures of approximately \$1.8 billion in Missile Procurement funds currently programmed for the FY 1995 through FY 2000 Future Years Defense Program (FYDP) and in a separate classified appropriation for the Titan IV follow-on acquisition (see Appendix A).

Background

The 41 Titan IVs are to fill launch vehicle requirements to place satellites in orbits for unclassified and classified users. More than half of the requirements for vehicles are for classified users. Six Titan IV launches have been successful.

In 1989, the Space Launch Mission Model (Mission Model) projected that all of the 41 Titan IVs would be launched by 1995. However, completion of launches has shifted to 2002 due to problems in the development of the Centaur and SRMU and changes in satellite launch requirements. Twelve vehicles are being held in storage, awaiting launch.

In 1991, the Titan IV contract was modified to slow down production from 10 to 5.5 vehicles per year. The modification resulted in an additional cost of \$547 million and shifted production completion from calendar years 1995 to 1997. The purpose of the slow down was to align production with the launch schedule.

The Space Launch Advisory Group (SLAG), consisting of representatives from various DoD Components and the National Aeronautics and Space Administration, plans, schedules, and assesses all U.S. space launch requirements. The Mission Model developed by the SLAG identifies requirements for launch vehicles by vehicle configuration and proposed launch date. In October 1992, the Mission Model indicated that a total of 65 Titan IV launches were required through 2005.

Request for Proposal

In November 1992, the SPO issued an RFP for Production Slowdown II to the contractor to reduce the production rate from 5.5 to 3 vehicles per year. According to the Program Element Monitor, the contractor estimated that the slowdown would cost a total of \$610 million. The slowdown was intended:

- o to ensure that critical skills required for the production and operation of the launch vehicle were retained,

- o to avoid a potential "critical" production gap between the 41st vehicle and the start of production on the 42d vehicle, and

- o to align vehicle deliveries with the anticipated launch schedule.

The RFP indicated that the contractor should "assume the Air Force will require delivery of the 42d vehicle in Government FY 99." The SPO stated in the RFP that the prime contractor can plan to proceed in FY 1995 and to start production on the first follow-on acquisition in FY 1996, with the first delivery scheduled for FY 1999. Although the RFP does not specify an exact number of vehicles for the follow-on acquisition, the SPO and the Program Element Monitor stated that a purchase of eight launch vehicles and associated components was anticipated.

According to the Program Element Monitor, the Air Force will issue a separate RFP for the follow-on acquisition in March 1994. Action has been initiated by the SPO to incorporate funding for the follow-on acquisition in the FY 1995 budget submission. If awarded in accordance with the time frames detailed in the November 1992 RFP, the follow-on acquisition will result in the delivery of the 42d and subsequent launch vehicles at least 3 full years ahead of the time the vehicles may be needed for launch.

Centaur. The Centaur is a single-stage, liquid propellant, restartable, upper stage booster. When used with the Titan IV, the Centaur is capable of placing a satellite into geosynchronous earth orbit.* Centaurs are needed for 31 of the 65 Titan IV launch vehicle requirements listed in the SLAG Mission Model. The initial launch capability for the Centaur, according to the SPO, was originally scheduled for 1988; however, problems with development have hampered achieving initial launch capability.

The initial Centaur structural test, scheduled for July 1989, was not completed until November 1989. Additional structural testing was not completed until April 1991. Also, in April 1991, a Centaur, used on an Atlas launch vehicle, failed due to engine contamination. A second failure occurred in August 1992.

*In geosynchronous orbit, a satellite orbits the earth but maintains the same relative position to it.

Follow-on Titan IV Acquisition

Because the engines on the Atlas Centaur and the Titan Centaur are similar, the Atlas Centaur failures have resulted in delays in the availability of the Titan Centaur. SPO officials stated that the Titan Centaur will not be approved for flight until the failures of the Atlas Centaur are understood, tested, and corrected. According to the Program Element Monitor, final testing of the Titan Centaur was completed in September 1993 and initial launch capability was achieved. The first launch was in February 1994.

Solid Rocket Motor Upgrade. According to the SPO, the development and production of the SRMU is to improve reliability and increase performance over the SRM. The SRM is based on 1960's technology. It is heavy and costly; uses asbestos; has reliability and environmental concerns; and due to deficiencies, safety waivers are needed when it is used. Design changes, intended to alleviate those problems and to help the SRM meet reliability and performance needs were incorporated in the SRMU design. The changes included a lighter weight, filament wound, three-segment casing rather than the SRM's nine segment steel casing. Also, the SRMU insulation process was automated in contrast to the manual SRM insulation process. Other improvements included verifiable O rings designed to prevent failure, increased fuel volume, and a movable nozzle for better guidance.

According to the SLAG, SRMU shipsets will be needed for 39 of the 65 launches. The SRMU program has experienced technical difficulties, accidents, a test failure, and numerous launch schedule delays. As a result, the initial launch capability for the SRMU has slipped 4 years. Although all testing has been completed except for the safety and electronic components, initial launch capability is not anticipated until September 1994. Further, the first Titan IV to be launched with an SRMU is not expected until FY 1996 or FY 1997. Before the first SRMU can be used, the backlog of existing vehicles must be launched and the development of the new range safety system and advanced avionics must be completed.

To determine the extent to which the development and production subcontract contributed to the unsatisfactory SRMU program status, the Congress requested that the Inspector General, DoD, review the SRMU subcontract. Report No. 92-132, "Quick-Reaction Report on the Management of the Titan IV Solid Rocket Motor Upgrade Subcontract," September 1992, states that the fixed-price subcontract did not contribute to the unsatisfactory progress of the SRMU program, but the financing strategy for SRMU development costs was not viable or equitable. Based on the recommendation in the report, Congress directed, in the 1993 DoD Appropriation Act, that the Air Force enter into a supplemental agreement with the contractor by March 1, 1993, to:

- o convert the subcontract for the SRMU from a firm fixed-price to fixed-price incentive contract,
- o remove concurrent SRMU development and production,
- o pay for working capital contributions,
- o amortize deferred recurring costs,

- o restructure the SRMU to align production with launch requirements, and
- o resolve legal disputes between the prime and subcontractors.

The Air Force was directed to provide up to \$350 million for the Titan IV program in FY 1993. Of that amount, \$200 to \$300 million was to come from other Air Force appropriations. The Air Force budgeted \$180.0 million for FY 1993 for payments of part of the SRMU obligations. In a reprogramming action, another \$200.7 million was identified for the SRMU. As of October 1993, negotiation had been completed for five of the six factors listed above.

Launch Vehicle Requirements. Titan IV launch vehicle requirements are dependent on requirements to launch satellites. The Mission Model lists 65 Titan IV requirements. The requirements are listed as firm, probable, or potential through FY 2005. A requirement is designated probable if the "satellite is incompletely funded-or-is a follow-on to existing program (primarily experiment funded)." Potential requirements are for "outyear unfunded programs." Our review of the Mission Model showed that only 43 of the 65 launch vehicles are for firm requirements. The remaining 22 requirements were designated as either probable or potential.

The Titan IV program for 41 vehicles includes 6 vehicles that have already been launched. The launch schedule for the remaining 35 vehicles has slipped 7 years from FY 1995 to FY 2002 and will probably experience further slippages. The program has slipped, in part, due to on-orbit missions lasting longer and because of developmental problems with the Centaur and the SRMU. Of the 35 remaining launch vehicles, 27 require either one or both of those components to achieve the requisite orbit. In addition, delays have been caused by satellites being replaced at a slower rate due to budget constraints and diminished threat. For example, launches for the Defense Support Program have slipped from 1 year between launches to 1 to 2 years. According to other Titan IV users, similar slippages are being experienced by their satellite systems. However, those slippages are not reflected in the Mission Model.

Investments, Goals, Priorities, and Other Factors Related to Titan IV Production

Congressional committees have expressed considerable concern over the already high and rising costs of the Titan IV program and have questioned its affordability. In the National Defense Authorization Act for FY 1993, the conferees required that the Secretary of Defense submit a space investment strategy to Congress aimed at reducing costs and increasing efficiencies. Noting that the space investment strategy had not yet been submitted, the Senate Armed Services Committee (the Committee) made several recommendations in its report accompanying the National Defense Authorization Act for FY 1994 that could, if implemented, significantly reduce FY 1994 expenditures for classified

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and unclassified space programs. The Committee also expressed hope that the space investment strategy of the Secretary of Defense, when completed, would provide additional cost reduction initiatives as well as a coherent long-term plan for DoD investment in space systems.

Regarding the Titan IV, the Committee noted that it may be possible to launch the Follow-on Early Warning System (since canceled) on a medium launch vehicle. The Committee also noted that it might be possible to launch the Military Strategic and Tactical Relay System on a medium launch vehicle. The Committee urged the Secretary of Defense and the Director of Central Intelligence to examine the potential for eliminating the need for heavy-lift launch capability sometime after the turn of the century and to consider the technology investments that might be required in the near-term to make that possible. Accordingly, the Committee recommended a provision requiring the Secretary of Defense to develop a space launch "road map" with clearly defined priorities, goals, and milestones. The "road map" would focus limited investment funds for improving space launch capabilities on either new developments or improvements to existing launch systems and would require a plan to reduce the industrial base for the production of launch vehicles.

Conclusion

No compelling reason exists to expedite a follow-on acquisition of Titan IVs, Centaurs, and SRMUs in FY 1995. The 41 Titan IVs, 15 Centaurs, and 15 SRMUs currently under contract can adequately satisfy the launch requirements listed in the Mission Model through at least calendar year 2002. The proposed acquisition of additional Titan IVs in FY 1995 will result in the delivery of the 42nd vehicle in FY 1999 and delivery of each subsequent vehicle at least 3 full years before they are scheduled for launch. Further, the SRMU has not been fully developed. Initial launch capability for the SRMU is projected for September 1994. However, that date is contingent on the successful accomplishment of future reviews and tests. In our opinion, the Air Force has no assurance that the initial launch capability schedule for the SRMU will be met. Budgeting and acquiring additional SRMUs before a demonstrated success would not be in the Government's best interest.

As a result of decreased Soviet threat, longer lasting on-orbit satellite missions, and budget constraints, current and future requirements for satellite systems and associated launch vehicles are uncertain. Budget constraints in particular could result in satellite programs being downsized, eliminated, or launched on less costly launch vehicles. Certain satellite program officials are already considering using smaller and more economical launch vehicles. In addition, the U.S. policy against using the space shuttle to launch national security satellites is being reconsidered, and the Air Force has been studying use of the space shuttle in launching certain classes of satellites. Many of the launch vehicle requirements listed as firm in the Titan IV Mission Model may no longer be valid. Before the Air Force commits to the acquisition of

additional Titan IVs, launch requirements should be reassessed to reflect the budgetary constraints affecting existing and future satellite programs and the potential use of smaller, less costly launch vehicles.

Considering the costs involved in acquiring additional Titan IVs, Centaurs, and SRMUs, and other factors that must be resolved, we believe it would be prudent to delay the follow-on acquisition.

Recommendation, Management Comments, and Audit Response

We recommend that the Assistant Secretary of the Air Force (Acquisition) delay the follow-on acquisition of the Titan IVs, Centaurs, and Solid Rocket Motor Upgrade shipsets until:

- 1. The space investment strategy and the space launch "road map" have been completed.**
- 2. Decisions regarding the resulting satellite architectures and appropriate launch vehicles have been made.**
- 3. Future requirements for Titan IVs have been reassessed.**
- 4. Uncertainties surrounding the development of the Solid Rocket Motor Upgrade shipsets have been resolved.**

Department of the Air Force Comments. The Air Force concurred with the conclusions and recommendations in the draft report. The Air Force plans a two year delay in the follow-on procurement, pending review by the Defense Acquisition Executive. The delay will provide time for the completion of a "number of studies and reviews including the space launch road map." The comments state that a delay in the follow-on procurement could increase program costs and risks in the event of loss of production capability. Therefore, timing of any follow-on procurement necessitates a balance between projected launch requirements and program cost-effectiveness. If the existing 41-vehicle contract is adjusted appropriately, costs and risks associated with the delay can be mitigated and would permit a smooth "bridge" to the delayed follow-on procurement. The Air Force believes that, although a delay may result in a deferral of \$800 million in hardware costs, an additional \$350 million would be required for the cost of the "bridge" on the existing 41-vehicle contract. According to the Air Force, the result will be a net deferral of \$450 million in lieu of the \$1.5 billion estimated in the draft report. The deferred procurement funds would be required after FY 1998.

Audit Response. The Air Force comments are partially responsive to the audit recommendation. Future requirements for Titan IVs cannot be determined until the space investment strategy and space launch "road map" have been completed and until decisions regarding the resulting satellite architectures and appropriate

Follow-on Titan IV Acquisition

launch vehicles have been made. Recent events have further demonstrated that requirements for Titan IVs are not firm because of changes in threat and the potential for budget cuts in satellite programs. For example, the Follow-on Early Warning System was recently canceled, thereby eliminating the need for five Titan IVs. Production Slowdown II was implemented in June 1993, decreasing the production rate from 5.5 to 3 vehicles per year at a cost of approximately \$610 million. The "bridge", approved by the Principal Deputy Under Secretary of Defense (Acquisition and Technology) on March 31, 1994, will decrease production to two vehicles per year. Therefore, we request that the Air Force provide comments on this final report that fully describe the specific actions and the actual or estimated completion dates for those actions that have or will be taken to implement each segment of the recommendation.

The Air Force's comments regarding the monetary impact of our audit recommendations need clarification. Although the Air Force indicates that a delay could defer about \$800 million of hardware costs, it is not clear whether the \$800 million relates to stretching out the existing 41-vehicle contract or to deferring the follow-on acquisition. At the time of the audit and before the submission of the FY 1995 through FY 2000 FYDP, potential monetary benefits associated with deferring the follow-on Titan IV acquisition were undeterminable, as reported in Appendix A of the draft report. The draft report indicated that if the funds for the follow-on acquisition were programmed in the FY 1995 FYDP, about \$1.5 billion could be put to better use if all currently questionable requirements were canceled. We subsequently determined that the FY 1995 through FY 2000 FYDP provides about \$1.8 billion for the follow-on acquisition of Titan IVs. Accordingly, we revised the summary of potential monetary benefits shown in Appendix A to reflect the programmed funds. Since the Air Force has decided to delay initiating any action on the follow-on acquisition of Titan IVs for two years, we contend that the FYDP should not contain any funds in FY 1995 through FY 1997 for the follow-on acquisition. In addition, the amounts currently programmed in FY 1998 through FY 2000 will need adjustment as soon as the requirements reassessment is completed. Alternatively, all amounts programmed for follow-on acquisition could logically be zeroed until firm requirements exist. We request that the Air Force comment on exactly what FYDP adjustments are currently planned in response to this final report. The Air Force response is requested by June 21, 1994.

Part III - Additional Information

Appendix A. Summary of Potential Benefits Resulting from Audit

Description of Benefit	Amount and/or Type of Benefit
<p>Economy and Efficiency. Delays funding the follow-on acquisition of Titan IVs, Centaurs, and SRMUs until certain issues related to the space investment strategy, satellite architectures, and launch vehicle requirements have been resolved.</p>	<p>Delay of the follow-on acquisition results in up to \$1.8 billion available for better use. The \$1.8 billion for the follow-on acquisition represents \$688 million programmed for the FY 1995 through FY 2000 Future Years Defense Program; (Appropriation: Missile Procurement, Air Force), and \$1.1 billion for FY 1995 through FY 2000 (classified appropriation). Unless it is decided to zero out all funds currently programmed for the follow-on acquisition, the exact amount will be determinable only after requirements are reassessed and the FYDP is rebalanced accordingly.</p>

Appendix B. Organizations Visited or Contacted

Office of the Secretary of Defense

Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence), Washington, DC

Department of the Air Force

Office of the Assistant Secretary of the Air Force (Acquisition), Space Launch Division, Washington, DC
Headquarters, Air Force Space Command, Peters Air Force Base, CO
Space and Missile Systems Center, Air Force Materiel Command, Los Angeles Air Force Base, Los Angeles, CA

Non-Government Organizations

General Dynamics, San Diego, CA
Hercules Aerospace Company, Magna, UT
Martin Marietta Astronautics Group, Denver, CO

Appendix C. Report Distribution

Office of the Secretary of Defense

Comptroller of the Department of Defense
Principal Deputy Under Secretary of Defense for Acquisition and Technology
Director of Defense Procurement
Assistant Secretary of Defense (Command, Control, Communications and Intelligence)
Assistant to the Secretary of Defense (Intelligence Oversight)
Assistant to the Secretary of Defense for Public Affairs

Department of the Army

Auditor General, Army Audit Agency

Department of the Navy

Auditor General, Naval Audit Service

Department of the Air Force

Secretary of the Air Force
Assistant Secretary of the Air Force (Acquisition)
Assistant Secretary of the Air Force (Financial Management and Comptroller)
Air Force Space Command
Auditor General, Air Force Audit Agency

Unified Command

Commander in Chief, U.S. Space Command

Defense Agencies

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Comptroller, National Security Agency
Inspector General, National Security Agency

Defense Agencies (con'd)

Inspector General, Defense Intelligence Agency
Director, Defense Logistics Studies Information Exchange

Non-Defense Federal Organizations

National Aeronautics and Space Administration
Office of Management and Budget
Office of Science and Technology Policy, Executive Office of the President
U.S. General Accounting Office, National Security and International Affairs Division,
Technical Information Center

Chairman and Ranking Minority Member of Each of the Following Congressional
Committees and Subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
Senate Select Committee on Intelligence
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Subcommittee on Oversight and Investigations, Committee on Armed
Services
House Committee on Government Operations
House Subcommittee on Legislation and National Security, Committee on
Government Operations
House Committee on Science, Space, and Technology
House Subcommittee on Space, Committee on Science, Space, and Technology
House Permanent Select Committee on Intelligence
House Subcommittee on Oversight and Evaluation, Permanent Select Committee on
Intelligence

Part IV - Management Comments

Department of the Air Force Comments



OFFICE OF THE ASSISTANT SECRETARY

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC



07 MAR 1994

MEMORANDUM FOR ASSISTANT INSPECTOR GENERAL FOR AUDITING
OFFICE OF THE INSPECTOR GENERAL
DEPARTMENT OF DEFENSE

FROM: SAF/AQ
1060 Air Force Pentagon
Washington DC 20330-1060

SUBJECT: Comments to Draft Report on Titan IV Requirements (Project No. 2RC-0070)--
INFORMATION MEMORANDUM

This is in reply to your memorandum requesting Air Force comments on the subject report. We concur with your conclusions and recommendations, although we have additional comments.

The draft report concludes a Titan IV follow-on procurement is planned in advance of requirements to support launches. The report is correct but it fails to note an additional consideration which will affect the timing of the follow-on procurement. Delaying a follow-on procurement could increase total program costs and risks if the delay results in a loss of production capability prior to the follow-on contract. The timing of any follow-on procurement requires a balance between projected launch requirements and total program cost-effectiveness.

The draft report recommends a delay in the follow-on procurement. Before receiving the draft report, the Air Force had already evaluated the opportunity for a delay and had concluded a delay would be prudent. The delay will allow completion of a number of studies and reviews, including the space launch road map. Cost and risk of the delay can be mitigated through adjustments to the existing, 41-vehicle contract to allow a smooth "bridge" to the delayed follow-on procurement. The Defense Acquisition Executive is currently reviewing Air Force plans to implement the delay and the "bridge."

The draft report indicated \$1.5 billion in "premature expenditures" between 1995 and 1998 could be avoided by delaying the follow-on procurement. We believe \$1.5 billion is a high estimate. Between 1995 and 1998, we expect a delay could defer about \$800 million of hardware costs but would require an additional \$350 million for the cost of the "bridge" on the existing, 41-vehicle contract, resulting in a net deferral of \$450 million. As the draft report suggests, any deferred procurement costs would be required after 1998 for the delayed follow-on procurement.

We appreciate the opportunity to comment on the draft report.


DARLEEN A. DRUYUN
Deputy Assistant Secretary
(Acquisition)

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