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Report to the Chairmen, House and Senate Committees on Armed Services

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STRATEGIC BOMBERS

B-1B Cost and Performance Remain Uncertain

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

The Honorable Sam Nunn
Chairman, Committee on Armed Services
United States Senate

This report addresses B-1B cost and performance issues and updates information we presented to the House and Senate Committees on Armed Services during testimonies in 1987. We are sending copies to interested congressional committees; the Secretaries of Defense and the Air Force; the Director, Office of Management and Budget, and other parties upon request.

Frank C. Conahan
Assistant Comptroller General

Executive Summary

Purpose

Early in 1987 GAO testified on the B-1B bomber program before the House and Senate Committees on Armed Services. It identified B-1B development deficiencies during the testimonies, and the Chairmen requested that GAO continue to monitor the program. This report updates and assesses the progress of the B-1B program since 1987 and presents other related issues.

Background

On October 2, 1981, the President announced his decision to develop and deploy 100 B-1Bs. In selecting the B-1B, DOD believed that the technology, cost, and schedule risks would be low because of the experience gained from the canceled B-1A program. On January 18, 1982, the President certified to the Congress that the B-1B would have an initial operational capability during 1986 and that the development and acquisition baseline cost of the B-1B fleet would not exceed $20.5 billion ($27.8 billion escalated dollars). However, to field the B-1B in just 5 years, the program would feature highly concurrent full-scale development, production, and testing schedules.

The Air Force declared the B-1B operational in September 1986 and accepted delivery of the 100th B-1B in April 1988.

Results in Brief

The Air Force has made progress in correcting certain deficiencies, such as flight controls and terrain-following radar. However, the expected progress in resolving defensive avionics problems did not materialize. In short, it is now known that the defensive avionics cannot meet specifications without a major redesign. Except for defensive avionics, testing conducted during the past year has continued to progress well, but some critical portions of the flight test program required for flight controls, terrain following, and cruise missiles are not finished.

To date, the Air Force has incurred costs of about $31 billion for 100 B-1B aircraft, including both baseline and non-baseline costs. Potential enhancements and modifications could cost another $9 billion.

Before final costs can be determined, however, there are important technical questions that must be answered. For example, can the defensive avionics problems be corrected? Will development and testing verify the effectiveness of flight control improvements? Will B-1B effectiveness as a cruise missile carrier be verified? What modifications and enhancements may be needed to enable it to perform as a multipurpose bomber?

GAO's Analysis

Full Performance Has Not Been Demonstrated

Analysis of tests conducted in the spring of 1988 revealed a major problem with the basic B-1B defensive avionics system that will prevent it from achieving the capability expected. It is unclear at this time what the schedule and operational implications of the defensive avionics problems will be. The Air Force assessed its options and completed its evaluation in October 1988. In December 1988, after completion of GAO's fieldwork, the program office estimated it would cost about $1 billion to correct the deficiencies to the extent the design will allow.

Testing of improvements being made to overcome deficiencies in flight controls has continued. Successful completion of remaining flight control testing is critical to the B-1B achieving the range capabilities needed to perform its primary mission of a low-level penetrator. It is planned to be completed by February 1989. Retrofitting of 91 aircraft is to be completed by June 1990, and the remaining aircraft are expected to be finished by 1994.

The data for the B-1B fleet show that the reported fuel leaks basically remained constant over the last year. Total elimination of B-1B fuel leaks is probably not possible because the fuel cells are a part of the airframe and seals and joints will continue to be subjected to flight stress.

The B-1B is designed to carry conventional and nuclear gravity bombs, the short range attack missile, and cruise missiles. The Air Force has identified solutions to most weapon delivery problems. However, projections show that external cruise missile carriage increases fuel consumption, reducing the unrefueled range of these missions. Only limited cruise missle testing has been completed to date.

Cost

To date, the Air Force has incurred costs of about $31 billion in escalated dollars for 100 B-1B aircraft. The program office estimates it will cost about $1 billion to improve the defensive avionics. The Strategic Air Command, the aircraft user, has identified a number of potential enhancements to permit the B-1B to effectively perform the mission of a multipurpose bomber. These are estimated to cost $7.4 billion. At this

time DOD has decided to request funding for only a few of these enhancements. In addition, the Oklahoma City Air Logistics Center, which is now assuming responsibility for support of the B-1B, has identified a number of needed modifications to the aircraft with an estimated cost of $1.7 billion.

Agency Comments

DOD partially concurred or concurred with most of GAO's findings (see app. II). DOD's major disagreement was with GAO's characterization of costs for potential modifications and enhancements. DOD requested that GAO clarify this issue, stating that the list of 14 projects identified by GAO was the result of a fiscally unconstrained planning exercise to identify potential capabilities applicable to the B-1B. DOD stated that the Air Force, after reviewing its options to maximize overall warfighting capabilities in a fiscally constrained environment, decided to request funding for only three of the potential enhancements at this time.

The enhancements GAO listed were identified by the Strategic Air Command and priced by the B-1B Program Office. GAO recognizes that funding will only be requested at this time for some of the enhancements identified by the Air Force. However, the other items remain as potential enhancements that may be needed if the B-1B is to fulfill its role as a multipurpose bomber.

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Abbreviations

ACM	Advanced Cruise Missile
ALCM	Air Launched Cruise Missile
DOD	Department of Defense
EOD	External Observable Difference
FLIR	Forward-Looking Infrared
GAO	General Accounting Office
IOC	initial operational capability
PMRT	Program Management Responsibility Transfer
SAC	Strategic Air Command
SAR	Selected Acquisition Report
SEF	stability enhancement function
SIOP	Single Integrated Operational Plan
SIS	stall inhibiter system
SRAM	Short Range Attack Missile

Introduction

In July 1980 the Congress directed the Secretary of Defense to vigorously pursue the full-scale engineering development of a new multirole bomber. Candidates included, but were not limited to, an advanced technology aircraft, the B-1A bomber canceled by the President in 1977, and derivatives of the B-1A and FB-111B/C aircraft. The Congress also directed that this multirole bomber be capable of performing strategic missions of penetration, cruise missile carriage, conventional bomber, and maritime support and that initial operational capability (IOC) be scheduled for not later than 1987.

On October 2, 1981, the President announced his decision to develop and deploy 100 B-1Bs. In selecting the B-1B, DOD believed that the technology, cost, and schedule risks would be low because of experience with the B-1A program. For example, about 80 percent of the B-1B airframe was planned to be common to the B-1A prototype, which had almost 1,900 flight test hours. On January 18, 1982, the President certified to the Congress that the B-1B would have an IOC in 1986 and that the development and acquisition cost of the B-1B fleet would be capped (i.e., not exceed) $20.5 billion (in constant 1981 dollars).

The Air Force undertook the B-1B bomber program to modernize the aircraft portion of the strategic TRIAD.[1] Air Force plans call for the B-1B to replace the B-52 as a penetrating bomber and provide the capability to penetrate Soviet defenses until the B-2 —a more advanced bomber— is deployed in the 1990s. The B-1B will eventually become a cruise missile carrier, first in a shoot and penetrate role, and later as cruise missile carrier only. The B-1B is also planned to be capable of being used as a conventional bomber. In its role as a penetrating nuclear weapon delivery system, it is intended to take maximum advantage of the combined effects of low altitude, high speed, reduced observability to radar, and sophisticated electronic countermeasures to penetrate and survive in enemy airspace. The Air Force declared the B-1B operational in September 1986 and received the 100th B-1B in April 1988. (The force has been reduced to 97 aircraft due to a crash in September 1987 and 2 crashes in November 1988.)

[1]The strategic TRIAD is composed of the B-52, FB-111, and B-1B bombers; the land-based intercontinental ballistic missile force; and the sea-based submarine ballistic missile fleet.

GAO Testimony on B-1B

In early 1987 we testified on the status of the B-1B program before the House and Senate Committees on Armed Services.[2] We stated that despite production delivery successes, the performance of the aircraft at the time that the Air Force declared the first 15 operationally capable (September 1986) was considerably less than originally intended. We also said that development and production problems in B-1B subsystems limited testing, necessitated operational restrictions, and prevented some training. Much remained to be done before the development and acquisition was completed. During our testimony we discussed problems with the defensive avionics, flight controls, terrain-following radar, avionics integration, fuel leaks, and logistics support.

We also testified that the initial ground rules and time frames for the program, particularly the requirement for near-simultaneous development and production, had created a severe management challenge for the Air Force. This program concurrency proved to be a contributing factor to many of the program problems that had developed.

Finally, we stated that although the Air Force believed it had identified solutions to known performance problems, assurance that problems had been solved would have to await successful completion of the test program. We noted that the revised test schedule extended testing 32 months to February 1989.

Congressional Response to B-1B Problems

Because of its dissatisfaction with the management of the B-1B program, the Congress required the Secretary of Defense to take several actions, including the following:

- Submit a detailed plan for testing the defensive avionics system and provide bimonthly status reports on it. This plan has been submitted, and bimonthly reports began in March 1988.
- Provide for an independent assessment of the capabilities of the B-1B to penetrate air defenses of potential enemies. This study is underway, and an interim report was released in September 1988.
- Restrict enhancements to the B-1B unless specifically authorized by law with funds specifically appropriated for that purpose.

In addition, the Chairmen of the House and Senate Committees on Armed Services asked us to continue to monitor the developments on the

[2]The B-1B Aircraft Program (GAO/T-NSIAD-87-4A, February 25, 1987, and GAO/C-T-NSIAD-87-22, April 2, 1987).

B-1B program. This report updates and assesses the progress of the B-1B program since our 1987 testimony and presents other related issues.

Objectives, Scope, and Methodology

To fulfill the request of the Chairmen of the House and Senate Committees on Armed Services, we evaluated the status of the major B-1B systems, the test program, the current B-1B cost estimates, and the cost estimates for identified enhancements.

Specifically, our objectives were to

- determine the status of efforts to correct known performance problems,
- monitor progress on the test program and other performance-related areas to determine test progress and identify any additional performance-related problems,
- determine the current status of the B-1B acquisition effort including the status of the baseline cost cap, and
- identify the requirements, estimated cost, and status of potential B-1B capability enhancements.

We reviewed Air Force program technical evaluations, test plans, threat documents, system specifications, schedules, and cost estimates. We discussed the B-1B program with officials at the B-1B System Program Office and Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio; Headquarters, Strategic Air Command, Offutt Air Force Base, Nebraska; Air Force Operational Test and Evaluation Center, Kirtland Air Force Base, New Mexico; Air Force Flight Test Center, Edwards Air Force Base, California; Oklahoma City Air Logistics Center, Oklahoma; Dyess Air Force Base, Texas; Defense Intelligence Agency, Bolling Air Force Base, Washington, D.C.; and Headquarters, Air Force, and the Office of the Secretary of Defense, Washington, D.C. We also contacted the AIL Division of Eaton Corporation, the defensive avionics system contractor.

We performed our review from December 1987 through October 1988 in accordance with generally accepted government auditing standards. The Department of Defense provided written comments on a draft of this report. These comments were incorporated in the report where appropriate and are included in appendix II.

Progress Has Been Made, But Full Performance Has Not Been Demonstrated

Except for the defensive avionics system, the performance problems we testified on last year have shown improvement; however, several areas critical to B-1B mission performance have not yet been demonstrated. For example, if final solutions to flight control problems are not fully successful, potential B-1B range shortfalls could affect both B-1B missions and Air Force tanker requirements. The current status of the problems highlighted in our 1987 testimony are discussed below.

Defensive Avionics—Major Limitations

As recently as January 1988, the Air Force finalized an incremental B-1B defensive avionics plan to attain contractual specified performance. Tests conducted between March and June 1988, however, disclosed major system design deficiencies that negate efforts to complete development and meet the contractual specifications.

The B-1B defensive avionics or electronic countermeasures system is designated the ALQ-161A. The ALQ-161A was designed to improve the probability of penetrating the Soviet Union by allowing the aircrew to avoid, degrade, and deceive the Soviet air defenses. It is one element of the B-1B penetration equation; the others are low-altitude, high-speed attack; low radar cross section; accurate navigation coupled with tactical route planning; and defense suppression.

As we testified in 1987, the system was originally intended to be fully capable at IOC in October 1986, but a series of production and performance problems delayed completion of the development program.

Recently disclosed problems center on the system's radar warning receiver and processor function, which is intended to initiate defensive action by receiving and identifying threat system signals. Although specific flight test results and the extent of ALQ-161A limitations are classified, the problem originates with the basic system design. The program office believes that software revisions may allow limited performance improvements, but these revisions will not be able to overcome design deficiencies. As a result, a significant degradation of system capability exists.

The results of a 3-month study on alternative ALQ-161A system architectures were presented to the Office of the Secretary Defense on September 26, 1988. The study included (1) enhancing the ALQ-161's ability to jam, degrade, and decoy threats, (2) pursuing an off-the-shelf radar

warning receiver for the B-1B, (3) determining the risk and cost of modifying the existing ALQ-161A radar warning receiver, and (4) determining future B-1B defensive needs. The Air Force has identified an approach to dealing with the problems and in December 1988, after completion of our fieldwork, the B-1B Program Office estimated it would cost about $1 billion to correct the deficiencies to the extent the design will allow. This includes about $500 million to maximize the capability of the ALQ-161A and about $500 million to add a radar warning receiver.

In its comments on our draft report, DOD stated that the flight test results, although revealing a design deficiency in the receiver/processor, demonstrated that the most effective electronic countermeasure did work. It should be noted, however, that only 5 percent of the ALQ-161A flight tests have been completed, and the countermeasure technique in question has several limitations, the details of which are classified.

Flight Control Improvements Are Being Tested

The B-1B has little inherent stall warning to notify pilots that they may inadvertently lose control of the aircraft and crash. Natural stall warning is characterized by buffeting—a shaking or wobbling experienced before entering a stall. A stall is a sudden reduction of lift, accompanied by the loss of aircraft control. This has been seen in B-1B simulations only, and these simulations have shown that once a B-1B stalls it will crash.

To ensure flight safety while flight control improvements are developed, an artificial warning system (warning tone and light) notifies pilots when the B-1B is within 20 percent of its stall point. This system prevents loss of control; however, it imposes the following restrictions on B-1B operations.

- The 20-percent safety margin limits the aircraft gross weight. For example, during terrain following[3] the B-1B weight is restricted to 280,000 pounds for training and 320,000 pounds should Emergency War Orders be implemented. Without these restrictions, the Strategic Air Command (SAC) would actually operate between 420,000 and 440,000 pounds. Consequently, munitions and/or fuel (i.e., payload or range) must be sacrificed.
- Pilot work load is increased because the pilot must pay increased attention to the flight controls. This may be unacceptable, when, in the heat

[3]Terrain following means the aircraft closely follows the natural features of the ground below it.

of battle, extensive maneuvering and attention to other mission-related tasks are required.

Three fixes have been designed to resolve these problems. The first two fixes, designated the stall inhibitor system 1 and 2 (SIS 1 and 2), allow the B-1B to come within 95 percent of its stall point. The third fix, the stability enhancement function (SEF), is a software upgrade to SIS 2 hardware intended to permit the B-1B to operate beyond its originally designed stall point.

The artificial warning system, currently in most of the operational fleet, merely warns the pilot if the 20-percent safety margin has been exceeded. By comparison, the SIS applies an increasingly strong force on the control stick as the aircraft approaches its stall point. The SIS makes it increasingly difficult for the pilot to approach and exceed the 95-percent margin available before stall warning is activated. According to the Air Force, the SIS will allow the B-1B gross weight to increase (i.e., more munitions and/or fuel) and reduce the pilot work load. The work load is reduced because the increased force on the control stick will give the pilot a better sense of the situation, without requiring intense attention to flight controls, and allow a safe approach to the 95-percent margin.

According to the Air Force, SIS is designed to provide significant flight improvement at heavy weights, but it will not allow the B-1B to perform all the maneuvers required during terrain following without activating the stall warning system. The solution for this is SEF. SEF is designed to control the aircraft automatically in a manner that helps prevent stalling during terrain following at heavy weights. Once SEF flight testing is complete, all aircraft modified at that time will be cleared for SEF limits. DOD stated in its comments on a draft of this report that eight aircraft have now been modified with SIS 2/SEF kits and cleared to fly SIS limits. Within the last year, the Air Force has modified 15 aircraft with SIS 1. The remaining aircraft will be modified with SIS 2 and SEF, as shown in table 2.1.

Table 2.1: Test and Retrofit Schedule for SIS 1, SIS 2, and SEF

	Flight test		Fleet retrofit	
	Start date	Completion date	Start date	Completion date
SIS 1	December 1986	April 1988	October 1987	April 1988
SIS 2 and SEF	May 1987	February 1989	March 1988	June 1990[a]

[a]According to DOD, current plans call for the completion of SEF retrofit of aircraft 10 through 100 by June 1990. Aircraft 2 through 8 require a number of modifications, so SEF retrofit will not be completed for these aircraft until 1994.

Both program office and Combined Test Force officials said that there is a high risk that flight controls testing may not be completed as scheduled. SEF represents a software change to existing hardware, and achieving full SEF performance capability is critical to B-1B heavyweight testing, low-altitude penetration, and range capability.

Progress Continues on Terrain-Following Radar

The B-1B's survivability when penetrating the Soviet Union will depend in part on its ability to fly low to avoid radar detection. The Air Force believes successful penetration of modern defenses will require the B-1B to fly underneath the coverage of ground-based radars and low enough to attempt to hide from airborne interceptor radars in the radar clutter created by surface features. As a result, the B-1B was designed to fly in an automatic terrain-following mode, at 200 feet, in all weather, and at night.

Although SAC wanted to begin training pilots in the use of terrain following at actual combat altitudes, a number of problems prevented this from happening. Initially, tests disclosed software problems with the terrain-following radar mode. The system erroneously flew up then down and did not accurately follow the terrain. Automatic terrain-following training was not allowed until early 1987, after the software had been modified and successfully tested.

Testing at lower altitudes has continued throughout the past year, and although software problems have surfaced, progress toward full capability continues. The B-1B incorporates two terrain-following modes. One mode, known as hard ride, closely follows terrain contours and is intended for high-threat environments. It provides greater concealment from radar detection in mountainous and moderate terrain. The other mode, known as soft ride, does not approximate the contour of the ground as closely as hard ride and provides a smoother, less turbulent, and fatiguing flight.

The Air Force has cleared the B-1B to fly at 200 feet, with the following restrictions: soft ride, during daylight, in good weather, over flat and rolling terrain. In comparison, the requirement is 200 feet, hard ride, at night, in all weather, and over rolling to moderate terrain. The complete release to SAC of the required terrain-following capability is planned for February 1989 after completion of flight tests.

Although progress on terrain following has continued, SAC suspended actual training pending modifications to improve the aircraft's bird strike protection. In September 1987, while on a terrain-following training mission, a B-1B struck a bird and crashed. Consequently, SAC suspended training until the aircraft's most vulnerable areas were modified to reduce the possibility of a catastrophic accident from future bird strikes. The modification has been designed, and the Air Force completed this modification to the first B-1Bs in April 1988. Additional aircraft are being modified each month, and, as of December 31, 1988, all but four aircraft had been modified.

Avionics Compatibility Has Not Been Proven

The B-1B incorporates one of the most complex collections of offensive and defensive avionics equipment ever built. When the B-1B was designed, the Air Force recognized that the offensive and defensive systems may have to operate on the same frequencies. This could cause the defensive system to jam the radar or altimeter.

To prevent this problem, the Air Force designed a system, known as the Radio Frequency Signal Management System, to prevent the avionics systems from interfering with one another. However, development and testing of the system cannot be completed until defensive avionics equipment is available. As a result, the Air Force has not been able to complete development testing, and the system remains not yet proven.

In commenting on this report, DOD stated that during the recent defensive avionics testing, a special test was performed at low altitude to demonstrate the compatibility of the offensive and defensive systems. Even though it was not a formal test, DOD said it gave a strong indication that the two systems are compatible.

Fuel Leaks Continue

The B-1B is subject to fuel leaks because its fuel cells are an integral part of the airframe structure. The B-1B has 21,000 feet of metal-to-metal seals requiring 290,000 fasteners and 1,200 pounds of sealant. Air Force officials said eliminating fuel leaks is virtually impossible. In its

comments on this report, DOD said that approximately 75 percent of all documented fuel leaks have been temporarily repaired to a "no leak" condition by using externally applied sealant. DOD pointed out, however, that fuel leaks must be repaired in a specific manner to be considered permanently fixed. These repairs will be made during programmed depot maintenance beginning in the 1991-1992 time frame.

Figure 2.1 compares B-1B aircraft with fuel leaks as a percent of total B-1B aircraft delivered. The leaks are described in two categories: grounding leaks and total leaks. Grounding leaks are those leaks that keep the aircraft from flying during peacetime training; however, the aircraft could be flown in the event of war. Total leaks include grounding leaks as well as leaks which do not prevent the aircraft from flying. Data for the entire B-1B fleet show that the reported leaks in both categories have remained about constant over the last year.

Weapons Delivery

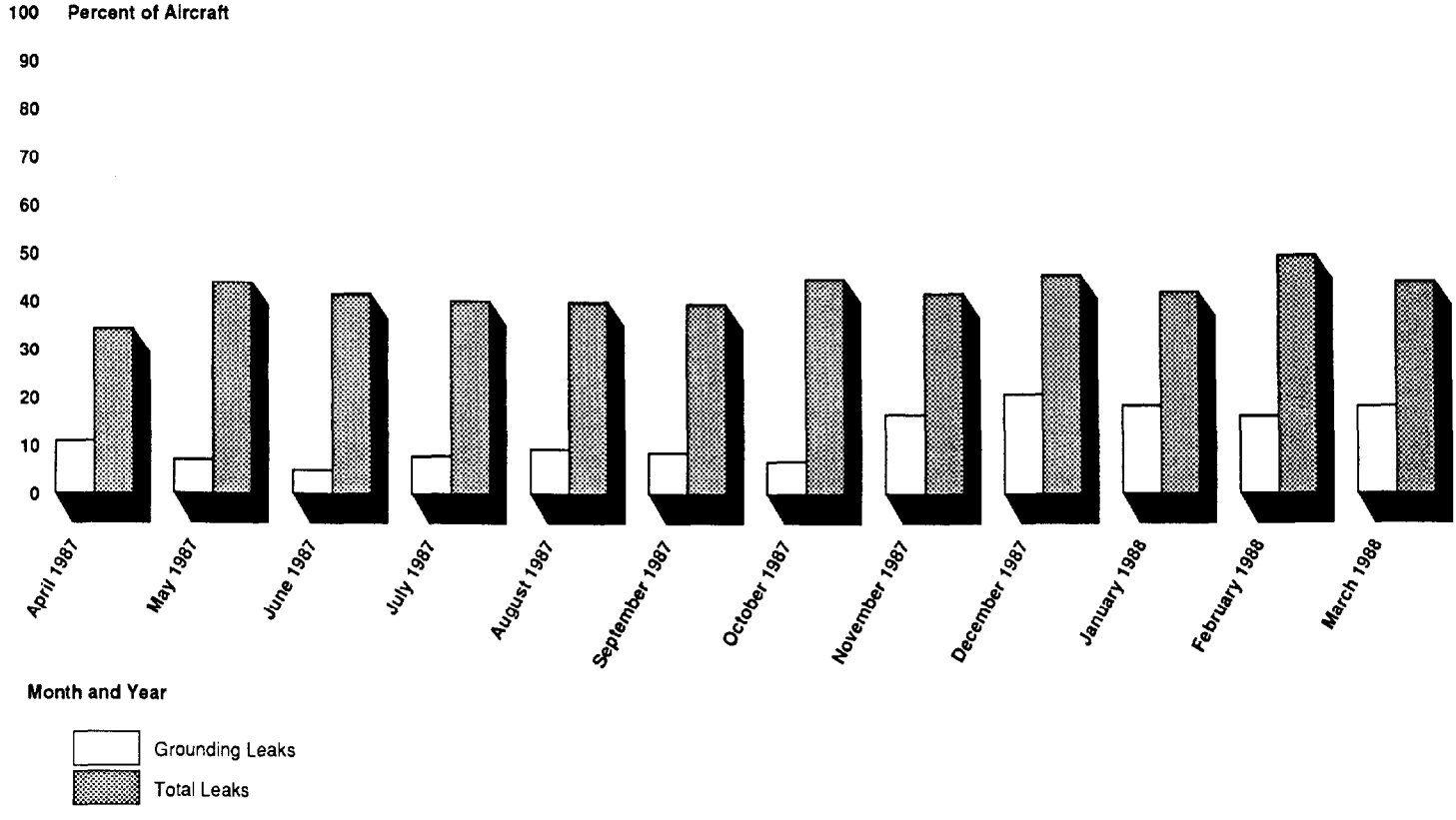
The B-1B is designed to carry conventional and nuclear gravity bombs, the short range attack missile (SRAM A), and cruise missiles. Testing revealed problems with weapons delivery, but the Air Force has identified solutions for most of them. The Advanced Cruise Missile external carriage testing has revealed problems, and a substantial amount of testing remains to be completed.

SRAM A Separation

A problem exists concerning the SRAM A separating from the aft weapons bay. Air turbulence could cause the missile to pitch down and exceed the pitchdown limit for rocket motor ignition, which would prevent the weapon from firing. The pitchdown problem is associated with a spoiler (a device used to break up airflow) located in front of the forward weapons bay. The spoiler is needed to prevent damage to the weapons bay doors due to wind stress when the doors are open.

During the past year, the Air Force identified two solutions to the problems: opening the mid weapons bay doors and fully extending its spoiler or extending the aft weapons bay spoiler only halfway. Both of these solutions alter the airflow, thus preventing missile pitchdown. There is no cost or schedule impacts with the first solution, but it would increase aircrew work load. The second solution requires minor modifications. The program office has not decided which solution will be implemented.

Figure 2.1: Percent of B-1Bs With Fuel Leaks From April 1987 to March 1988



Note: The increase in grounding leaks beginning in November 1987 is partially due to the change in the classification of grounding leaks. Before November 1987 any aircraft that could still fly with a grounding leak (it would fly with that particular fuel tank empty) was considered flyable. Beginning in November 1987 any grounding leak classified the aircraft as grounded.

Conventional Weapons Certification

The B-1B has not yet been certified to carry conventional bombs. In December 1987 the Nonnuclear Munitions Safety Board determined that the bomb ejector design on the B-1B conventional weapons release system did not incorporate the degree of design safety necessary to prevent the inadvertent release of weapons. When this problem was recognized, the Air Force stopped accepting delivery of the contractor's conventional weapons release systems.

In its comments, dated November 16, 1988, DOD indicated that the problem with the weapons release system had been solved and that hardware deliveries should resume in November 1988. On November 21,

1988, however, the program office was notified that a new problem with the system had been discovered during testing. As a result, delivery of the weapons release system had been stopped again while the contractor investigates the cause and identifies potential solutions to the problem.

The program office stated that the Munitions Safety Board Certification had been rescheduled for February 1989.

Cruise Missile Testing and Certification Is Not Complete

Testing and certifying the B-1B as a cruise missile carrier has not been completed, and it is unclear when it will be. Limited testing to date, however, has disclosed problems with the B-1B's ability to carry missiles externally.

The original B-1B configuration the Air Force recommended to the Office of the Secretary of Defense did not contain provisions for the B-1B to carry cruise missiles. In approving the program, however, the Office of the Secretary of Defense added both internal and external cruise missile carriage, and provided additional funding and test time to certify the B-1B as a cruise missile carrier. In April 1986 the Air Force directed that the Advanced Cruise Missile (ACM) rather than the Air-Launched Cruise Missile (ALCM) be the principal cruise missile weapon to be tested and qualified.

Testing to date has revealed problems with B-1B external cruise missile carriage. Wind tunnel tests indicated that the four rear weapons stations on the B-1B will experience air turbulence and vibration problems that could affect ability to use those stations. Defining these problems cannot be done until the testing is completed. Tests also showed that the external carriage increases air resistance, or drag, on the B-1B significantly more than was originally anticipated. Increased drag translates directly into increased fuel consumption. This, in turn, will cause either decreased range or increased refueling requirements. In addition to affecting the B-1B's ability to meet contractual mission specifications, increased tanker requirements could affect the entire bomber portion of the Single Integrated Operational Plan (SIOP). The SIOP allocates all strategic assets—land- and sea-based ballistic missiles, bombers, tankers, and cruise missiles—to specific targets.

Current Projections Show Potential Range Shortfalls

Current program office performance projections indicate that range shortfalls will prevent the B-1B from meeting parts of its contractual performance specifications. The specifications represent the minimum mission performance expected of the aircraft when the program started. Although actual specification compliance must await completion of development tests, the program office can project performance specification based on available test data. These projections depend heavily on the SEF flight control fixes attaining full capability.

The contract performance specifications listed seven mission profile descriptions that the aircraft should be able to perform. These profiles are written in general terms, with only overall mission range and critical range subsets (i.e., low-level penetration range) actually specified.

As of September 1988, the program office projections indicated that the B-1B will be able to significantly exceed required performance on one of the seven missions and slightly exceed three others. The projections also show relatively minor shortfalls on two others, and one mission, the ACM standoff mission, will fall substantially below specification. Table 2.2 shows the projected mission performance for each specification mission.

Table 2.2: Projected B-1B Performance Compared to Contract Requirements
(Range in Nautical Miles)

Mission	Current requirement	Current projection	Difference
SIOP			
Penetrate	5,874	5,900	26
Standoff ALCM	4,945	4,770	−175
ALCM shoot and penetrate	5,503	5,670	167
Standoff ACM	4,684	4,040	−644
ACM shoot and penetrate	5,376	5,090	−286
Conventional			
High altitude	7,842	9,850	2,008
Low altitude	4,614	4,860	246

The projected shortfalls are caused primarily by increased fuel consumption due to higher-than-anticipated drag.[4] The drag is particularly severe when the aircraft is carrying external weapons, such as the ALCM. Carrying weapons on the outside also may raise the weapon load, which would decrease the fuel that can be carried because of gross weight considerations.

[4]In an airplane, drag is the retarding force caused by air resistance that decreases speed and lift.

These projections also assume that SEF development and tests will be fully successful. Lack of full SEF capability would increase existing shortfalls in the ACM shoot and penetrate mission and would cause the ALCM shoot and penetrate mission to fall below the specification range.

Without full SEF capability, there would be a significant reduction in the range for the low-level portion of the SIOP penetration missions. For example, the basic SIOP mission requires a low-level penetration leg of 1,500 miles. Because of weight restrictions a non-SIS aircraft with a full SIOP weapons load can only travel 870 nautical miles at low level, whereas a SIS aircraft can fly 1,340 nautical miles. The additional fuel available with a fully capable SEF improvement increases this leg of the mission to 2,370 miles.

Other Issues Have Been Identified

Although attention has been focused on major B-1B problems related to mission effectiveness, a number of other issues have been identified. Some of these surfaced as maintainability and support concerns, but could affect performance if not corrected.[5]

Engine Icing Has Caused Additional Restrictions

Under certain conditions, ice will build up on the B-1B's engine nacelles (the engine housing) during flight. Ice can dislodge during flight and be ingested into the engine, causing damage. In an effort to correct this problem, the Air Force fitted the B-1B with heating panels where icing occurred, but this has not corrected the problem.

The Air Force believes the problem can be solved by moving the heating panels. Testing is currently underway to determine if this solution will correct the problem. Until the problem is resolved, maintenance considerations require the following restrictions:

- No engine should be operated on the ground when icing is possible and when one or more of the following is occurring: rain, freezing rain, drizzle, freezing drizzle, ice pellets, snow, or fog that reduces visibility to less than 1 mile.
- During in-flight cruise operations, areas where weather reports indicate possible icing conditions should be avoided.

[5]Strategic Forces: Supportability, Maintainability, and Readiness of the B-1B Bomber (GAO/NSIAD-87-177BR, June 26, 1987) and Strategic Bombers: B-1B Maintenance Problems Impede Its Operations (GAO/NSIAD-89-15, October 24, 1988).

Air Logistics Center Has Identified Post-Production Modifications

The process of shifting management responsibility for the B-1B from the program office, which was responsible for procuring the B-1B system, to the Air Logistics Center, which will support it, is currently underway. During this process, known as Program Management Responsibility Transfer (PMRT), the Air Force identifies program activities that remain, and determines which command will fund and manage the completion of those activities.

The Oklahoma City Air Logistics Center, which has primary responsibility for supporting the B-1B fleet, identified a number of B-1B modifications. It prepared descriptions of the modifications, which represent post-production requirements that must be addressed. These descriptions are preliminary because agreement on transfer of management responsibility has not been completed. The total cost of these modifications was estimated at $1.047 billion.

In commenting on our draft report, DOD provided new information, not available when our draft was completed. This information is included in the following descriptions of the problems identified by the Air Logistics Center.

- B-1B computer memories

The Oklahoma City Air Logistics Center originally indicated that the B-1B needed a new computer system with increased memory capacity at a cost of $414 million. The Center said the B-1B computer memories were 93 percent full, and any additional software changes to fix deficiencies, or add additional systems cannot be input to the computers because of a shortage of computer memory capability.

In its comments, DOD stated that the B-1B has sufficient memory to meet its baseline requirements, and current software operates within the memory constraints of the available computers. It also noted that the B-1B computer memory will be upgraded as part of the program to integrate the SRAM II missile into the B-1B. DOD said these cost are already programmed into the SRAM II program budget.

The SRAM II Program Office confirmed that it is funding two recently negotiated changes to the basic B-1B contracts to develop the systems needed to integrate the SRAM II into the B-1B airframe and avionics systems. These changes include doubling the memory capacity of selected computers, adding common weapons interface capability, and minor airframe changes needed to accommodate the SRAM II missile.

The SRAM II Program Office currently estimates it will provide $471 million dollars to fund the development, testing, and initial SRAM II qualification on the B-1B, which is being managed by the B-1B Program Office. Once completed, the B-1B program will have to provide funds to buy and install integration kits for the B-1B fleet. As shown on page 27, procurement of SRAM II integration kits is currently estimated to cost $410 million.

- B-1B structural vibration study

The Center originally cited the need for a comprehensive aircraft structural vibration study at an estimated cost of $83 million. The B-1B has several vibration-related problems such as oil pressure switches in the engine nacelles, antenna failure in the aft fuselage, and flap attachment problems on the wings.

DOD stated that studies to date substantiate that although vibration may be a problem, it is localized and does not affect an entire aircraft. In the future DOD plans to address vibration problems individually as they arise. DOD did not indicate who would be required to fund these efforts.

- Standardize the B-1B fleet

The Center originally identified $387 million as the cost to standardize the configuration of the B-1B fleet to prevent having to buy and stock multiple spare parts for each B-1B configuration. Currently, many different B-1B configurations exist due to the multiple changes in aircraft configuration made during production.

In its comments, DOD stated that it is aware of the configuration differences and plans are ongoing to correct most of the problems that have significant logistical impacts during the SIS/SEF retrofit. DOD did not indicate the estimated cost.

After we received DOD's comments, the Air Logistics Center released the results of its B-1B post-production study. The study identified 58 items that were considered a priority need and required funding attention. The estimated cost of the 58 items is $1.7 billion. The $387 million to standardize the B-1B fleet was identified as a priority need.

The definition of PMRT responsibilities has been ongoing for over 18 months. The Air Force's report indicates that these requirements will continue to be refined as the B-1B program progresses and incorporated

into long-range planning documents for inclusion in formal budget submissions.

Conclusions

Over the last year, the Air Force has made progress on resolving performance problems that we cited in 1987 testimony, but the continuing defensive avionics system problems represent a major concern for the program. Almost 2 years after system development was to have been completed, major defensive avionics design problems are still surfacing in the system.

Even though the program office has made progress in the test program, those tests that remain on the flight control, terrain-following radar, and cruise missile systems are critical to the B-1B's ability to perform its intended missions. Successful demonstration of the final phase of flight control fixes is critical to both low-level penetration and range needed to complete the mission for which the aircraft was designed.

The process of transferring B-1B management responsibility has highlighted a variety of post-production tasks needed to adequately support and maintain the B-1B as an effective bomber through the 1990s.

Cost

Although all 100 B-1B aircraft have been delivered, more money will be required to complete the system acquisition effort. To date, the Air Force has incurred costs of about $31 billion in escalated dollars for 100 B-1B aircraft. This includes about $3.7 billion in funds expended on non-baseline items such as simulators and interim contractor support. These items were excluded from the baseline by the Office of the Secretary of Defense when the program was established in 1981.

Funds may also be needed for potential capability enhancements. The program office has estimated the cost of 14 potential enhancements at $7.4 billion. Additionally, as shown in chapter 2, the Oklahoma City Air Logistics Center has identified needed modifications estimated to cost $1.7 billion.

Cost Cap

In a January 18, 1982, letter to the Congress, the President certified that the Air Force would complete the tasks necessary to develop and acquire a baseline B-1B system for an amount equivalent to $20.5 billion (in fiscal year 1981 dollars). The $20.5 billion is referred to as the B-1B cost cap. Since 1981 the B-1B Program Office, which is responsible for tracking the status of the cost cap, has added and deleted items from the program baseline.

The program office cited a number of items it has added to the original baseline with no corresponding increase in funds. Some of these items, such as conventional weapons certification and the low-frequency/very low-frequency radio, were clearly excluded from the original baseline. We identified other baseline items that have been dropped. For example, the baseline cost estimate specifically included costs to retrofit the first eight aircraft to enable them to carry external cruise missiles. Although this retrofit itself is no longer considered part of the baseline program, the baseline estimate was not reduced.

The program office stated that a detailed accounting of each item in the cost cap was not kept because it was not needed to manage the program. Consequently, no running account exists to portray the exact status of each item included in the $20.5 billion cap. Program office officials maintain that their estimate of baseline costs is and always has been within one-half of 1 percent of $20.5 billion. They also stated, however, that until all costs are finalized by the contractor, it will be impossible to determine the final status of the baseline.

$921 Million Needed to Complete B-1B Baseline Procurement

The program office estimates that it needs $921 million, in addition to the amount that has been requested and appropriated to date, to complete the B-1B procurement effort. Table 3.1 shows a description of the work and the program office's estimate of its unfunded cost. These estimates are included in the Air Force estimate to complete the program within the baseline cost cap.

Table 3.1: Estimated Unfunded B-1B Procurement Work

Work remaining	Description	Unfunded cost (millions)
Rockwell over-target costs and other engineering changes	SIS/SEF development and procurement, fix of fuel leaks, acceptance flight test fixes, tail warning function integration, bird strike modification, and various other items.	$429.1
Correction of deficiencies	Defensive avionics retrofit of hardware and software.	242.7[a]
Defensive avionic depot support	Cost to provide Air Force depot support. Currently, interim contract support is being, and will be, used until funds are available for organic support.	228.7
Tooling disposition	Disposition of tooling and equipment.	20.0
Total		**$920.5**

[a]In December 1988, after completion of our fieldwork, the B-1B Program Office estimated that it will cost about $1 billion to improve the defensive avionics.

The $921 million is included in the baseline but is unfunded because several reductions have been made in the B-1B program baseline. These reductions were made mostly in fiscal year 1986, but they affected both the fiscal year 1985 and 1986 appropriations. The reductions were due to (1) direct congressional decreases in funding, (2) Gramm-Rudman-Hollings Budget Reduction Act cuts, and (3) DOD apportionments of congressionally directed decreases in overall defense funding.

The reductions amounted to $1.27 billion in then-year dollars. The Congress restored $279 million in 1987 to extend the flight test program. The Air Force is expecting to receive $191.8 million to extend the flight test program to September 1989. Current plans are to use expired years Air Force funds[6] from other programs to pay for all items, except the

[6]If not obligated within 3 years, procurement appropriations expire but remain available for restoration to liquidate any procurement obligations incurred in the years for which the funds were originally appropriated.

defensive avionics depot support. Funds for depot support will be requested in the 1990 budget.

The program office said that its estimate reflects the cost of fixing known problems; however, little program funding reserve is available to fund any new problems that may arise, and additional funds may be required.

Estimated Cost of Some Potential B-1B Enhancements Exceeds $7 Billion

If the B-1B is to perform the mission of a multipurpose bomber effectively through the 1990s, it will be necessary to enhance its baseline capability. Even though it is normal to add newly developed systems to aircraft, the decision to acquire 100 baseline-configured B-1Bs precluded the addition of new systems before this time. As a result, a number of potential performance enhancements have been identified for the B-1B fleet.

The President's fiscal year 1988 budget included a request for the initial funding for two of these enhancements. However, the Congress was not satisfied with the progress of the basic program, and the funding request was not approved. Since then, the Congress has put formal restrictions on B-1B enhancements. Section 244 of the DOD Appropriation Act of 1988 states

"The Secretary of Defense may not carry out any enhancement of the B-1B aircraft unless the enhancement is specifically authorized by law and funds are specifically appropriated for that purpose."

The B-1B Program Office has priced the cost of 14 potential B-1B enhancements that have been identified by SAC. The enhancements and the cost to complete them are listed in table 3.2. Appendix I provides a description of each enhancement.

Table 3.2: Cost to Complete Potential B-1B Fleet Enhancements

Enhancement	Cost (millions)
Situational Awareness Forward-Looking Infrared Receiver	$391.1
MILSTAR integration	188.3
Global Positioning System (installation)	70.3
Electromagnetic Countermeasures MOD X	2,289.9
On-board Mission Planning System	592.4
Target Forward-Looking Infrared Receiver	1,006.1
Synthetic Aperture Radar	642.9
Second Inertial Navigation System	33.0
Hardness maintenance/hardness surveillance	34.2
Cruise Missile Carrier (External Observable Difference)	32.3
B-1B reliability and maintainability enhancements	586.8
B-1B avionics system enhancements	357.1
External MIL STD 1760 (common weapons interface)	787.2
SRAM II integration	410.0
Total	**$7,421.6**

In its comments, DOD requested that we clarify this issue to emphasize that these are potential enhancements and have not been formally requested by SAC. DOD said the list of projects was the result of a fiscally unconstrained planning exercise to identify potential capabilities applicable to the B-1B. It further stated that, given existing fiscal constraints, the Air Force has decided to fund B-1B improvements associated with SRAM II, MILSTAR, and the Global Positioning System. Air Force officials told us this decision would be reflected in the fiscal year 1990 DOD budget and the Five Year Defense Plan.

We recognize that funding will only be requested for some of the enhancements identified by the Air Force. However, the other items remain as potential enhancements that may be needed if the B-1B is to fulfill its role as a multipurpose bomber.

Selected Acquisition Report Does Not Reflect B-1B Program Status

Selected Acquisition Reports (SAR) are the primary means by which DOD reports the status of major weapon system acquisitions to the Congress. The SAR is supposed to be a comprehensive report that contains information on the cost, schedule, and performance of major weapon systems. DOD Instruction 7000.3 provides SAR reporting requirements.

The need to keep Congress apprised of the status of weapon systems in general, and the B-1B in particular, using the SAR was emphasized in

hearings last year before the House Committee on Armed Services. During the hearings it was pointed out that the December 31, 1986, B-1B SAR did not adequately describe the cost, schedule, and performance status of the weapon system. It also was emphasized that the Congress wants the SAR to provide full, open, and vigorous disclosure to facilitate communication between DOD and the Congress.

The most recent B-1B SAR, dated December 31, 1987, (the first one published since the December 31, 1986, SAR) does not accurately reflect the current cost, schedule, and performance status of the program. For example, the most recent SAR

- does not mention the performance problems described in this report, although they were the subject of congressional hearings over 1 year ago;
- shows the test program ending in May 1989, rather than in September 1989; and
- shows a completed program estimated cost of $27 billion, whereas the program office estimate, published 2 months before the SAR, estimated the cost to be more than $800 million higher.

In its comments on the draft report, DOD stated that the annual SAR submitted for the December reporting period reports the cost, schedule, and technical status that is reflected in the President's budget and supporting justification material. It noted that the President's budget represents the administration's approved program and supercedes any prior estimates. DOD agreed that it did not provide an adequate discussion of performance problems in the narrative highlights of the December 31, 1987, SAR. DOD added that every attempt would be made to improve disclosure aspects in the remaining B-1B SARs.

Conclusions

Past discussions of the B-1B program have generally focused on the cost cap for the baseline $20.5 billion program. The Air Force has indicated that it believes that its final cost will be very close to the established cost cap. However, it will be several years before the actual cost of the program can be determined. It appears that the cost cap issue is being overcome by time and events. At this time there are important technical questions that must be answered. These questions include: Can the defensive avionics problems be corrected? Will development and testing verify the suitability of improvement in flight controls? Will suitability for cruise missile carriage be verified? What will it likely cost to provide those modifications and enhancements that the Air Force determines are needed?

Potential B-1B Enhancements

The following 14 items are potential enhancements to the B-1B. The estimated cost of each appears in parentheses.

1. Situational Awareness Forward-Looking Infrared (FLIR) System ($139.1 million): The cost of this enhancement provides for full-scale development, production, integration, and installation of a FLIR system, including an enhancement of the vertical situation display. Its capabilities will include snap looks, look into turn, pointing of video image, and display of image with flight control data superimposed.

2. MILSTAR integration ($188.3 million): This amount funds the installation of MILSTAR terminals to allow for world-wide secure, jam-free communications in nuclear conditions.

3. Global Positioning System ($70.3 million): This amount covers the cost of installing this system, which provides improved navigation accuracy and enhances weapons delivery by providing precision position, altitude, and velocity to B-1B subsystems.

4. Electromagnetic Countermeasures MOD X Enhancement ($2,289.9 million): This amount funds the development production and installation of a follow-on defensive system to meet new threats in its SIOP mission. It includes development of advanced programming techniques, mission data software improvements, improved ALQ-161A receiver and processor, a more accurate directional finding system, and electromagnetic countermeasure verification testing in the anechoic chamber.

5. On-board Mission Planning System ($592.4 million): The cost of this enhancement provides for development, procurement, and installation of this system, which assists B-1B crews by providing electronic displays of mission data, such as checklists and combat mission folders.

6. Target FLIR ($1,006.1 million): This amount funds the development, procurement, integration, and installation of a target FLIR, which will improve the B-1B crew's capability to detect, recognize, and locate strategic relocatable targets. In addition, the FLIR will provide a silent terrain-avoidance capability.

7. Synthetic Aperture Radar ($642.9 million): This amount covers the cost of the development, procurement, and installation of an upgraded radar. Enhanced resolution of the current radar will improve the B-1B's capability to detect, queue, and identify strategic relocatable targets.

8. Inertial Navigation System ($33 million): A second inertial navigation system will improve the probability of mission success by providing a redundant navigational data sources. Provisions exist in the B-1B to add a second system.

9. Hardness maintenance/hardness surveillance ($34.2 million): This amount funds the development and procurement of support equipment, which is required so the Air Force can test to ensure the inherent hardness of the B-1B is maintained throughout the life of the weapon system.

10. Cruise Missile Carrier External Observable Difference (EOD) ($32.3 million): This amount includes the cost of the design, development, qualification test, and installation of this refined EOD. The B-1B cruise missile test aircraft at Edwards Air Force Base must be equipped with an EOD so they can be distinguished from noncruise missile-carrying aircraft in accordance with arms limitation agreements.

11. B-1B reliability and maintainability enhancements ($586.8 million): Continuing B-1B flight tests and user comments have identified certain aspects of aircraft hardware and software design that do not fall under contract correction of deficiency provisions. These enhancements include improvements in aircraft electrical generators, a new video recorder, central integrated test software revision, electrical wiring changes, new windshield development, and other enhancements.

12. B-1B avionics system enhancements ($357.1 million): During the B-1B design, development, and flight tests, numerous opportunities were identified to increase operational effectiveness of aircraft avionics and electronic systems. They include increasing the avionics computer memory, computational speed, and data storage capacity through application of very high speed integrated circuit technology. Other enhancements include refining the human-machine interface and reducing crew work load through increased automation and optimized data presentation.

13. External MIL-STD-1760 Class V Modification ($787.2 million): This amount covers the cost of MIL-STD-1760 (common weapons interface) kits that equip the B-1B fleet with DOD standardized aircraft/stores interconnection systems for external weapons carriage.

14. SRAM II integration ($410.0 million): The cost of this enhancement provides for modification upgrades to 99 aircraft and provides weapon carriage capability to include internal MIL-STD-1760 capability to carry SRAM II. The B-1B will receive a new missile interface unit, a modified

power control assembly, new cabling on its launcher, and new computers to accommodate SRAM II.

Comments From the Director of Defense Research and Engineering

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301-3010

Mr. Frank C. Conahan
Assistant Comptroller General
National Security and
  International Affairs Division
United States General
  Accounting Office
Washington, DC 20548

1 NOV 1988

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "STRATEGIC BOMBERS: B-1B Cost and Performance Remains Uncertain", Dated August 29, 1988 (GAO Code 392386), OSD Case 7747. The Department concurs with seven findings, partially concurs with seven findings and nonconcurs with four findings.

The GAO report acknowledges the significant progress made during the past year in the development and deployment of the B-1B strategic bomber. Since the last GAO annual overall report, a number of key production, operational, and developmental milestones have been achieved as planned.

In April 1988, the 100th and final B-1B was accepted by the Air Force two months ahead of schedule. The B-1B is now operationally deployed at four Strategic Air Command (SAC) bases and is fully integrated into the Single Integrated Operational Plan as our foremost penetrator.

The highly publicized terrain following issues of a year ago are now solved. Recent test activity has successfully demonstrated automatic 200 foot terrain following flight in hard ride mode over rugged mountainous areas at attack speeds. Regarding compatibility of the terrain following and defensive avionics systems, laboratory and preliminary flight testing results have been positive resulting in the removal of the initial precautionary restrictions.

Flight control testing is also progressing. The Stall Inhibitor System (SIS 1) retrofit is complete and deployed with the SAC. Stability Enhancement Function (SEF) retrofit has begun and the initial aircraft are cleared to the expanded SIS 1 envelope. Both systems improve aircraft maneuvering and low altitude range capabilities.

The fuel leak problem evident in the early production aircraft has been stabilized with approximately 75 percent of all documented fuel leaks temporarily repaired to a "no leak" condition. Permanent repairs will be made during programmed depot maintenance.

The last significant hurdle remaining in the baseline B-1B program is the defensive avionics challenge. The results of the latest flight testing of the AN/ALQ-161 revealed a design problem with the receiver/processor, precluding the achievement of the full operation capabilities without modifications to the system. However, the flight test activity also demonstrated that the most operationally significant electronic countermeasures technique did work. Currently, the Air Force is assessing options to achieve the required operational performance in the defensive avionics suite. These efforts should be concluded in November 1988.

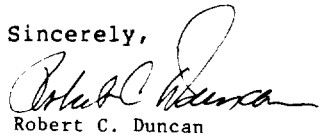
The GAO report erroneously states that no weapons are currently certified due to developmental problems. The B-1B nuclear weapons (B-61 and B-83 bombs) delivery system completed all certification testing with no problem and was certified for operational use prior to initial operational capability (IOC) in October 1986. The short range attack missile (SRAM) delivery system was also certified for B-1B operational use prior to IOC.

Finally, the GAO report states that approximately $8.4 billion in modifications is potentially required for the B-1B aircraft. This is an issue that needs clarification. The list of Air Force projects identified by the GAO was the product of a fiscally unconstrained planning exercise to identify potential capabilities applicable to the B-1B. From this list, the Air Force corporately elected to program funds for only the SRAM II, MILSTAR, and the Global Positioning System integration at a cost of $500 million-- well below the GAO reported figure of $8.4 billion. However, fixes and enhancements to the defensive avionics system will require some additional funds.

In summary, significant progress has been made over the past year on all fronts on the B-1B program. Progress in developmental testing has been noteworthy particularly in the terrain following and flight control areas. Although some developmental challenges still remain, the DoD is fully committed to attaining the full potential of this vital national asset.

The detailed DoD comments on the specific report findings are provided in the enclosure. The DoD appreciates the opportunity to comment on the draft report.

Sincerely,



Robert C. Duncan

Enclosure

GAO DRAFT REPORT - DATED AUGUST 29, 1988
(GAO CODE 392386) OSD CASE 7747

"STRATEGIC BOMBERS: B-1B COST AND PERFORMANCE REMAIN UNCERTAIN"

DEPARTMENT OF DEFENSE

* * * *

FINDINGS

FINDING A: GAO Testimony and Congressional Response to B-1B Problems. The GAO noted that, in 1987, it presented testimony before the House and Senate Congressional Committees on Armed Services on the status of the B-1B program. The GAO noted it testified that (1) despite production delivery successes, the performance of the aircraft was considerably less than originally intended, (2) development and production problems in B-1B subsystems limited testing, necessitated operational restrictions, and prevented some training, and (3) the initial ground rules and time frames for the program, particularly the requirement for near-simultaneous development and production, had created a severe management challenge for the Air Force. The GAO observed that, because of its dissatisfaction with the management of the B-1B program, the Congress required the Secretary of Defense to:

- submit a detailed plan for testing the defensive avionics system and provide bi-monthly status reports;
- provide for an independent assessment of the capabilities of the B-1B to penetrate air defense of potential enemies; and
- restrict enhancements to the B-1B, unless specifically authorized by law, with funds specifically appropriated for that purpose.

In addition, the GAO was asked by the Chairman of the House and Senate Committees on Armed Services to continue its monitoring of B-1B program developments. (pp. 8-9/GAO Draft Report)

Now on p. 9.

DOD Response: Concur. The above finding is background information on the B-1B program from a GAO perspective. The DOD and the GAO have differed in their past assessments of the B-1B. The finding, as written, reflects the GAO viewpoint only.

Now on pp. 3, 11-12.

- FINDING B: Defensive Avionics--Major Limitations. The GAO reported that, analysis of tests conducted in the spring of 1988, revealed a major problem with the basic B-1B defensive avionics system, which the GAO concluded will prevent the B-1B from achieving the capability expected. According to the GAO, the B-1B defensive avionics or electronic countermeasures system, designated the ALQ-161A, is intended to be a major contributor in enabling each B-1B to complete its wartime mission by improving the probability of penetrating the Soviet Union (i.e., by allowing the aircrew to avoid, degrade, and deceive the Soviet air defenses). The GAO observed that the system was originally intended to be fully capable at initial operational capability (IOC) in October 1986, but production and performance problems have delayed completion of the development program. According to the GAO, the problems center on the system's receiver/processor function, which is intended to initiate defensive action by receiving and identifying threat system signals. The GAO reported that the problem originates with the basic system design; however, the program office contends that software revisions may allow limited performance improvements. The GAO concluded, however, that the revisions will not be able to overcome design deficiencies and, as a result, a significant degradation of system capability will exist. The GAO found that the B-1B Program Office has initiated a stop work order to the contractor for any system functions that affect the design deficiencies and intends to do whatever can be done to maximize the system capability under the current contract. According to the GAO, a 3-month study of alternative ALQ-161A system architectures is underway, and an improved software is scheduled to be installed in 1989. The GAO concluded, however, that at this time, it is unknown what the final defensive capabilities will be. (p. 3, pp. 12-13, p. 28/GAO Draft Report)

  DOD Response: Concur. As indicated by the GAO,The B-1B electronic countermeasure system is but one significant element of the B-1B penetration equation -- the others being low altitude high speed attack, low radar cross section, accurate navigation coupled with tactical route planning, and defense suppression. As intended, the B-1B is fully integrated into the Single Integrated Operational Plan (SIOP) as an effective penetrator and full partner with the other elements of the TRIAD.

  Regarding development efforts on the AN/ALQ-161A, on June 29, 1988, the Air Force notified Congress of the flight test results involving the MOD 1 Block 4.0 configuration of

the system. These flight test results, although revealing a design deficiency in the receiver/processor, demonstrated that the most effective electronic countermeasure did work. However, the program office issued a 90-day stop work order to EATON, the defense avionics contractor, specifically targeted to actions associated with MOD 2 efforts only. This would allow a thorough review of options and alternatives to achieve operational requirements. The Air Force Electronic Combat Office, in concert with the B-1B program office, has been charged with this responsibility. A revised Air Force electronic countermeasures game plan should be available in October 1988.

o FINDING C: Flight Control Improvements Are Being Tested. The GAO reported the B-1B has little inherent stall warning to notify a pilot that he may inadvertently lose control of the aircraft and crash. According to the GAO, to ensure flight safety while fixes are being developed, an artificial warning system (warning tone and light) notifies pilots when the B-1B is within 20 percent of its stall point. The GAO explained that, while this interim system prevents loss of control, it imposes two restrictions on B-1B operations, as follows:

- the 20 percent safety margin limits the aircraft gross weight (for example, during terrain following, the B-1B weight is restricted to 280,000 pounds for training and 320,000 pounds should Emergency War Orders be implemented, but the Strategic Air Command (SAC) requirement is 440,000 pounds--consequently, munitions and/or fuel (i.e., payload or range) must be sacrificed); and

- pilot work load is increased because the pilot must pay increased attention to his flight controls (which may be unacceptable when, in the heat of battle, extensive maneuvering and attention to other mission-related tasks are required).

The GAO found that three fixes have been designed to resolve these problems. The GAO explained that the first two fixes are designated the stall inhibitor system 1 and 2 (SIS 1 and SIS 2), which allows the B-1B to come within 95 percent of its stall point. The GAO further explained that the third fix is the stability enhancement function (SEF). According to the GAO, the SEF is a software change intended to permit the B-1B to operate beyond its originally designed stall point. The GAO noted that, within the last year, the Air Force modified 15 aircraft with the SIS 1 and will modify

Now on pp. 12-14.

the remaining aircraft with the SIS 2 and the SEF. According to the GAO, flight testing is planned to be completed by February 1989, and retrofitted into the fleet by early 1992. The GAO observed, however, that both Program Office and Combined Test Force officials advised there is a high risk flight controls testing that may not be completed as scheduled. (p. 3, pp. 13-16; pp. 28/GAO Draft Report)

DOD Response: Partially concur. The Strategic Air Command has no stated requirements to fly terrain following at 440,000 pounds. The current maximum gross weight for terrain following, with the SEF, is 420,000 pounds. Additionally, SEF modifications began in March 1988. Currently, eight aircraft have been modified with SIS II/SEF kits and cleared to fly SIS limits, thus increasing the performance envelope. Once flight testing is complete in February 1989, all modified aircraft at that time will be cleared to SEF limits. This is contrary to the GAO position which states that SEF capabilities will not be available until January 1992. The retrofit schedule portrayed by the GAO needs clarifying. Current plans call for the completion of SEF retrofit of Aircraft 10 through 100 by June 1990, while Aircraft 2 through 8 require a number of pacing modifications prior to the SEF retrofit, with completion in 1994.

- FINDING D: Progress Continues on Terrain-Following Radar. The GAO reported that Air Force Intelligence estimates indicate that successful penetration of modern defenses will require the B-1B to fly underneath the coverage of ground-based radars and low enough to attempt to hide from airborne interceptor radars in the radar clutter created by surface features; hence, the B-1B was designed to fly in an automatic terrain-following mode, at 200 feet, in all weather, and at night. The GAO concluded that the B-1B survivability, when penetrating the Soviet Union, will depend in part on its ability to fly low to avoid radar detection. According to the GAO, the SAC planned to begin training pilots in the use of terrain following at actual combat altitudes; however, tests disclosed that the system erroneously flew up then down and did not accurately follow the terrain. The GAO reported that, as a result, automatic terrain-following training was not allowed until early 1987, after the software had been modified and successfully tested. The GAO further reported that testing at lower altitudes has continued and, although software problems have surfaced, progress toward full capability continues.

The GAO explained that the B-1B incorporates a terrain following mode known as hard ride, which closely follows terrain contours and is intended for high-threat environments, providing greater concealment from radar detection in mountainous and moderate terrain. The GAO further explained that the other mode, known as soft ride, does not approximate the contour of the ground as closely as hard ride and provides a smoother, less turbulent and fatiguing flight. The GAO found that, as of April 1, 1988, the Air Force cleared the B-1B to fly at 200 feet but with the following restrictions: soft ride, during daylight, in good weather, over flat and rolling terrain. The GAO observed that these restrictions still do not compare with the requirements--i.e., 200 feet, hard ride, at night, in weather, over rolling to moderate terrain. According to the GAO, complete release to the SAC of the required terrain-following capability is planned for February 1989, after completion of the flight tests. The GAO recognized that the percentage of development testing successfully completed in terrain following rose from 35 percent in March 1987 to 73 percent in June 1988. The GAO observed, however, that although progress on terrain following has continued, the SAC suspended actual training pending modifications to improve the aircraft bird strike protection because, in September 1987, while on a terrain following training mission, a B-1B struck a bird and crashed. The GAO noted that suspension continued until the aircraft's most vulnerable areas were modified to reduce the possibility of a catastrophic accident from future bird strikes. The GAO found that the modification has been designed, with (1) the modification to the first B-1Bs completed in April 1988, and (2) additional aircraft being modified each month until the program is completed (which, the GAO learned, is planned for December 1988). (pp. 16-17, p. 28/GAO Draft Report)

Now on pp. 14-15.

DOD Response: Concur. The 200 foot soft ride daylight restrictions only apply to peacetime training missions. Test sorties at Edwards Air Force Base (AFB) have demonstrated 200 foot hard ride over mountainous terrain. In combat, aircrews will use full performance capabilities as necessary to accomplish the mission.

- FINDING E: Avionics Compatibility Has Not Been Proven. The GAO reported that the B-1B incorporates one of the most complex collections of offensive and defensive avionics equipment ever built. According to the GAO, when the B-1B was designed, the Air Force recognized that the offensive and defensive systems may have to operate on the same frequencies and cause the defensive system to jam the radar

Now on p. 15.

or altimeter. The GAO explained that, to prevent this problem, the Air Force designed the Radio Frequency Signal Management System (RFSMS); however, development and testing of the system cannot be completed until defensive avionics equipment is available. The GAO concluded that, as a result, the Air Force has not been able to complete development testing and the system is not yet proven. (pp. 17-18/GAO Draft Report)

DOD Response: Partially concur. It is true that, initially, the Air Force was concerned about the defensive avionics system jamming the radar altimeter. Actual experience to date has not found this to be a problem, however. Although the radio frequency compatibility testing is just beginning, the DoD expects no major problems that will preclude completion of the tests in early 1989. Laboratory testing has already been completed with positive results that facilitated the removal of initial precautionary restrictions on operations of the electronic countermeasures system and the terrain following radar. This restriction was removed in March 1987. In addition, it should be noted that during recent defensive avionics flight testing on aircraft 40 with the EATON Block 4.0 software, a special test was performed at low altitude to demonstrate the compatibility of the offensive and defensive systems. While this was not a formal RFSMS test, it gave strong indication that the two systems are compatible since no interference was noted during simultaneous operation of the terrain following radar and the defensive system.

Now on pp. 3, 15-16, 17.

- FINDING F: Fuel Leaks Continue. The GAO reported that the B-1B is subject to fuel leaks because its fuel cells are an integral part of the airframe structure, which makes eliminating the leaks virtually impossible. According to the GAO, unlike many other planes, fuel cell bladders were not used on the B-1B because their added weight would penalize performance. The GAO commented that data for the entire B-1B fleet indicate that the reported leaks have remained basically constant over the last year. The GAO concluded that total elimination of B-1B fuel leaks is probably not possible because the fuel cells are a part of the airframe and seals and joints will continue to be subjected to flight stress. (The GAO explained that grounding leaks are those leaks that keep the aircraft from flying during peacetime training; however, the aircraft could be flown in the event of war and total leaks include grounding leaks as well as flyable leaks.) (p. 3, pp. 18-19/GAO Draft Report)

See comment 1.

DOD Response: Partially concur. The DoD does not agree with the implication that had fuel bladders been used, there would be no fuel leaks. Neither does the DoD agree that integral fuel tanks are necessarily more difficult to repair. (For example, with a bladder on a multiengine aircraft, the floor may have to be removed in order for the bladder to be removed.) The DoD does agree that an integral tank may experience more leaks simply because of the many seams and rivets inherent in its assembly. Air Force fuel system technical orders require fuel leaks to be repaired in a specific manner in order to be considered permanently fixed and removed from the aircraft maintenance forms (whether fuel bladders or integral tanks). However, fuel leaks are often temporarily repaired to a "no leak" condition in accordance with approved technical order procedures using externally applied sealant. This is the case with the B-1B, where approximately 75 percent of all documented fuel leaks are temporarily repaired to a "no leak" condition.

All aircraft with integral fuel tanks exhibit some measure of leakage. Consequently, the DOD agrees that "total" elimination of B-1B fuel leaks is probably not possible. However, the level of B-1B fuel leaks has stabilized. The main fuel leak problems exist primarily on the initial lot of B-1B aircraft at Dyess and Ellsworth AFBs due to known production problems which were corrected on later aircraft. In addition, seasonal temperature changes influence fuel leaks. Although the near term corrective action continues to be fixing the leaks with sealant as they occur, the Air Force plans to fix the remaining problems as aircraft undergo Programmed Depot Maintenance (PDM), beginning in the 1991-1992 time frame.

- FINDING G: Weapons Delivery. The GAO explained that the B-1B is designed to carry conventional and nuclear gravity bombs, the short range attack missile (SRAM), and cruise missiles. The GAO observed that testing has revealed problems with all weapons delivery systems and, as a result, none have yet been certified for use. The GAO reported, however, that solutions to known weapons delivery problems have been identified. (pp. 3-4, p. 19/GAO Draft Report)

Now on pp. 3, 16.

See comment 2.

DOD Response: Nonconcur. The B-1B nuclear weapons (B-61 and B-83 bombs) delivery system completed all certification testing with no problems and was certified for operational use prior to IOC in October 1986. The SRAM delivery system was also certified for B-1B operational use prior to IOC.

o FINDING H: SRAM Separation. The GAO reported that two solutions have been identified to the SRAM separation problem from the aft weapons bay. The GAO explained this separation was caused by air turbulence resulting in the missile pitching down and exceeding the pitchdown limit for rocket motor ignition, thereby preventing the weapon from firing. According to the GAO, the SRAM pitchdown problem is associated with a spoiler (a device used to break up airflow) located in front of the aft weapons bay. The GAO noted that the spoiler is needed to prevent wind stress damage to the weapons bay doors when the bay doors are open. The GAO observed that the two solutions under consideration are:

- opening the mid weapons bay doors and fully extending its spoiler; or
- extending the aft weapons bay spoiler only halfway.

According to the GAO, both of these solutions alter the airflow, thus preventing missile pitchdown. The GAO noted that there is no cost or schedule impacts with the first solution, but it does increase aircrew work load, while the second solution requires minor modifications. According to the GAO, the program office has not yet decided which solution to the SRAM separation will be implemented. pp. 3-4, p. 20/GAO Draft Report)

Now on pp. 3, 16.

DOD Response: Concur. Nuclear certification of the SRAM is not affected by the aft bay problem. The discovery and correction of problems during testing is an expected practice in development programs. Additional testing of two possible solutions provided the data necessary for management to determine the best solution. A program office decision is scheduled for October 1988, resulting in a release of complete capability by late 1989.

Additionally, there are two points in the finding that should be corrected.

- The pitch down problem is caused by a combination of B-1B aerodynamic forces, not the spoiler. Changes in spoiler position (i.e., full down or half down) represent part of the solution to the problem.
- The first solution discussed by the GAO involves opening the mid bay and deploying the mid bay spoiler in addition to the existing aft bay spoiler.

See comment 3.

DOD Response: Partially concur. The GAO report is inaccurate regarding B-1B range degradation with external Advanced Cruise Missiles. The problems identified by the GAO are well within the range of normal expectation for the B-1B/cruise missile integration program. There is no indication that the ability to meet contractual mission specifications will be impacted by this integration effort. The GAO figures reflect preliminary flight test data, which indicated higher drag levels than predicted for the ACM pylons and pylons with missiles. As a result of the most recent flight test results, the range projections for the ACM standoff mission profile and weapons load now is 4,040 nautical miles compared to the 4,648 nautical mile requirement--a 640 nautical mile difference. The GAO reported difference was 1,034 nautical miles.

- FINDING L: Engine Icing Has Caused Additional Restrictions. The GAO found that, under certain conditions, ice will build up on the B-1B engine housing, which can dislodge during flight and be ingested into the engine, causing damage. The GAO reported that, where icing occurred, the Air Force fitted the B-1B with heating panels--but this has not corrected the problem. According to the GAO, the Air Force contends that the problem can be solved by moving the heating panels and this solution is currently under testing. The GAO reported that, until the problem is resolved, however, flight safety and maintenance considerations require restrictions, which include the following:

  - no engine should be operated on the ground when icing is possible and when one or more of the following is occurring--rain, freezing rain, drizzle, freezing drizzle, ice pellets, snow, or fog that reduces visibility to less than one mile; and

  - during in-flight cruise operations, those areas where weather reports indicate icing conditions may exist should be avoided. (p.26/GAO Draft Report)

Now on p. 20.

DOD Response: Partially concur. The current aircraft icing restrictions are not due to safety of flight concerns, but rather reflect a decision to limit equipment damage. Some minor deformations were experienced on the blades of the first two compressor sections of the engines. As a result, flight through icing conditions is temporarily restricted. None of these restrictions impact SIOP operations.

- FINDING M: Performance Problems Requiring B-1B Modifications. The GAO reported that the process of shifting management responsibility for the B-1B from the program office to the Air Logistics Center (ALC), which will support the aircraft, is currently underway. According to the GAO, during this process known as Program Management Responsibility Transfer (PMRT), the Air Force identifies program activities that remain and determines which command will fund and manage the completion of those activities. The GAO explained that those activities identified as program office responsibility are referred to as residual tasks and must be funded or completed before the Logistics Command takes responsibility for that part of the B-1B program. The GAO reported that some of the residual tasks represent potential performance problems for the B-1B system. The GAO observed that the Oklahoma City Air Logistics Center, which has primary responsibility for supporting the B-1B fleet, has identified a number of current B-1B performance problems it recommends should be fixed--for example;

  - Computer Memories. The B-1B computer memories are presently 93 percent full. Resolution of current deficiencies cannot be input to the computers because of a shortage of computer memory capability. The Center maintains that a new computer system with increased memory capacity is needed, at an estimated cost of $414 million.

  - Structural Vibration Study. The B-1B has several vibration-related problems, such as oil pressure switches in the engine housing, radar antenna failure in the aft fuselage, and flap attachment problems on the wings. The Center maintains that a comprehensive aircraft structural vibration study is needed, with the cost of the study estimated to be $83 million.

  - Avionics Cooling. Many B-1B avionics components are failing and a shortage of adequate cooling air is considered to be the primary cause. Because the exact reason for this shortage is unknown, testing needs to be conducted under all ground and flight conditions to determine the cause. Cost of the testing is estimated to be $16.3 million.

  - Standardizing The B-1B Fleet. Many different B-1B configurations exist. Some examples of equipment differences involve radomes, power control assemblies, central air data computers, display panels and wire

harnesses. The Center contends that, unless the B-1B fleet is standardized, it will have to buy and stock multiple configurations to support each B-1B. Costs to standardize are estimated to be $387 million.

The GAO reported that the Logistics Center has also identified problems with outdated computer software, the inflight stress data recorder, and correction of engineering drawings. According to the GAO, the estimated cost of correcting these problems is $146.5 million. (pp. 26-29/GAO Draft Report)

Now on pp. 21-23.

DOD Response: Nonconcur. The items cited are not performance shortfalls. A residual task does not necessarily mean that a performance problem exists; it simply states that some program activity remains to be completed before full transfer to AFLC. At one point Oklahoma City Air Logistics Center (OC-ALC) proposed three cited items (computer memories, structural vibration, and avionics cooling) as residual tasks to PMRT. The presence of residual tasks normally requires that the program office would perform some corrective action prior to Air Force Logistics Command (AFLC) acceptance of responsibility for that particular program element. However, engineering data was made available to OC-ALC that has satisfied the AFLC concerns. Specifically:

- The computer memory available meets the baseline specification. The B-1B has sufficient computer memory to fulfill all of its baseline mission requirements. The current software block (Block 4.5) corrects deficiencies and observes the memory constraints of the available computers. The only anticipated future software releases will be in support of the SRAM II integration effort. This weapon will increase B-1 memory requirements; therefore, part of its costs of integration will be to upgrade the B-1B's computer memory. These costs are already programmed into the SRAM II program at $51.3 million, substantially less than the $414 million quoted.

The aircraft vibration studies that have been performed substantiated that, while vibration may be a problem, it is localized and not a "whole aircraft" situation. Recent program office and ALC meetings have indicated that sufficient vibration studies and testing have been accomplished over the years. The future approach will be to address the vibration technical issues individually as they arise. The current GAO findings are therefore incorrect.

The avionics cooling ties back to the aircraft specification, which calls for source volume, and this is being met. There is no major cooling issue on the B-1B. There are only two radar line replaceable units failing due to inadequate cooling air and this is due to a cooling air ducting problem, which is being fixed. There is not a cooling air capacity problem on the B-1B. The GAO finding which states that "many B-1B avionics components are failing" is not correct.

Standardization of the B-1B fleet is desirable from an economic standpoint, but lack of standardization does not constitute a "performance problem" and is not considered a residual task. The Department is aware of the B-1B configuration differences generated during production and has plans on-going to correct most of those with significant logistical impacts coincident with the SIS/SEF retrofit. Regarding the examples identified in the GAO finding,

- There are no differences in radome configuration except for the wing glove radomes on the first eight aircraft.

- The power control assembly, central air data computer, and wiring harnesses will be modified to a common configuration upon completion of the SIS/SEF modification.

Finally, the DOD disagrees with the GAO reference to "outdated software." The flight data recorder change has been approved for incorporation in the fleet (using baseline funds). Estimates of effort necessary to correct engineering drawings are premature as deliveries of Rockwell International drawings are just now starting.

o FINDING N: Cost Cap. The GAO noted that on January 18, 1982, the President certified to the Congress that the Air Force would complete the tasks necessary to develop and acquire a baseline B-1B system for an amount equivalent to the $20.5 billion (in FY 1981 dollars), known as the cost cap. The GAO found that, since 1981, the B-1B program office (which is responsible for tracking the status of the Presidentially certified cost) has added and deleted items from the program baseline. The GAO reported that the program office has added a number of items to the original baseline with no corresponding increase in funds. The GAO observed that some of these items, such as conventional weapons certification and the low-frequency/very low-frequency radio, were clearly excluded from the original

Now on p. 24.

See comment 4.

baseline. The GAO identified other baseline items that have been dropped--for example, the original program specifically provided funds to retrofit the first eight aircraft to enable them to carry external cruise missiles. The GAO noted that, although the funds remain in the program, this retrofit itself is no longer considered part of the baseline program and will not be done without more funds. The GAO reported that, according to the program office, a detailed accounting of each item in the cost cap was not kept because it was not needed to manage the program; as a result, a running account to portray the exact status of each item included in the $20.5 billion cap does not exist. The GAO noted that program office officials maintain their estimate of baseline costs is and always has been within one-half of one percent of $20.5 billion; but until all costs are finalized by the contractor, it will be impossible to determine the final status of the baseline. (p. 31, p. 37/GAO Draft Report)

DOD Response: Partially concur. The DoD disagrees that the $20.5 billion cap included retrofitting aircraft 2 through 8. These aircraft were already contracted for before the decision was made to integrate cruise missile carriage into the B-1B. Funds have not since been appropriated for cruise missile integration on Aircraft 2 through 8. In the FY88-FY89 President's Budget, funds for this effort were requested starting in FY 88. As a result of the late 1987 budget summit to resolve Government deficits, $10 billion in Air Force Total Obligation Authority (TOA) was removed from the FY89 budget request. This effort was deferred in the FY89 Amended Budget Submission to accommodate this budget constraint.

- FINDING O: Additional Funds Needed to Complete the B-1B Baseline Procurement. According to the GAO, the program office estimates that, in addition to the amount that has been appropriated and requested to date, $921 million is needed to complete the B-1B procurement effort. The GAO provided the following table detailing the unfunded work.

Estimated Unfunded B-1B Procurement Work

Work Remaining	Description	Unfunded Cost (millions)
Rockwell over-target costs and other engineering changes	SIS/SEF development and procurement; fix of fuel leaks; acceptance flight test fixes; tail warning function integration; bird strike modification; and various other items.	$ 429.1
Correction of deficiencies	Defensive avionics retrofit of hardware and software.	242.7
Defensive avionic depot support	Cost to provide Air Force depot support. (Currently, interim contract support is being, and will be, used until funds are available for organic support.)	228.7
Tooling disposition	Disposition of tooling and equipment.	20.0
Total		$920.5

The GAO explained that the $921 million is included in the baseline, but is unfunded because several reductions were made in the B-1B program baseline (mostly in FY 1986) that affected both FY 1985 and FY 1986 appropriations. The GAO explained that these funding reductions resulted from (1) direct congressional decreases in funding, (2) Gramm-Rudman-Hollings Budget Reduction Act cuts, and (3) DOD apportionments of congressionally directed decreases in overall defense funding. The GAO noted that last year the Congress restored $279 million, to extend the flight test program and, this year, the Air Force is expecting to receive $191.8 million to extend the flight test program to September 1989. The GAO further noted that current plans are to use expired years Air Force funds from other programs to pay for all items, except the defensive avionics depot support funds which will be requested in the 1990 budget. The GAO observed that, according to the program office, these estimates reflect the cost of fixing known problems, but little program funding reserve is available to fund any new problems that may arise, and additional funds may be required. (pp. 32-33/GAO Draft Report)

Now on pp. 25-26.

DOD Response: Concur.

- FINDING P: Preliminary Estimates Of Cost For B-1B Modifications. The GAO reported that, according to the Oklahoma City Air Logistics Center, the B-1B will require modifications at a cost of $1.047 billion, in order to improve logistics support as well as its performance capability. The GAO provided the following table listing the modification work and associated cost.

Estimated Costs of Proposed B-1B Modifications

Modification	Estimated Cost (millions)
Expand computer memory	$ 414.0
Conduct B-1B structural vibration study	83.0
Complete a comprehensive software correction and update	100.0
Standardize B-1B fleet to a common configuration	387.0
Provide adequate avionics cooling	16.3
Correct engineering drawings	38.2
Improve strain data recorder	8.3
Total	$1,046.8

According to the GAO, these represent potential residual tasks that may be assigned to the B-1B program office when the Air Force transfer management responsibility plan is completed. The GAO noted that this process has been underway for over a year, and the initial definition of these responsibilities was to be completed by May 15, 1988, to allow preparation of budget submissions. The GAO concluded that, until the results of this process are complete, program office funding requirements to complete residual tasks cannot be finalized. (pp.33-34/GAO Draft Report)

Now on pp. 21-23.

See comment 5.

DOD Response: Nonconcur. This is essentially a repeat of Finding M. The previous response to Finding M therefore applies.

- FINDING Q: Potential B-1B Enhancement Could Cost $7.4 Billion. The GAO reported, that if the B-1B is to perform its mission effectively through the 1990s, it will be necessary to enhance its baseline capability to include systems and weapons developed since the B-1B configuration was frozen in 1981. The GAO commented that the B-1B program office has priced the cost of 14 potential B-1B enhancements that have been identified by the SAC. The GAO provided the following list of enhancements and the estimated cost to complete them:

Cost to Complete Potential B-1B Fleet Enhancements

Enhancement	Cost (millions)
Situation Awareness Forward-Looking Infrared Receiver	$ 391.1
MILSTAR Integration (installation)	188.3
Global Positioning System (installation)	70.3
Electromagnetic Countermeasures MOD X Enhancement (Follow-on Defensive Avionics)	2,289.9
Onboard Mission Planning System	592.4
Target Forward-Looking Infrared Receiver	1,006.1
Synthetic Aperture Radar	642.9
Second Inertial Navigation System	33.0
Hardness Maintenance/Surveillance	34.2
Cruise Missile Carrier	32.3
B-1B Reliability and Maintainability Enhancements	586.8
B-1B Avionics System Enhancements	357.1

External MIL STD 1760 (Common Weapons Interface)	787.2
SRAM II Integration	410.0
Total	$7,421.6

The GAO reported that the President's FY 1988 Budget included a request for the initial funding for two enhancements; however, because the Congress was not satisfied with the progress of the basic program, the funding request was not approved. The GAO observed that, since then, the Congress placed formal restrictions on B-1B enhancements. (pp. 35-36/GAO Draft Report)

Now on pp. 3, 26-27.

DOD Response: Nonconcur. The statement that "SAC has identified 14 such potential enhancements with an estimated cost of $7.4 billion" is not correct. Of the list identified, operational requirements exist for MILSTAR/GPS integration, cruise missile carriage, and SRAM II integration. The B-1B has growth capability enabling it to evolve to meet changing roles, missions, and threats throughout its 30 year life. The list of Air Force projects identified by the GAO were the product of a fiscally unconstrained planning exercise to identify potential capabilities applicable to the B-1B. However, no enhancements are added to any weapon system unless a valid operational requirement exists. In this light, the Air Force corporately reviewed its options to maximize overall warfighting capability in a fiscally constrained environment and decided to fund B-1B improvements associated with SRAM II, MILSTAR, and GPS integration.

- FINDING R: Selected Acquisition Report Does Not Reflect B-1B Program Status. The GAO explained that the Selected Acquisition Reports (SARs) are the primary means by which the DOD reports the status of major weapon system acquisitions to the Congress. The GAO observed that the SAR is supposed to be a comprehensive report containing information on the cost, schedule, and performance of major weapon systems. The GAO pointed out that the need to use the SAR to keep the Congress apprised of the status of weapons system, in general, and the B-1B in particular, was emphasized in hearings last year before the House Armed Service Committee. The GAO noted that, at that time, it was pointed out the December 31, 1986, B-1B SAR did not adequately describe the cost, schedule and performance status of the weapon. The GAO found that, again, the most recent B-1B SAR, dated December 31, 1987, still does not

accurately reflect the current cost, schedule, and performance status of the program, as follows:

- performance problems are not described in this report, although they were the subject of congressional hearings over a year ago;
- test program is shown ending in May 1989, rather than in September 1989; and
- completed program estimated cost shown as $27.0427 billion, whereas the program office estimate, published two months before the SAR, estimated the cost to be more than $800 million higher.

The GAO concluded that the Congress has emphasized that it wants the SARs to provide full, open, and vigorous disclosure to facilitate communication between the DOD and the Congress. (pp. 36-37/GAO Draft Report)

Now on pp. 27-28.

DOD Response. Partially concur. The annual SAR submittal for the December reporting period reports the cost, schedule, and technical status that is reflected in the President's budget and supporting justification material. The President's budget represents the Administration's approved program and supercedes any prior estimates. This applies to schedule milestones and performance characteristics, as well as cost. However, the GAO is correct in that the DoD did not adequately provide a discussion of performance problems in the narrative highlights of the December 31, 1987, SAR. Every attempt will be made to improve disclosure aspects of the remaining B-1B SARs.

RECOMMENDATIONS

NONE.

GAO Comments

The following are GAO's comments on DOD's letter dated November 16, 1988.

1. The discussion of fuel bladders was deleted from our report.

2. Our draft report incorrectly stated that none of the weapons had been certified for use. This has been corrected in the final report.

3. Our report has been revised to reflect the most recent flight test results.

4. DOD disagreed that the $20.5 billion cost cap included retrofitting aircraft 2 through 8. DOD stated that these aircraft were already contracted for before the decision was made to integrate cruise missile carriage into the B-1B.

The record does not support DOD's comments. The decision to add cruise missile carriage to the B-1B was made late in the decision process. The timing was such that changes could not be made to the first eight aircraft in production and still maintain the delivery schedule. As a result, DOD decided to retrofit the first eight aircraft after delivery. However, congressional testimony at that time shows that the funds ($800 million) provided for cruise missile carriage included the cost of the retrofit effort. For example, in a written response to the House Committee on Appropriations in July 1982, DOD stated, ". . . retrofit costs for ALCM carriage for the first B-1Bs not so equipped are included in the baseline." Moreover, in testimony before the same committee, an Air Force official stated, "Cost to retrofit the aircraft for cruise missile carriage for the first few that don't have it is included in the baseline costs."

5. A draft of this report contained a list of estimated costs ($1.047 billion) for proposed modifications to the B-1B. The list was prepared by the Oklahoma City Air Logistics Center. In commenting on our draft report, DOD provided new information that was not available when our draft was completed. Further, subsequent to the receipt of DOD's comments, additional data were received from the Air Force. The report has been revised based on the new information.

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