United States General Accounting Office

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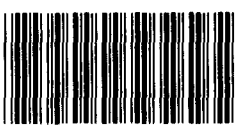
Report to Congressional Requesters

September 1991

TITAN IV LAUNCH VEHICLE

Restructured Program Could Reduce Fiscal Year 1992 Funding Needs



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National Security and
International Affairs Division

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September 6, 1991

The Honorable Daniel K. Inouye
Chairman, Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Les Aspin
Chairman, Committee on Armed Services
House of Representatives

As you requested, we reviewed the Air Force's coordination of production and launch schedules for the Titan IV expendable launch vehicle program. Although finalized data on the Air Force's restructuring plan are not available, this report focuses on what is currently known about such coordination efforts and their possible effect on the President's fiscal year 1992 budget for the Titan IV program. Our overall objective was to note opportunities for savings by citing instances of unneeded and unused funding related to the Titan IV program.

Background

The Titan IV is an unmanned, expendable launch vehicle that, along with the space shuttle, provides the nation's capability to propel its heaviest satellites into space. The expendable launch vehicle option became more important to national launch strategy after the Challenger space shuttle accident in January 1986 cut the planned shuttle fleet capacity and disrupted its planned launch schedules. After the Challenger accident, some satellite payloads designed for launch on the shuttle were redesignated for launch on Titan IV vehicles. According to Titan IV program officials, integration of these payloads introduced engineering problems that contributed to the delay in Titan IV launch schedules.

The Air Force has contracted for a total of 41 Titan IV vehicles. Four vehicles were launched between 1989 and mid-1991. Another Titan IV is scheduled for launch later this year, and four are scheduled for 1992. All of the remaining 32 vehicles to be produced under the current U.S. government contract are scheduled to be launched by the end of 1998, although Air Force officials stated that some planned launches could slip.

Each Titan IV launch vehicle is made up of a core, a fairing, and a set of solid rocket motors. These parts are shown on a schematic drawing of

the Titan IV that appears in appendix I. Solid rocket motors, along with liquid rocket engines in the core, provide the propulsion for the Titan IV. A solid rocket motor upgrade program, intended to allow the Titan IV to launch heavier satellites, reduce manual production processes through automation, and provide greater reliability, is currently undergoing development and testing.

The Titan IV may also have an optional upper stage to provide the additional booster capacity that some satellite payloads require to reach their intended orbit. The Inertial Upper Stage (IUS) has been used on a combination of shuttle, Titan 34D, and Titan IV vehicles since 1982. While the IUS is managed as a separate program with its own program office and budget, the newer Centaur upper stage is managed and budgeted as an integral part of the Titan IV program.

The Air Force plans eventually to have three launch complexes for the Titan IV: two at Cape Canaveral Air Force Station, Florida, and one at Vandenburg Air Force Base, California. A fourth complex, SLC-6 at Vandenburg, has not been funded. According to program officials, Titan IV launch requirements can be met without the fourth launch site, but loss of the site reduces backup launch capability. The Solid Rocket Motor Assembly and Readiness Facility, currently under construction at Cape Canaveral, Florida, will serve the two launch complexes at that location and is designed to provide the capability to assemble both the solid rocket motor and the solid rocket motor upgrade.

Results in Brief

Program delays and uncertainties may result in lower funding requirements for fiscal years 1992 and 1993 for the Titan IV program. The Air Force is planning a slowdown of production to better synchronize production and launch schedules for the Titan IV expendable launch vehicle program. Since Titan IV program officials and the contractor have not yet reached agreement on the revised schedule and cost estimate, specific information about the impact on the budget is not yet available. In addition, not all of the fiscal year 1992 procurement funding may be needed for the solid rocket motor upgrade due to program delays.

Program uncertainties also raise questions about the long-lead funding and future full procurement of two IUS vehicles. First, the Defense Support Program satellites that are to be boosted by the two IUS vehicles are not yet on contract, and their launch is expected to be delayed. Second, while the Air Force plans to continue long-lead funding for the

two IUS vehicles in fiscal year 1992, they plan to slip full production until 1995. Finally, the IUS acquisition strategy may no longer be cost-effective since the National Aeronautics and Space Administration (NASA)—a planned partner in the IUS procurement—may no longer be participating in a coordinated buy.

Construction costs for the Solid Rocket Motor Assembly and Readiness Facility at Titan IV's Cape Canaveral launch site were less than expected. Therefore, $35.5 million of funds from the Air Force military construction appropriation for fiscal year 1990 can be rescinded.

Production to Be Slowed Down

Program officials plan to slow Titan IV production to address recognized problems in synchronizing production and launch schedules. Before this slowdown, more vehicles were scheduled to be produced each year than were needed to satisfy launch requirements. We attempted to conduct a vehicle-by-vehicle cost analysis to determine the impact of launch delays on funding requirements but could not do so because neither the program office nor the contractor maintained costs by individual vehicle.

Delays in the construction and renovation of launch facilities and engineering problems associated with integrating former space shuttle payloads with Titan IV vehicles were major contributors to delays in the Titan IV launch schedule. Program officials now explain that earlier estimates for repairing and constructing launch facilities were overly optimistic. In addition, all of the vehicles under the current contract are assigned to satellites originally intended to be launched on the shuttle. As a result, much work is required to tailor the vehicles to the payloads.

Although only 41 vehicles are under contract, the December 1990 Titan IV Selected Acquisition Report describes the total program as including 65 vehicles at an estimated cost of $18.3 billion over a 16-year period. The current 41-vehicle contract with Martin Marietta runs through fiscal year 1995, but the program office plans to extend the contract and slow production.

Early in 1990, Titan IV program office staff and employees of Martin Marietta, the prime contractor, began exploring ways to more closely correlate production and launch schedules. After more than a year of studying alternatives, program officials plan to restructure the program by slowing production from 8-10 vehicles per year to not more than 6 vehicles per year beginning in fiscal year 1992. As of August 1, 1991,

the Titan IV program office and the contractor were in the process of revising preliminary cost and schedule estimates, but details had not been completed. Although officials in the program office showed us rough estimates, they were not able to define exactly how the anticipated changes would affect fiscal year 1992 funding requirements for the Titan IV program or for classified satellite programs, which also provide Titan IV funding.

Program Funding

The Titan IV program is funded both by direct appropriation and by classified satellite programs that use Titan IV to launch their payloads. The President's 1992 budget requests $530.8 million in direct appropriations for the Titan IV program with the funding earmarked for non-vehicle procurement items. Table 1 provides the anticipated allocation of the budget as projected by Air Force headquarters officials in January 1991 and as revised in July 1991.

Table 1: Budget Allocation for Titan IV Program for 1992

Dollars in millions

Appropriation Account		Budget Allocation Jan. 1991	Budget Allocation July 1991
3020 Missile Procurement			
	Launch Services	$137.3	$163.0
	Production Slowdown/ Product Improvement	58.7	29.7
	Peculiar Support Requirements	37.5	37.5
	Production Support	14.7	20.7
	Award/Incentive Fees	27.8	22.2
	Propellants	12.0	6.3
	Other	4.7	13.3
	Subtotal	**$292.7**	**$292.7**
3300 Military Construction			
	Centaur Processing Facility Phase I	**$24.0**	**$24.0**
3400 Operations and Maintenance			
		$70.2	**$70.2**
3600 Research, Development, Test, and Evaluation			
	Launch Vehicle	11.0	11.0
	Launch Complex 40	59.7	46.1
	Centaur Processing Facility	12.1	12.3
	Payload Integration	14.9	28.5
	Systems Engineering and Production Management	16.9	16.9
	Launch Communications Development	15.0	15.0
	Program Office Support and Other Government Costs	14.3	14.1
	Subtotal	**$143.9**	**$143.9**
	Total	**$530.8**	**$530.8**

Program officials estimate that in fiscal year 1992 the program will also receive $774.3 million from various classified satellite programs. Because of the compartmentalized nature of the data, limited information was available on classified satellite funding for the Titan IV. Table 2 shows anticipated Titan IV program funding both for launch vehicles and non-vehicle support broken out by source—direct Titan IV

program funding and funding provided by classified users.[1] As shown, classified users are expected to fund all vehicle costs and 43 percent of non-vehicle procurement costs for the Titan IV in fiscal year 1992.

Table 2: Anticipated Fiscal Year 1992 Funding

Dollars in millions

	Vehicle	Non-vehicle	Total
Classified Users	$366.1	$408.2	**$774.3**
Titan IV Program	0.0	530.8	**530.8**
Total	**$366.1**	**$939.0**	**$1,305.1**

Data on Titan IV program funding are taken from the President's budget for Titan IV for fiscal year 1992. Data on classified user funding were provided by the Titan IV program office.

Classified user funding for fiscal year 1992 is intended to cover portions of the cost of 16 Titan IV vehicles. Because user funding is authorized and appropriated on a 1-year basis, vehicle costs noted above do not include total cost for any one vehicle.

Impact of Slowdown and Delays on Program Costs

According to an Air Force headquarters official, although slowing Titan IV production may eventually increase overall program costs, the budgetary requirement for Titan IV may be reduced by $47 million in fiscal year 1992 and by $11 million in fiscal year 1993. Preliminary estimates by program officials of additional costs due to the slowdown, including those for the solid rocket motor and upgrade, range from approximately $629 million to approximately $769 million. Air Force headquarters officials noted that about $350 million of the projected additional costs would be incurred under the current production schedule; therefore, these costs should not be attributed to the slowdown. In estimating the cost of the slowdown, program officials considered: (1) contractor overhead; (2) storage, maintenance, and replacement of equipment; (3) contract changes; and (4) success incentives and award fees. Their analysis does not include offsetting costs, such as storage, retrofit, or other modifications, which could have occurred had launch vehicles been produced before they were needed. As of August 1, 1991, program officials were still negotiating revised costs with the prime contractor.

[1]Non-vehicle support includes items such as launch services, product improvement, incentive fees, and propellants.

Additional Potential for Reduced Funding

Solid Rocket Motor Upgrade

According to Air Force officials, $10-17 million in procurement funds is designated in the fiscal year 1992 President's budget for the extra costs needed to slow down production of the solid rocket motor and the solid rocket motor upgrade. Because numerous problems have delayed the transition of the solid rocket motor upgrade program from development and testing to production, we believe that not all of the fiscal year 1992 procurement funding may be needed. Furthermore, cost increases attributed to the slowdown need to be scrutinized due to the continuing problems delaying the initiation of production.

Several incidents have delayed development of the rocket upgrade. In March 1989 a fire at the contractor's Hercules plant caused extensive damage delaying production capability. During the casting of the first solid rocket test motor in December 1989, the propellant de-bonded from the case lining of the motor. Thus the case lining had to be redesigned. In June 1990, a segment of the first test motor was damaged during movement, resulting in the loss of that motor segment. In September 1990 a crane accident during movement of one of the test motor segments resulted in an explosion that damaged the solid rocket motor test stand. These four incidents resulted in a 17-month delay to the solid rocket motor upgrade program.

On April 1, 1991, during the first static firing test of the rocket motor upgrade, the test motor exploded. This fifth incident was still under investigation in June 1991, but results of a preliminary program office review indicate that production of the solid rocket motor upgrade will be delayed by at least 1 year beyond the currently scheduled production initiation date of October 1991.

Inertial Upper Stage

During consideration of the fiscal year 1991 Appropriations Act, Congress approved long-lead procurements for the IUS in both fiscal years 1991 and 1992. Congress' action to fund long-lead items for 2 years was based on the expectations that (1) the Air Force would realize significant savings from a coordinated procurement of IUS's with NASA and (2) there were firm requirements for the IUS vehicles.

Early in 1991, the IUS program office put long-lead items for two IUS vehicles on contract for $9.1 million. In the fiscal year 1992 budget request, the Air Force asked for $29.5 million for the second year of long-lead procurement for these vehicles. According to the IUS program office, about $112 million was to have been requested in fiscal year 1993 for producing those two vehicles. Air Force officials were aware that the procurement scheduled for fiscal year 1993 was 2 years earlier than required, but they considered the early procurement to be cost-effective.

In April 1991, when we questioned the IUS program office about the need for the initiation of the procurement of these vehicles (in light of the anticipated Titan IV slowdown), IUS program officials were unaware of the planned Titan restructuring. However, IUS program officials said that delays in funding could adversely affect the industrial base for the IUS and increase program costs. At that time, the IUS program office estimated that a 1-year delay of fiscal year 1992 funding could cost the program $30 million as a result of inflation and the cost of retaining contractor personnel for integration and launch services.

Congressional action and additional Air Force funding requests for fiscal year 1992 long-lead procurements occurred prior to the restructuring and slowdown of the Titan IV program. The two IUS's for which the long-lead fiscal year 1992 funding is requested are designated for use with Titan IV vehicles that are not among the 41 vehicles included in the current Titan IV contract. Additionally, the IUS's are to be used to boost Defense Support Program satellites, which also are not yet on contract and whose launch is expected to be delayed.

In commenting on a draft of this report, Air Force officials said that the Air Force had modified the IUS program to respond to changing Defense Support Program launch requirements. These officials told us that the modifications met their requirements at both the lowest cost and risk to the government. After evaluating several options, including procurement of additional Centaur rather than IUS vehicles, the Air Force has decided to postpone full funding and production of the two IUS vehicles until fiscal year 1995. However, the Air Force still plans to go ahead with the fiscal year 1992 long-lead procurement for two vehicles because of concern that some of the subcontractors would go out of business. According to Air Force officials, NASA's participation in the IUS procurement is now uncertain. If NASA does not participate, the Air Force procurement will mark the end of the IUS program.

While we have not examined the potential impact on the industrial base of delaying long-lead funding, there have been gaps in IUS procurement in the past without a catastrophic effect.

Potential Rescission

We have identified a potential rescission of $35.5 million in fiscal year 1990 Air Force military construction funding for the Titan IV program. Because construction costs were less than estimated, some of the fiscal year 1990 funds appropriated for construction of the Solid Rocket Motor Assembly and Readiness Facility at Titan IV's Cape Canaveral launch site will not be needed.

In fiscal year 1990, Congress appropriated $89 million for the motor assembly facility. However, the facility contract was awarded for considerably less than projected. With more than half of the construction completed, program officials now estimate the costs for the facility will not exceed the $51 million that has already been released to the Titan IV program.

The Air Force Systems Command reprogrammed approximately $2.5 million of the $89 million originally appropriated for the motor assembly facility in the fiscal year 1990 military construction budget. As of July 1, 1991, the remaining $35.5 million had not been reprogrammed. In commenting on a draft of this report, Air Force officials indicated that they were considering reprogramming these funds to other fiscal year 1990 construction efforts.

Matters for Congressional Consideration

Congress may wish to consider requiring the Secretary of Defense to report to the House and Senate Committees on Armed Services and Appropriations on the following issues prior to obligating fiscal year 1992 funds:

- details of the planned Titan IV production slowdown and the impact of this production slowdown on fiscal year 1992 funding requirements for the Titan IV and associated classified users; and
- analysis of alternatives to long-lead funding in fiscal year 1992 and procurement in fiscal year 1995 of two IUS vehicles given the uncertainties in the program.

Congress should also note that $35.5 million could be rescinded from the fiscal year 1990 Air Force military construction appropriation provided for the construction of the Solid Rocket Motor Assembly and Readiness Facility.

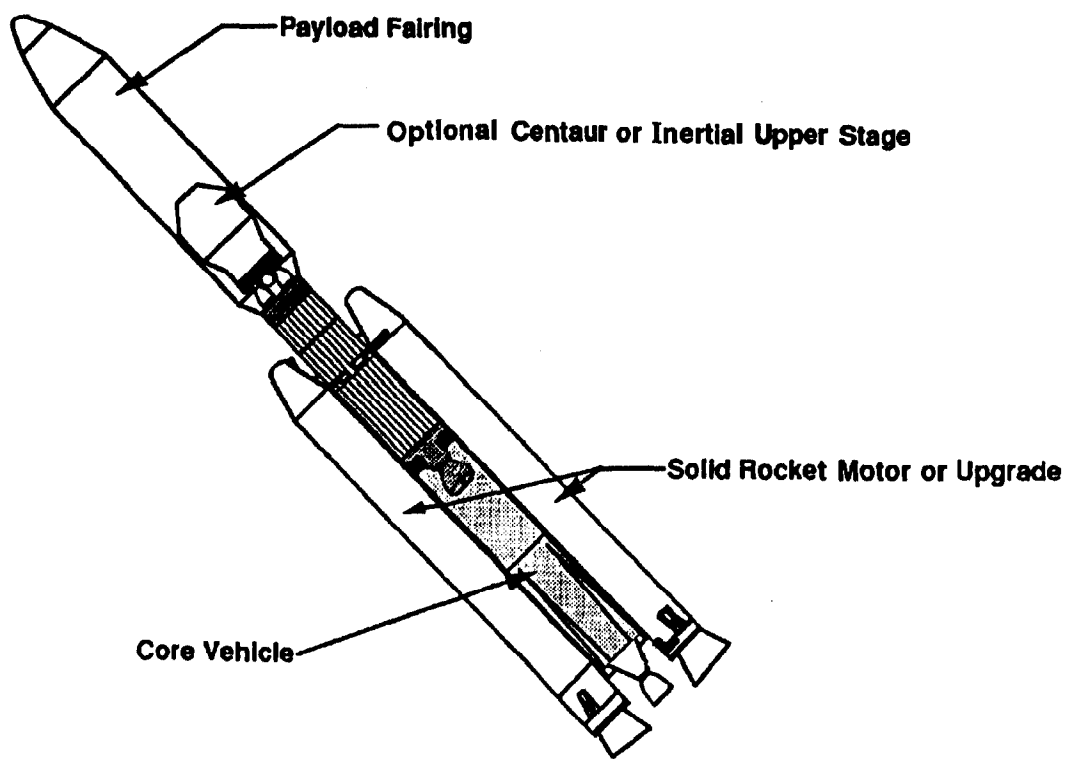
Appendix II discusses in detail our objectives, scope, and methodology. Major contributors to this report are listed in appendix III.

We are sending copies of this report to the Chairmen, Senate Committee on Armed Services and House Committee on Appropriations, Subcommittee on Defense; the Secretaries of Defense and the Air Force; and the Director, Office of Management and Budget. Copies will be made available to others on request.

Please contact me on (202) 275-4268 if you or your staff have any questions concerning this report.

Nancy R. Kingsbury
Director
Air Force Issues

Titan IV Configuration



Objectives, Scope, and Methodology

Our initial objective was to review the Atlas, Delta, Titan II, and Titan IV expendable launch vehicle programs in order to identify schedule discrepancies between Air Force launch vehicle production rates and space launch plans. Later, we narrowed our scope to Titan IV schedule discrepancies that might affect the President's fiscal year 1992 budget.

We interviewed Titan IV program officials and reviewed pertinent program documents, launch and production schedules, and funding and budget data at the Titan IV Systems Program Office, Space Systems Division, Air Force Systems Command, Los Angeles, California; Air Force Space Command, Peterson Air Force Base, Colorado; Office of the Assistant Secretary of the Air Force (Acquisition), Pentagon, Washington D.C.; and Martin Marietta Corporation, Littleton, Colorado. We also interviewed Inertial Upper Stage program officials and reviewed program documents at the Inertial Upper Stage Program Office, Space Systems Division, Los Angeles, California.

The continuing changes generated by the restructuring of the Titan IV program limited the availability of detailed, current cost and schedule data for the Titan IV program and its solid rocket motor upgrade. Because the Titan IV program does not maintain unit cost data by vehicle, our analysis of annual funding requirements was extremely limited.

We performed our review between August 1990 and June 1991 in accordance with generally accepted government auditing standards. Because the review focused specifically on issues affecting the fiscal year 1992 budget, we did not examine internal controls or agency compliance with regulations. Although we did not obtain official written agency comments, we obtained informal comments from the Titan IV Systems Program Office, the Inertial Upper Stage Program Office, Headquarters, United States Air Force, and the Office of the Secretary of Defense, and incorporated their comments as appropriate.

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