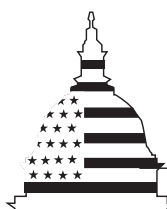


June 1999

DEFENSE ACQUISITIONS

Achieving B-2A Bomber Operational Requirements



GAO

Accountability * Integrity * Reliability



B-280223

June 10, 1999

Congressional Committees

The conference report on the National Defense Authorization Act for Fiscal Year 1994 requires us to report to the congressional defense committees at regular intervals on the total acquisition costs of the B-2A bomber program through completion of the production program. In response, we have issued five reports since 1994.¹ Because B-2A production is essentially completed, this will be the last of these reports. The present report discusses deficiencies in achieving B-2A operational requirements and the status of acquisition costs. We have not obtained and evaluated details on the effectiveness of the B-2As currently employed in Operation Allied Force. Even though B-2As are employed in that operation, concerns remain about this aircraft's ability to achieve the operational requirements discussed in this report.

Results in Brief

Operational testing indicated that the B-2A met most operational requirements, but four significant deficiencies were identified that will limit or, under some circumstances, slow its pace in flight operations. These deficiencies included (1) incomplete development of the ground mission planning system, (2) limited situational awareness for the crew because defensive avionics do not provide the planned capability, (3) insufficient reliability and maintainability of low observable materials and features, and (4) inability to effectively operate B-2As from operational sites other than the main operating base in Missouri. A March 1999 Air Force assessment of progress on correcting the deficiencies confirmed that three of the four had not been remedied, but that one—development of the ground mission planning system—was nearly corrected. Although the Air Force is taking steps to improve B-2A operational capabilities, it does not expect to incorporate all improvements before the next planned operational milestone, known as Full Operating Capability, which is scheduled to occur by June 30, 1999.

The Congress has appropriated 98 percent of the funds that in March 1999 the Air Force estimated it would need for the acquisition of 21 block 30

¹A list of related GAO reports is included at the end of this report.

B-2As² and certain future improvements. This program cost estimate is \$44.5 billion and, according to Air Force officials, includes costs to complete development, production, modification, correction of the major deficiencies, and certain improvements to the block 30 configuration. Air Force officials told us, however, that funding requirements for future years and the total acquisition cost for the program may increase. They indicated that certain assumptions used to calculate the March 1999 estimate may no longer be valid. These assumptions include the cost to install certain improvements to low observable features, the period of time the contractor is expected to support the aircraft, and the cost of acquiring shelters for B-2A maintenance.

This report contains no recommendations.

Background

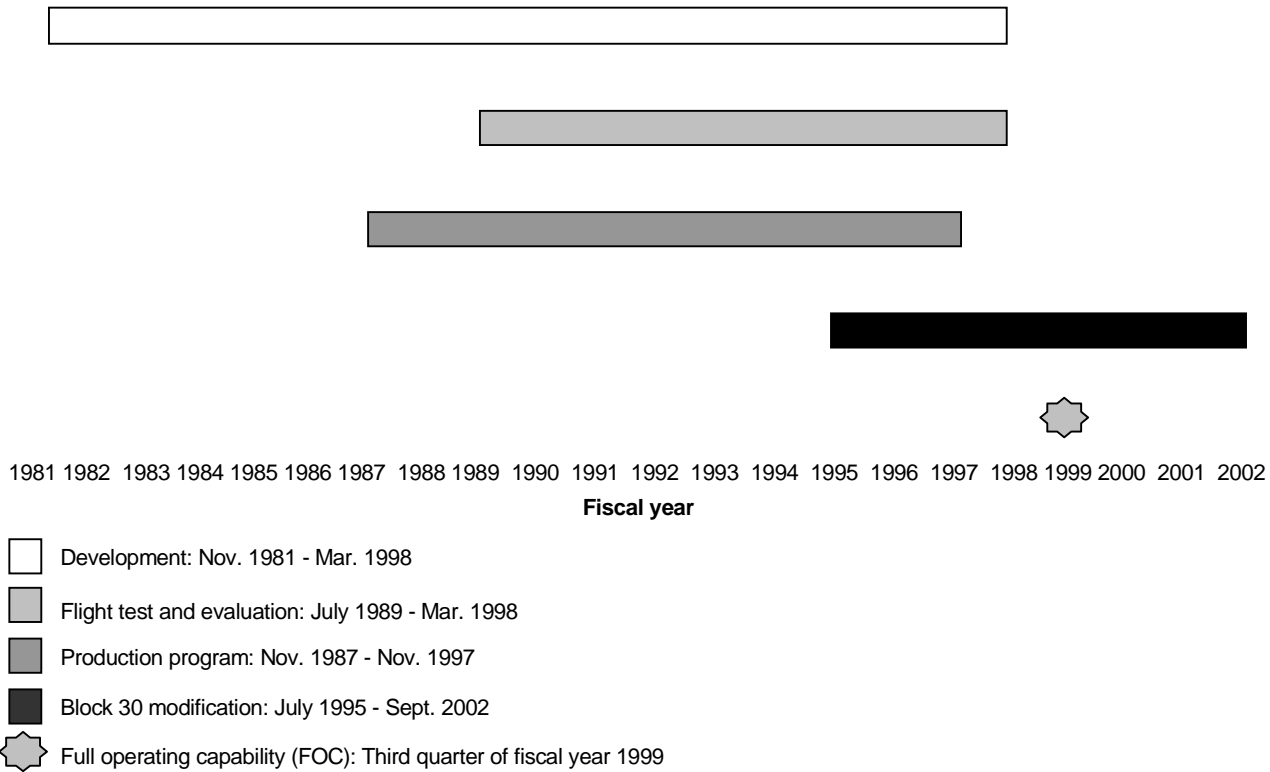
The 21 B-2As ordered by the Air Force have been delivered, but most were delivered in configurations known to need modifications. Production was begun and aircraft delivered before developmental and initial operational tests were completed. Accordingly, problems and deficiencies noted in the tests had to be corrected and some features and equipment had to be added after the aircraft were delivered to the Air Force. A comprehensive modification program was designed to correct problems and defects and to incorporate the needed equipment. This modification program was designed to bring each B-2A up to a configuration designated "block 30." Through January 1999, 12 B-2As were still being modified to the block 30 configuration. On average, they were about 50 percent complete. The B-2A acquisition schedule and the overlap of development and production are shown in figure 1.

Between the beginning of development and completion of the block 30 modification program, 21 years will have elapsed. The next milestone for the program is Full Operating Capability (FOC), which is defined as the capability to meet block 30 operational requirements, operate from a forward operating location, support planned sortie rates, and achieve mission requirements. The commander of the Air Force Air Combat Command is scheduled to determine by June 30, 1999, whether the B-2A

²The B-2As operational configuration is defined as a block 30 aircraft. The Air Force accepted B-2As in two other configurations, a block 10 training aircraft and block 20 interim capability aircraft, all of which will be upgraded to the block 30 configuration.

has achieved FOC based on an assessment of the B-2A system performance measured against the operational requirements.

Figure 1: Overview of the B-2A Acquisition Schedule as of January 1999



Source: Air Force B-2A Program Baseline Roadmap.

Deficiencies in Achieving Operational Requirements

Initial operational testing and evaluation (completed in June 1997) indicated that B-2As in the block 30 configuration met most operational requirements, but it highlighted four deficiencies. A March 1999 Air Force assessment of the progress being made in meeting the B-2A's operational requirements indicated three of these four deficiencies had not been fully remedied, but that one was nearly corrected. The four deficiencies were

- incomplete development of the ground mission planning system,

- limited situational awareness for the crew because defensive avionics do not provide the planned capability,
- insufficient reliability and maintainability of low observable materials and features, and
- inability to effectively deploy and operate B-2As from operational sites other than the main operating base in Missouri.

The Air Force periodically assesses the extent to which it has demonstrated that B-2A operational requirements are achievable. Table 1 shows the results of the Air Force's March 1999 assessment.

Table 1: March 1999 Assessment of Achieving Operational Requirements

Operational requirement	Status of demonstration
Ground mission planning (AFMSS) ^a	Incomplete
Situational awareness (defensive avionics)	Incomplete
Reliability/Maintainability (low observables)	Incomplete
Deployment (shelters)	Incomplete
Terrain following and avoidance system	Incomplete
Radar	Incomplete
Signature	Achievable
Penetration	Achievable
GPS ^b aided targeting system	Achievable
Navigation	Achievable
Contrail management system	Achievable
Fixed target effectiveness	Achievable
Command and control	Achievable
Air refueling	Achievable
All weather	Achievable
Flying qualities	Achievable
In-flight mission planning	Achievable
Training	Achievable
Range and payload	Achievable

^aAir Force Mission Support System.

^bGlobal Positioning System.

Note: Requirements italicized were identified as significant deficiencies in operational testing.

Demonstration of terrain-following and avoidance system capability and radar capability are listed as incomplete on the table; however, test officials

indicated that both systems have generally satisfied operational requirements and need only minor improvements for operating in the rain. Testing of new software for these systems should be completed late in 1999.

In another March 1999 report,³ the Air Force states that the ground mission planning system still has deficiencies but that improvements have been demonstrated, situational awareness (defensive avionics) is unsatisfactory, low observable reliability and maintainability reduces operational capability, and all operational requirements for deployment have not been met.

Development of Mission Planning System Incomplete

Mission planning is critical to effective B-2A operations. The mission plan is intended to provide the crew with the most effective routing to achieve mission goals with the highest survivability for the crew and the weapon system. Air Force officials emphasized that successful use of AFMSS requires mission planners well trained in mission planning and survivability techniques for low observable aircraft.

Air Force officials told us the upgraded AFMSS met, as of March 31, 1999, the requirements for operational use with one exception: A component that is unique to mission planning for low observable aircraft was considered unsatisfactory in the March 1999 B-2A follow-on test and evaluation report. However, Air Force officials said the upgraded AFMSS was capable of planning most B-2A missions within the 8-hour operational requirement.

The upgraded AFMSS includes a new computer with faster speeds and new software intended to correct most of the deficiencies identified during initial operational testing. Based on development testing of the new system by the contractor, Air Force officials stated the upgraded AFMSS could complete most B-2A mission plans within the 8-hour requirement. However, as of April 20, 1999, Air Force operational testing of AFMSS was incomplete, and operational testers had not yet prepared a B-2A mission plan in the required 8 hours. Air Force test officials conducting the operational testing said that, based on testing completed, it appears AFMSS will meet the 8-hour planning requirement for most of the expected B-2A

³On March 14, 1999, the Air Force issued the B-2A follow-on test and evaluation report, which covers operational testing from July 1997 through December 1998. This is the first of two phases of operational testing that follows the initial operational testing that was completed in June 1997.

missions. In addition, test officials said the AFMSS component used to generate routes that optimize B-2A low observable features is still unsatisfactory. Because of deficiencies in this component—called the common low observable auto-router (CLOAR)—some mission planning timelines could grow to 10 hours. New CLOAR software is scheduled to be tested and delivered to the operational B-2A wing by early 2000. Air Force officials stated that even with the CLOAR improvements there would be some small percentage of missions that could take longer than 8 hours to plan because of the complexity of these missions and their plans.

AFMSS is being developed by the Air Force as a separate acquisition program. AFMSS is being integrated with the B-2A weapon system and is being incorporated as part of the block 30 modification.

Limited Situational Awareness Caused by Ineffective Defensive Avionics

Situational awareness requirements for the B-2A stipulate that crews be provided sufficient information about the threats they encounter on a mission, which will allow them to make adjustments to the mission plan to ensure survivability of the crew and weapon system. The defensive avionics system was intended to provide B-2A aircrews with information on the location and identity of threats that may be encountered during a B-2A mission.

The Air Force spent over \$740 million to develop the defensive avionics, which does not provide the planned capability. Developmental and initial operational testing showed the defensive avionics system failed to provide the situational awareness information required. It either incorrectly identified threats or did not provide an accurate location of threats, significantly reducing the situational awareness to the crew. The March 1999 B-2A follow-on test and evaluation report states that the defensive avionics is unsatisfactory and there has been little improvement to this component since initial operational testing was completed in June 1997. However, the Air Force believes that the B-2A's survivability can be obtained through effective tactics, mission planning, and low observability features, and that failure to provide the crew with all of the intended situational awareness information will not prevent the B-2A's use in combat operations.

Air Force officials said the deficiencies in the defensive avionics would be too costly to correct. As a result, the Air Force plans to modify the defensive avionics system to provide a useful capability, but less capability than considered necessary for Air Force operational requirements as

defined in the original contract specification. The cost to make this modification is included in the March 1999 estimate. The Air Force does not expect to complete testing of the reduced capability until November 1999.

Inadequate Reliability and Maintainability for Low Observable Materials Reduces Planned Use Rates for B-2A

The low observable features and materials on the B-2A are not durable, and repairs of these features and materials require time-consuming maintenance under environmentally controlled conditions with materials that require long cure times. These factors diminish the ability of the Air Force to fly the aircraft as frequently as operational requirements stipulated, especially when the aircraft is deployed to an operating location other than the main operating base in Missouri. Although the Air Force has improved maintenance procedures and has developed improved materials, these problems remain the primary cause for high maintenance times and a reduced pace in flight operations. Further improvements are being pursued to reduce maintenance, increase aircraft availability, and achieve the required pace of flight operations.

The March 1999 follow-on test and evaluation report concluded that low observable reliability and maintainability is still the number one challenge for the Air Force because of its impact on B-2A mission capabilities. The report states that poor low observable reliability and lengthy maintenance times reduce mission capable rates, adversely affect aircraft availability for crew training, restrict operations when deployed, and limit sustained combat operations.

Total maintenance rates have improved since initial operational testing was completed in June 1997, but low observable maintenance remains as a high percentage of total maintenance—one third of maintenance man-hours per flying-hour.⁴ Air Force officials stated that the block 30 aircraft are designed to incur an average of 17.7 maintenance man-hours for each flying-hour to repair low observable features; thus, following a 12-hour mission, a B-2A would require on average about 212 man-hours to repair low observable features. This estimate does not include the lengthy times required for some low observable materials to cure (72 hours in some cases) before the aircraft can return to a flight status. The Air Force

⁴Maintenance man-hours per flying-hour is used as a measure of maintenance performance for total aircraft maintenance but can be used to identify problem maintenance drivers like low observable features.

estimates that the number of maintenance man-hours per flight hour must be reduced to 7.5 or lower to generate the number of flights in a specified period (sortie rates) required for wartime. The follow-on test results showed low observable maintenance man-hours per flying-hour had improved, but still averaged 24.6 maintenance man-hours for the period from July 1997 to December 1998.

Low observable maintenance and material cure times are important factors in achieving a specific mission capable rate, which is the percentage of time B-2As are available to perform assigned missions. For example, if the low observable tape on the wing does not meet the radar cross section mission requirement, the aircraft cannot fly its mission and the mission capable rate is reduced, or the mission is flown with the degraded capability. The Air Force threshold requirement for the B-2A mission capable rate is 60 percent; however, the long-range requirement is a mission capable rate of 77 percent. During calendar year 1997, the average mission capable rate was 36 percent. However, as B-2As are upgraded to the block 30 configuration, the rate has improved. For the 3-month period ending November 1998, the rate was 46.1 percent.

A series of low observable features and materials design improvements are being developed or implemented to achieve the maintainability requirements. The B-2A has about 150 different low observable materials, and the improvements are directed toward those materials creating most of the problems, primarily tapes and caulks used to fill gaps and seams in the B-2A's exterior surface. The Air Force is also evaluating materials with faster cure times, shorter process times, less dependence on specialized support equipment, longer shelf life, and fewer restrictions on storage requirements. In addition, the Air Force is developing diagnostic tools intended to speed the process of (1) assessing areas with damaged low observable materials and (2) verifying the repairs of these deficiencies.

Not all of the improvements will be completed and installed by the planned FOC date. Two improvement projects designed to improve mission capable rates and reduce low observable maintenance for the B-2As are scheduled to be installed during the next depot maintenance cycle, which will take place from late 1999 through early 2006. Not all installation costs for the material improvements are included in the March 1999 estimate as discussed later in this report.

Inability to Sustain B-2A Operations When Deployed

Initial operational test reports indicated that the block 30 B-2A aircraft must be sheltered when deployed to forward operating locations to provide a suitable environment in which to maintain and restore low observable materials. Currently, adequate shelters do not exist at planned deployment locations, and until these are provided, the Air Force will not be able to repair low observable features quickly enough to fly B-2As at sortie rates required at deployment locations and to sustain these rates over the required time frames.

The March 1999 B-2A follow-on test and evaluation report states that, based on two deployment exercises to Guam, operational requirements for deployed aircraft were not achievable. Requirements include the capability to sustain the operations of eight aircraft for 14 days at specified sortie generation rates. Problems with low observable maintenance were identified as the major obstacles to achieving B-2A operational requirements during these exercises. For example, during one of the exercises, two of the three B-2As deployed had significant low observable deficiencies. The report states that the lack of shelters would have prevented any major repairs of low observable features, but that some repairs were made without the benefit of shelters. The report also states that progress had been made, but that improvements in low observable features and shelters are required to successfully achieve the deployment requirements.

Status of Acquisition Costs

Most acquisition efforts for the B-2A program have been completed. The March 1999 cost estimate of \$44.5 billion includes costs to complete the block 30 modifications as well as to develop and incorporate improvements beyond the block 30 configuration. Through fiscal year 1999, the Air Force has been appropriated \$43.7 billion, or 98 percent, of the total estimated costs. According to Air Force officials, the estimate includes cost to complete development, production, modification, correction of major deficiencies, and certain improvements to the block 30 configuration. The Air Force stated, however, that the cost estimate is based on certain assumptions that are no longer valid. Air Force officials advised us that as much as an additional \$155 million could be required for improvements to the block 30 configuration and interim contractor support. These efforts were previously believed to have been fully covered in the cost estimate. Further, the cost to acquire aircraft shelters for maintenance may be higher than planned.

Funds Available to Complete Major Contracts

Air Force officials said adequate funds are included in the cost estimate to complete the major contracts for development, production, and aircraft modifications to the block 30 configuration planned through fiscal year 2002. Finishing block 30 modifications is the major effort remaining in the program. Nineteen of the original aircraft delivered to the Air Force needed modifications to achieve the block 30 configuration. Through January 1999, 12 B-2As were still being modified, and they were on average about 50 percent complete. The block 30 modifications began in 1995 and are scheduled to be completed in 2002.

Program office contract management reports and assessments by the Air Force indicate adequate funds are available to complete the development and the production contracts. For example, the Air Force estimates that \$455 million is required to complete the modification of five test aircraft to the block 30 configuration. The contract performance report shows that the current contractor estimate of cost to complete the modification of these test aircraft to block 30 is within the amount provided by the current contract and budget. The Air Force has also evaluated the status of modifying the initial production aircraft to the block 30 configuration, and their evaluation shows adequate funds are available.

Potential Increases to the Acquisition Costs

The Air Force is assessing some estimating assumptions during its fiscal year 2001 budgeting process, which may result in higher estimated costs than included in the current B-2A estimate of \$44.5 billion. The Air Force may require up to an additional \$155 million for installing low observable material improvements to the block 30 configuration and for interim contractor support efforts. Further, Air Force officials indicated that cost to acquire aircraft shelters for maintenance may be higher than planned.

The Air Force may need an additional \$83 million to install critical improvements in the low observable features. The Air Force March 1999 cost estimate assumed that one of the low observable improvement programs needed to meet maintainability requirements for the B-2A would be installed as part of the programmed depot maintenance process to begin in late 1999. The Air Force did not include installation costs for this improvement in the March 1999 cost estimate. The Air Force and contractor did not believe a significant amount of additional labor hours would be required to install the new materials since all low observable coatings are removed and then replaced during depot maintenance. The contractor has further studied the efforts required for the installation process and now believes it will take a significant amount of additional

labor hours to complete the installation. They have estimated the cost for this increased labor to be about \$83 million. If the Air Force determines this estimated increase in labor hours and cost to be accurate, then the B-2A program cost estimate will increase.

The Air Force estimates it will need up to an additional \$72 million to pay for contractor maintenance contracts—referred to as interim contractor support—until an in-house capability is available. Interim contractor support is typically funded from the procurement appropriation as part of the acquisition program until an internal Air Force maintenance capability is available; once available, the Air Force maintenance capability is paid for largely through the operation and maintenance appropriation. The Air Force cost estimate for maintenance contracts is based on use of interim contractor support through fiscal year 2003. Because the Air Force delayed the purchase of selected depot support equipment needed to achieve the internal Air Force maintenance capability, it will require greater reliance on the contractor for depot support during fiscal years 2001 through 2003. Air Force officials pointed out that operation and maintenance funds that would have been used to pay for this support effort will no longer be required, but they could not provide an estimate for them.

The Air Force has identified a requirement for 13 portable shelters to maintain low observable features of the B-2A at locations other than the main operating base. The Air Force does not have a firm price for the shelters, and the initial contractor estimates are higher than the Air Force expected. If the shelters ultimately cost more than expected, the current cost estimate will not be adequate to buy the required number of shelters. This would create additional funding requirements for the B-2A program and cause the March 1999 cost estimate to increase.

Agency Comments and Our Evaluation

In commenting on the draft of this report, the Department of Defense (DOD) agreed that the four primary areas of deficiency discussed in the report—AFMSS, defensive avionics, low observable features, and operational capability when deployed—require additional effort to meet desired performance levels. DOD commented, however, that more progress had been made in some of these areas than was indicated in the draft report. We added information concerning test results that were reported for AFMSS after the release of our draft report to DOD for comment.

DOD commented that we misinterpreted Air Force cost estimates for work required to complete the baseline acquisition program. In particular, DOD

said costs of certain improvement efforts should not be counted against the baseline goal. Our report discusses the added costs to improve the B-2A. We did not attempt to define the amount of costs associated with a baseline cost goal because the Congress removed the cost ceiling associated with the baseline program.

DOD also provided technical comments, which were incorporated as appropriate. DOD comments are included in appendix I.

Scope and Methodology

To evaluate the status of aircraft deliveries, modifications, and achievement of operational requirements, we reviewed program office management plans, progress reports, and schedules. We also reviewed testing and progress assessment reports by the B-2A program office, the Air Combat Command, and the 509th B-2A Operational Wing on the status of modifying and correcting deficiencies to bring all B-2As into the planned block 30 operational configuration. We also reviewed progress assessments by the Air Force in achieving the operational requirements necessary to achieve the full operating capability requirement by its scheduled date in 1999. To obtain more detailed information and discuss matters of concern in these review areas, we also interviewed officials in the B-2A Program Offices at Wright-Patterson Air Force Base, Dayton, Ohio, and at Tinker Air Force Base, Oklahoma; the Global Attack Office, Air Combat Command, Langley Air Force Base, Virginia; the 509th Bomb Wing, Whiteman Air Force Base, Missouri; and Air Force and Office of the Secretary of Defense in the Pentagon, Washington, D.C.

To identify cost issues and the potential for increases in the current B-2A program cost estimate, we reviewed B-2A program cost estimates, budgets, funding plans, and assessments of the Air Force's ability to execute the current program and contracts within estimated costs. We also reviewed contract management reports on the status of contractor performance in meeting contract schedules within estimated costs. We interviewed B-2A Program and Air Combat Command program and financial managers to discuss the adequacy of current cost estimates, estimating assumptions, issues of concern, and the need and schedule for additional costs to complete the program.

We performed our review from June 1998 to March 1999 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the Honorable William Cohen, Secretary of Defense; the Honorable F. Whitten Peters, Acting Secretary of the Air Force; the Honorable Jacob Lew, Director of Office of Management and Budget; and other interested parties. We will make copies available to others upon request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix II.

A handwritten signature in black ink, reading "Louis J. Rodrigues". The signature is written in a cursive style with a large, looping initial "L".

Louis J. Rodrigues
Director, Defense Acquisitions Issues

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Abbreviations

AFMSS	Air Force Mission Support System
CLOAR	common low observable auto-router
DOD	Department of Defense
FOC	Full Operating Capability

Comments From the Department of Defense

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



OFFICE OF THE UNDER SECRETARY OF DEFENSE

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28 APR 1999

Mr. Louis J. Rodrigues
Director, Defense Acquisitions Issues
National Security and International
Affairs Division
U.S. General Accounting office
Washington, D.C. 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "B-2 BOMBER: Cost to Achieve Operational Requirements," dated March 29, 1999 (GAO Code 707352/OSD Case 1778).

The DoD partially concurs with the draft report. The DoD agrees that the four primary areas of deficiency cited in the report -- Air Force Mission Support System (mission planning system) performance, defensive management system (DMS) performance, insufficient reliability and maintainability capability for low observable (LO) materials and features, and limited deployed operations capability -- require additional effort to meet desired performance levels. However, the DoD believes that more progress has been made in some areas than indicated in the GAO report. Also, the DoD believes that the GAO has misinterpreted Air Force cost estimates for work required to complete the baseline program.

Specific areas of disagreement follow:

1. AFMSS performance. An 8-hour conventional weapon mission planning capability has been demonstrated on new mission planning system hardware and software upgrades that have been tested and delivered to the Air Force.
2. DMS performance. The draft report states that "insufficient" situational awareness information is provided for the crew. The report should read "limited" or "reduced" situational awareness information is provided compared to the originally planned DMS capability. Insufficient implies an inability to perform the mission, whereas B-2s are currently participating in combat operations.
3. Insufficient reliability and maintainability of LO materials and features. Wording in the text should reflect that further improvements focused at improving mission capable rates (MCR) and reducing LO maintenance man-hours per flying hour are required and being pursued to achieve the required

See comment 1.

See comment 2.

See comment 3.



Appendix I
Comments From the Department of Defense

pace of flight operations. The draft report, as currently worded, implies there is an Operational Requirements Document (ORD) requirement for LO maintenance man-hours per flying hour; there is not. The ORD requirement is actually for MCR and total maintenance man-hours per flying hour.

See comment 4.

4. Inability to effectively deploy. A more accurate description is an inability to perform some LO maintenance activities at deployed locations without hangars or deployable shelter capability. B-2s have successfully deployed during two exercises in 1998 and some LO maintenance activities were successfully demonstrated without shelters. The inability to perform some (not all) LO maintenance activities without climate controlled shelters appears to be the limiting factor that will prevent achievement of desired MCRs at deployed locations. The Air Force is planning to procure deployable shelters.

See comment 5.

5. Cost estimates to complete the baseline acquisition program. The draft report currently states that, "Air Force officials advised us that the estimated costs could increase by about \$155 million to complete efforts previously believed to have been fully covered in the cost estimate." This cost data has been misinterpreted by the GAO. First, \$83M of the figure is for the Low Observable Materials Improvement effort, which should not be counted against the B-2 baseline cost goal. Also, some additional money that is needed to extend Interim Contractor Support will be offset by funds currently programmed for Air Force Operations and Maintenance activities.

Suggested technical changes for clarification and accuracy have been provided separately.

The Department appreciates the opportunity to comment on the draft report.

Sincerely,



George R. Schneider
Director
Strategic and Tactical Systems

The following are our comments on the Department of Defense's (DOD) letter dated April 28, 1999.

GAO Comments

1. The Air Force completed some testing of an upgraded Air Force Mission Support Systems (AFMSS) since our draft report was issued. However, an important component of the system, the common low observable auto-router (CLOAR), is still unsatisfactory and improvements are being made to system software. This component will in some cases prevent mission plans from being completed within the operationally required time. In addition, operational testing of AFMSS has not been completed. Our final report includes updated information on the AFMSS development.

2. DOD stated our description of the defensive avionics as "insufficient" implied an inability of the B-2A to perform its mission, whereas B-2As are currently participating in combat operations. DOD stated some situational awareness information in current operations was being provided by the defensive avionics. We changed our report to state situational awareness was "limited" rather than "insufficient." Although the defensive avionics is being used to some extent at this time, improvements are still required to meet the operational requirements.

3. DOD indicated that the wording of the draft report implied there was an operational requirement for low observable maintenance man-hours per flying-hour when the requirement is actually for total B-2 maintenance activities. The final report reflects this distinction; however, it should be noted that the Air Force uses maintenance man-hours per flying-hour to measure maintenance improvements for low observable features. This metric was used in both the Air Force initial and follow-on operational test reports to show low observable maintenance is the main driver for overall B-2 maintenance.

4. DOD stated that B-2As successfully deployed to Guam during two exercises in 1998 and that during these exercises some low observable maintenance was accomplished without shelters. The final report acknowledges that not all low observable maintenance requires an environmentally controlled shelter, but it points out that the Air Force follow-on test and evaluation report concluded that operational deployment requirements were not achieved during these 1998 exercises and that the lack of shelters would have prevented any major repair of low observable features had they been needed. The test report states that on the second deployment exercise, significant low observable deficiencies

occurred and that one of the three aircraft deployed had to be returned to the contractor's facility in the United States for the repairs. Although the Air Force can deploy B-2As, the Air Force cannot sustain operations at the level required for eight aircraft over a 14-day period without shelters for low observable maintenance.

5. DOD agreed additional funds would be required to complete efforts included in the March 1999 B-2A cost estimate. Their comments stated, however, that we misinterpreted the Air Force cost estimate for work to complete the baseline acquisition program. As stated in the Agency Comments and Our Evaluation section, we discuss the added costs to improve the B-2A, but we did not attempt to define the amount of costs associated with the baseline cost goal because the Congress removed the cost ceiling associated with the baseline program. During the formal exit conference, DOD officials also stated that additional funds might be needed to buy deployable shelters.

Major Contributors to This Report

**National Security and
International Affairs
Division, Washington,
D.C.**

David E. Cooper

Chicago Field Office

Robert D. Murphy
Michael J. Hazard
Marvin E. Bonner

Related GAO Products

B-2 Bomber: Additional Costs to Correct Deficiencies and Make Improvements (GAO/NSIAD-98-152, June 16, 1998).

B-2 Bomber: Cost and Operational Issues (GAO/NSIAD-97-181, Aug. 14, 1997).

B-2 Bomber: Status of Efforts to Acquire 21 Operational Aircraft (GAO/NSIAD-97-11, Oct. 22, 1996).

B-2 Bomber: Status of Cost, Development, and Production (GAO/NSIAD-95-164, Aug. 4, 1995).

B-2 Bomber: Cost to Complete 20 Aircraft Is Uncertain (GAO/NSIAD-94-217, Sept. 8, 1994).

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