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Acquisition of the B-1 Fully Integrated Data Link

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## Acronyms and Abbreviations

AESG	Aeronautical Systems Group
AFPEO/AC	Air Force Program Executive Officer/Aircraft Systems
APB	Acquisition Program Baseline
CLIP	Common Link Integration Processing
FIDL	Fully Integrated Data Link
GAO	Government Accountability Office
IG	Inspector General
LRIP	Low-Rate Initial Production
SDD	System Development and Demonstration



INSPECTOR GENERAL  
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September 22, 2008

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

SUBJECT: Report on the Acquisition of the B-1 Fully Integrated Data Link  
(Report No. D-2008-134)

We are providing this report for your information and use. We considered your comments on a draft of this report when preparing the final report.

Comments on the draft of this report conformed to the requirements of DoD Directive 7650.3 and left no unresolved issues. Therefore, we do not require any additional comments.

We appreciate the courtesies extended to the staff. Please direct questions to Mr. John E. Meling at (703) 604-9091 (DSN 664-9091) or Mr. Kevin W. Klein at (703) 604-9032 (DSN 664-9032). The team members are listed inside the back cover.

A handwritten signature in black ink, reading "Richard B. Jolliffe".

Richard B. Jolliffe  
Assistant Inspector General  
Acquisition and Contract Management



# Results in Brief: Acquisition of the B-1 Fully Integrated Data Link

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## What We Did

We reviewed the Air Force's preparation of the B-1 Fully Integrated Data Link (FIDL) program for the low-rate initial production phase of the acquisition process. The B-1 FIDL program will provide the B-1 aircraft combat forces with integrated data links for both line-of-sight and beyond line-of-sight communication capability for enhanced situational awareness, command and control connectivity, and weapons management. The Common Link Integration Processing (CLIP) software is being provided to the contractor as Government-furnished equipment in the B-1 FIDL development effort. As of July 2008, the program's funding to develop and procure the system totaled \$472 million, with \$242 million in research, development, test, and evaluation funds and \$230 million to procure 67 kits.

## What We Found

We determined that the Air Force Program Executive Officer for Aircraft Systems prematurely approved the B-1 FIDL program for program initiation even though the CLIP software, a critical B-1 FIDL technology, had not been demonstrated in a relevant or an operational environment to be considered mature enough to support system development.

- Instead of a technology development strategy, a 326 Aeronautical Systems Group representative stated that the program office prepared a systems engineering plan that identified a technology insertion strategy. The technology insertion strategy did not address maturation of the CLIP software technology or alternatives to the use of

the CLIP software in the B-1 FIDL development as a technology development strategy would.

- Using the immature CLIP software in the development of the B-1 FIDL contributed to the program breaching its schedule by 10 months and incurring contract cost overruns of \$23 million.
- Continued delays in the development and integration of CLIP software in the B-1 FIDL program may result in further schedule delays and costs increases.

## What We Recommend

We recommend that:

- the Air Force Program Executive Officer for Aircraft Systems direct the 326 Aeronautical Systems Group to prepare a technology development strategy to support the program's low-rate initial production decision.
- the Air Force Program Executive Officer for Aircraft Systems not approve the B-1 FIDL program for low-rate initial production until the CLIP software technology is mature and the B-1 FIDL has demonstrated, with the inclusion of the CLIP software, acceptable performance in developmental, test and evaluation, and operational assessment.

## Client Comments and Our Response

The Air Force Program Executive Officer for Aircraft Systems agreed with our recommendations. We consider the reply responsive to our recommendations and do not require any additional comments.

## Recommendations Table

<b>Client</b>	<b>Recommendations Requiring Comment</b>	<b>No Additional Comments Required</b>
Air Force Program Executive Officer for Aircraft Systems		1. and 2.

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**B-1 Bomber**

Source: <http://www.boeing.com/defense-space/military/b1-lancer/>

# Introduction

## Objectives

The audit objective was to evaluate the overall management of the Air Force B-1 Fully Integrated Data Link (FIDL) Program. Because the program is in the system development and demonstration (SDD) phase, we determined whether management was effectively preparing the program for the low-rate initial production (LRIP) phase of the acquisition process. We also evaluated the internal controls as they related to the audit objectives. Appendix B provides a glossary of technical terms used in this report.

## Background

The B-1 FIDL is a major system in the SDD phase of the acquisition process. The B-1 FIDL program began SDD in May 2005, and an LRIP decision is planned for FY 2009.

## *Mission and System Description*

The purpose of the B-1 FIDL program is to provide the B-1 aircraft combat forces with integrated data links for both line-of-sight and beyond line-of-sight communication capability for enhanced situational awareness, command and control connectivity, and weapons management.

The integration of the B-1 FIDL system in the B-1 weapon system will allow combat forces to exchange secure and jam-resistant digital communications in-theater with other platforms that are equipped with line-of-sight capabilities provided by the link 16 datalink and beyond line-of-sight communication provided through the Joint Range Extension protocol. The real-time information available through the integration of FIDL in aircraft platforms will decrease communication time, increase accuracy of information exchange, and increase information flow.

The B-1 FIDL program will also expand on existing capabilities within the B-1 weapon system. The B-1 FIDL will provide the BoneNet infrastructure for the entire B-1 weapon system. The BoneNet is an ethernet infrastructure contained within the B-1 weapon system and includes the hardware and open-system software infrastructure to support integration of datalinks with:

- front displays provided by the vertical situation display upgrade,
- the new aft displays required for datalink, and
- the avionics flight software.

As directed, the 326 Aeronautical Systems Group (AESG) required the contractor to use Government-furnished equipment in the development of the B-1 FIDL. Specifically, Government-furnished equipment provided to the contractor includes the Multi-Functional Information Distribution System Joint Tactical Radio System and the



Common Link Integration Processing (CLIP) software that are being developed by the Navy. As part of the B-1 FIDL, the Multi-Functional Information Distribution System Joint Tactical Radio System will increase B-1 aircraft communication capabilities over the current link 16 terminals along with advanced secure communications, jam-resistant information distribution, and precise participant location. The CLIP software is intended to perform the link 16 message processing function. In conjunction with implementing the CLIP software, the B-1 FIDL contractor is developing the Data Link Data Manager that will interface with the CLIP software to provide display images to all flight crew stations.

The CLIP software, a critical B-1 FIDL technology, was not demonstrated in a relevant or an operational environment before initiation of the B-1 FIDL program. The Government Accountability Office (GAO) has identified immature technology readiness levels of critical technologies for acquisition programs in system development as a major cause for program cost and schedule overruns. In 2008, GAO assessed 72 programs, as part of an ongoing series of assessments,<sup>1</sup> and all 72 programs proceeded into the SDD phase of the acquisition process with critical technologies that were immature. Also in the report, GAO performed an analysis of major Defense acquisition programs, finding that the total acquisition costs increased 26 percent in 2007 from first program cost estimates and the average delay was 21 months for delivering initial capabilities.

### ***Program Management***

The 326 AESG Commander is developing the B-1 FIDL program<sup>2</sup> for the U.S. Air Force Air Combat Command, the operational user of the B-1 program. The 326 AESG Commander reports to the Air Force Program Executive Officer for Aircraft Systems (AFPEO/AC) for B-1 FIDL program execution. In March 2005, the Air Force Acquisition Executive delegated the milestone decision authority responsibility to the AFPEO/AC for the B-1 FIDL program.

### ***Program Rebaseline***

Delays in Navy development of the CLIP software and overall contractor performance caused the 326 AESG to breach the July 2006 threshold schedule date for its critical design review. As a result, the AFPEO/AC approved a new acquisition program baseline (APB) in November 2006 that extended program schedule milestone dates. Specifically, the developmental testing schedule was extended to October 2008 from November 2007 and the LRIP decision date was extended to May 2009 from July 2008. The new APB did not adjust the B-1 FIDL performance or cost parameters identified in the initial APB.

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<sup>1</sup> The GAO report is "Defense Acquisitions: Assessments of Selected Weapon Programs," March 2008 (Report No. GAO-08-467SP).

<sup>2</sup> The B-1 FIDL program does not have a standalone program office within the 326 AESG command for all B-1 programs; therefore, in the report, when referring to 326 AESG, it includes all staff assigned to the B-1 FIDL program.

## ***Funding and Contract***

As of July 2008, the 326 AESG had \$242 million in program funding to develop the B-1 FIDL and \$230 million to procure 67 B-1 FIDL kits,<sup>3</sup> for a total program cost of \$472 million. On June 1, 2005, the U.S. Air Force Materiel Command began the B-1 FIDL development by awarding The Boeing Company a contract delivery order for \$154.9 million. Through December 2007, the Air Force contracting officer had increased the contract value to \$178.9 million through 27 contract delivery order modifications.

## **Overall Program Assessment**

We determined that the 326 AESG was adequately preparing the B-1 FIDL for LRIP in the areas of capability development, test and evaluation planning, and funding structure. However, the 326 AESG needs to prepare a technology development strategy and to demonstrate that the B-1 FIDL, with the inclusion of the CLIP software, has acceptable performance in development, test and evaluation, and in an operational assessment before the LRIP decision as discussed in the finding section of the report.

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<sup>3</sup> Of the 67 B-1 FIDL kits that will be procured, 2 kits will be used in research, development, test, and evaluation.



# Finding: Approval of the Fully Integrated Data Link for Program Initiation and Development

The Air Force Program Executive Officer for Aircraft Systems (AFPEO/AC) prematurely approved the B-1 FIDL program for program initiation since the CLIP software, a critical B-1 FIDL technology, had not been demonstrated in a relevant or an operational environment. This condition partially occurred because the B-1 Program Manager prepared alternative documentation to satisfy the requirement to prepare a technology development strategy. The alternative documentation did not address the maturation of the CLIP software technology or identify other alternatives to using the CLIP software that should have been addressed in developing a technology development strategy. This condition also occurred because the AFPEO/AC accepted the recommendation of the B-1 Program Manager<sup>4</sup> for program initiation even though the CLIP software technology was not mature enough to support system development. As primarily the result of the program office not providing the contractor with mature CLIP software, as Government-furnished equipment, the 326 AESG breached the approved program schedule by 10 months and incurred increased contract costs of \$23 million. It also resulted in the 326 AESG Commander having to obtain approval of a revised acquisition program baseline agreement. In addition, because CLIP software development problems have not been fully resolved, the 326 AESG may experience further program schedule delays and increased program costs.

## Program Management Criteria

DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003, and the *Defense Acquisition Guidebook* provide guidance on the Defense Acquisition System. In addition, Air Force Instruction 63-101, "Operations of Capabilities Based Acquisition System," July 29, 2005, and *The DoD Technology Readiness Assessment Deskbook*, May 2005, provide guidance for developing technology readiness assessments and technology development strategies for acquisition programs.

### ***DoD Instruction***

DoD Instruction 5000.2 requires that programs entering the SDD phase of the acquisition process have mature software with approved requirements and funding. It states that the management and mitigation of technology risk, which allows less costly and less time-consuming systems development, is a crucial part of overall program management and is especially relevant to meeting cost and schedule goals. Further, the Instruction states that technology procured from industry or other sources should have been demonstrated in a relevant or an operational environment to be considered mature enough to use for product development in systems integration based on the performance of technology readiness

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<sup>4</sup> The B-1 Program Manager is the 326 Aeronautical Systems Group Commander.

assessments. If technology is not mature, the DoD Component should use alternative technology that is mature and that can meet the user's needs. Technology maturation and demonstration needs are the basis of a program's technology development strategy. Further, the Instruction states that acquisition program entry into the LRIP phase of the acquisition process is dependent on software maturity and acceptable performance in development, test and evaluation, and operation assessments.

### ***Defense Acquisition Guidebook***

The *Defense Acquisition Guidebook* identifies nine technology readiness levels that program offices are to use in making an assessment of the demonstrated technology capabilities and technological maturity of critical technologies. The Guidebook further states that, when making milestone decisions for acquisition programs, decision authorities are to consider the recommended technology readiness levels of critical program technologies. Technology readiness levels of critical program technologies are needed to support milestone decisions when decision authorities are assessing program risk and readiness for the next phase of the acquisition process. As shown in Appendix C, a determination that a critical program technology is at technology readiness level 6 indicates that a representative model or prototype system has been tested in a relevant environment. Appendix C contains definitions of all nine technology readiness levels.

### ***Air Force Instruction***

Air Force Instruction 63-101 requires that the milestone decision authority obtain an objective technology readiness assessment of critical program technologies for milestone decision consideration in support of the SDD decision and the production decision. The Instruction states that the assessment is to determine whether critical technologies are sufficiently mature for product development and LRIP. It also states that the milestone decision authority determines who will prepare the technology development strategy in support of the program initiation milestone decision as required by DoD Instruction 5000.2. Air Force Instruction 63-101 states that this process should result in higher fidelity requirements that are time-phased to a more realistic schedule with more accurate cost estimates.

### ***DoD Technology Readiness Assessment Deskbook***

The *DoD Technology Readiness Assessment Deskbook* states that technology readiness assessments should be performed near the completion of the technology development phase of the acquisition process to ensure that a program does not enter SDD relying on immature technologies. It states that all critical technology elements should be identified and demonstrated successfully at a technology readiness level of 6 or higher before the decision is made to initiate a program.

## **Entry Into System Development and Demonstration**

The AFPEO/AC approved the B-1 FIDL program for program initiation and entry in the SDD phase of the acquisition process in May 2005, even though the program office

determined, before the milestone decision review, that the technology risk for several technologies, including the CLIP software, was high for the B-1 FIDL program.

### ***Technology Risk***

In July 2004, the 326 AESG completed a risk assessment that determined that the CLIP software was a high-risk critical component of the B-1 FIDL program. However, the AFPEO/AC approved the B-1 FIDL program's entry into the SDD phase in spite of the DoD Instruction 5000.2 requirement that technology from other sources will have been demonstrated in a relevant or operational environment to be considered mature enough to use for product development in systems integration. In June 2005, shortly after the program initiation decision for the B-1 FIDL program, the Assistant Secretary of the Navy for Research, Development, and Acquisition, the milestone decision authority for the CLIP software program, established as an exit criteria from the SDD phase of the acquisition process, that the CLIP Program Office obtain a successful operational assessment that the CLIP software had demonstrated software maturity.

Immediately after program initiation, the 326 AESG, as part of Air Force Materiel Command, also performed a program management review of the B-1 FIDL Program in June 2005. The review identified that the CLIP software development schedule may not meet the B-1 FIDL schedule requirements and suggested that the 326 AESG request a fallback plan from the contractor. The 326 AESG did not act on the suggestion at that time.

### ***CLIP Software Technology Maturity Level***

When the B-1 FIDL program was initiated in May 2005, the Navy had not yet approved the CLIP software program as an acquisition program or entry into the SDD phase of the acquisition process. Even so, the 326 AESG assessed the technology maturity of the CLIP software at technology readiness level 6 in its technology readiness assessment supporting program initiation. The technology readiness assessment stated:

For software technology, [the] development of the CLIP software is assessed at a level 6 since it is currently under development by a joint USAF/USN [United States Air Force/United States Navy] program office. Although there is FIDL program risk (cost and schedule) due to the CLIP development effort, we believe the technology is available and similar algorithms and message processing software are in use on other airborne platforms.

As supported in the technology readiness assessment, the 326 AESG incorrectly assessed the CLIP software as technology level 6 because the CLIP software had not been demonstrated in a relevant environment. Specifically, the assessment statement that the 326 AESG believed that the technology was available and similar algorithms and message processing software are in use on other airborne platforms does not support a determination that the CLIP software had already been demonstrated in a relevant environment, the criteria defined for a level 6 technology readiness assessment. Further, the CLIP Program Office was attempting to implement specific requirements for a layered, open architecture for the CLIP software that met requirements not satisfied by

any existing products, including portability; configurability; interoperability; maintainability; modifiability; object-oriented design implemented in an embedded, real-time environment; and a common host interface.

The CLIP Program Office did not prepare a technology readiness assessment for the CLIP software in support of its program initiation decision in June 2005. However, in March 2008, the CLIP Program Office did prepare a draft technology readiness assessment that stated that the initial technology readiness of the CLIP software program was at a technology readiness level 4. Technology readiness level 4 is defined as the integration of basic technological components to establish that they will work together. In the March 2008 technology readiness assessment, the CLIP Program Office revised the CLIP software technology readiness level to technology readiness level 6 based on test results of the CLIP software in a relevant environment. Technology readiness level 6 is the technology readiness level that critical technologies of a program should have at program initiation.

A 326 AESG representative stated that alternative documentation to the technology development strategy requirement in DoD Instruction 5000.2 was prepared. Because the B-1 FIDL program did not have a technology development phase, the representative stated that the program office prepared a systems engineering plan that identified a technology insertion strategy. The technology insertion strategy did not address maturation of the CLIP software technology or alternatives to the use of the CLIP software in the B-1 FIDL development. DoD Instruction 5000.2 states that the technology development strategy should be performed in support of the technology development phase of the acquisition process and updated before each subsequent milestone decision review. Further, *The DoD Technology Readiness Assessment Deskbook* states that the technology development strategy is a precursor to the program acquisition strategy and is an important prerequisite to the technology readiness assessment.

## **CLIP Software Development Program**

The CLIP software is a Navy-developed software application that will serve as a common software integration solution for the B-1 weapon system, and other weapons platforms, to allow accurate processing and exchange of tactical data with Joint and Coalition forces over multiple types of tactical data links. The Navy approved program initiation for the CLIP software in June 2005.

### ***CLIP Software Capabilities and Program Management***

The CLIP will provide the primary message processing capability for the B-1 FIDL and is intended to isolate the platform from the multiple changes that occur with data link evolutions. The Air Force Air Combat Command decided to use the CLIP software to reduce software development costs during the SDD phase and to significantly reduce life-cycle software support costs for link 16. When mature, the CLIP software will enable the B-1 FIDL to meet its interoperability key performance parameter requirement. In FY 2008, the Navy stopped funding the CLIP software program, leaving the Air Force as the program's only funding source. Air Force representatives stated that the Navy

Program Executive Officer Command, Control, Communications, Computers, Intelligence, and Space retained program execution responsibility for the CLIP software program through successful completion of the delivery readiness review,<sup>5</sup> scheduled for January 2009. Once the CLIP software program meets the goals of the delivery readiness review, the Air Force's Hanscom Electronic System Center will take over the full management responsibility for the CLIP software program.

### ***CLIP Software Development Progress***

The CLIP software program has experienced development delays since it entered the SDD phase in June 2005. Development delays that have impacted the B-1 FIDL schedule include:

- In June 2006, the B-1 Program Manager reported to the AFPEO/AC delays with the Navy's progress in developing the CLIP software and the B-1 FIDL prime contractor's ability to timely complete the detailed design for the man-machine interface. This condition caused the 326 AESG to breach its critical design review schedule identified in the APB agreement. As a result, the program office had to have a new APB agreement approved that extended the B-1 FIDL SDD phase by at least 10 months, and to make an upward equitable price adjustment to the contract target price of \$23 million. The revised APB included extending the start of developmental test and evaluation to October 2008 from November 2007 and the LRIP decision to May 2009 from July 2008.
- In January 2008, the CLIP software program office announced another schedule slip in moving the start of the program's acceptance test from April 2008 to September 2008. This will delay the performance of the delivery readiness review for the CLIP software from April 2008 to January 2009. The 326 AESG representatives stated that the schedule slip in the CLIP software acceptance test and the subsequent completion of link 16 functionality tests for the Data Link Data Manager will delay the start of the B-1 FIDL developmental test and evaluation flight test from July 2008 to October 2008. As a result, the 326 AESG does not expect that developmental test and evaluation of the B-1 FIDL will be completed within the schedule threshold established in the revised APB. Accordingly, the 326 AESG and the contractor are in the process of assessing the additional impact to the B-1 FIDL development schedule resulting from the CLIP software schedule slip.

### **Alternatives to the CLIP**

In August 2007, the 326 AESG tasked The Boeing Company to perform an independent study to identify industry alternatives to the CLIP software for use in the B-1 FIDL program. The program office tasked the contractor with the study to reduce program

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<sup>5</sup> The delivery readiness review is an internal CLIP program review used by the Assistant Secretary of the Navy for Research, Development, and Acquisition to determine the CLIP program's readiness for the next acquisition phase.



software risk in the event that the CLIP software was not available to support the B-1 FIDL program. In the September 2007 study, The Boeing Company concluded that industry alternatives were not readily available that could replace the CLIP functionality in the B-1 FIDL architecture. The alternatives that were identified would further increase program cost and delay the schedule of the B-1 FIDL program.

A working group with representatives from the 326 AESG and the contractor continues to monitor the CLIP software program risks. In addition, the 326 AESG stated that development of the CLIP remained a high risk that could not be avoided with the current program approach.

## **Impact on Cost and Schedule and Conclusion**

The AFPEO/AC decision to initiate the B-1 FIDL program before the CLIP software, a critical B-1 FIDL technology, was demonstrated in an operational environment led to contract cost and schedule overruns on the B-1 FIDL program. By initiating the B-1 FIDL program before the CLIP software was mature, the 326 AESG will most likely incur further contract cost and schedule overruns. As of June 2008, delays in developing the CLIP software had already caused the 326 AESG to delay the start of B-1 FIDL developmental flight testing and the LRIP decision by 10 months and incur an upward equitable price adjustment to the contract target price of \$23 million. Further, the 326 AESG was awaiting a revised program schedule from the contractor to determine further contract cost impacts and schedule delays.

Because the technology insertion strategy developed by the 326 AESG did not address maturation of the CLIP software technology or alternatives to the use of the CLIP software in the B-1 FIDL development, the 326 Aeronautical Systems Group should prepare a technology development strategy in preparation for the B-1 FIDL program's LRIP decision. Further, the AFPEO/AC should not approve the B-1 FIDL program for the LRIP phase of the acquisition process until the CLIP software is mature and the B-1 FIDL has demonstrated, with the inclusion of the CLIP software, acceptable performance in development, test and evaluation, and operational assessment.

## **Recommendations, Client Comments, and Our Response**

**We recommend that the Air Force Program Executive Officer for Aircraft Systems:**

- 1. Direct the 326 Aeronautical Systems Group to prepare a technology development strategy to support the program's low-rate initial production decision in accordance with DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003.**

### ***Air Force Program Executive Officer for Aircraft Systems***

The Air Force Program Executive Officer for Aircraft Systems agreed with the recommendation. He stated that he will ensure that the 326 Aeronautical System Group

prepares a technology development strategy in support of the B-1 FIDL LRIP decision as a part of the documentation package required by DoD Instruction 5000.2 for Milestone C LRIP decisions. He further stated that strategy will include documentation of the maturity of the CLIP software.

### ***Our Response***

The Air Force Program Executive Officer for Aircraft Systems comments were responsive to the recommendation.

- 2. Not approve the B-1 Fully Integrated Data Link program for low-rate initial production until the Common Link Integration Processing software technology is mature and the B-1 Fully Integrated Data Link has demonstrated, with the inclusion of the Common Link Integration Processing software, acceptable performance in developmental, test and evaluation, and operational assessment in accordance with DoD Instruction 5000.2, "Operations of the Defense Acquisition System," May 12, 2003.**

### ***Air Force Program Executive Officer for Aircraft Systems***

The Air Force Program Executive Officer for Aircraft Systems agreed with the recommendation. The Air Force Program Executive Officer for Aircraft Systems stated he will make the LRIP decision based upon the requirements of the applicable DoD and Air Force regulations as well as upon the progress of the B-1 FIDL program in meeting performance criteria for entrance into LRIP established at Milestone B or as subsequently modified.

### ***Our Response***

The Air Force Program Executive Officer for Aircraft Systems comments were responsive to the recommendation.

## **Appendix A. Scope and Methodology**

We conducted this audit from August 2007 through July 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our finding and conclusions based on our audit objectives.

During the audit, we evaluated whether management was effectively developing and readying the program for the low-rate initial production phase of the acquisition process. We reviewed program documentation on requirements and capabilities, testing, systems engineering, contracting, acquisition strategy, technology readiness assessments, and funding dated from July 1999 through March 2008. We interviewed staff from the offices of the Assistant Secretary of the Air Force (Acquisition); the 326<sup>th</sup> Aeronautical Systems Group Commander for B-1 Programs; the Chief, Program Management Division for B-1 Programs; the Program Manager, B-1 Fully Integrated Data Link Program; the Program Manager, Common Link Integration Processing Program; and representatives from the office of the Defense Contract Management Agency.

### **Review of Internal Controls**

We determined that no material internal control weakness existed, as defined by DoD Instruction 5010.40, "Managers' Internal Control (MIC) Program Procedures," January 4, 2006, in the B-1 FIDL Program.

### **Use of Computer-Processed Data**

We did not use computer-processed data to perform this audit.

### **Use of Technical Assistance**

A computer engineer from the Technical Assessment Directorate of Policy and Oversight, Department of Defense Office of Inspector General assisted in the audit. The engineer evaluated and reviewed systems engineering, software, and other acquisition planning-related documents in the B-1 FIDL program.

## **Prior Coverage**

During the last 5 years, the Department of Defense Inspector General (IG) issued one report on the adequacy of Air Force's management oversight of acquisition category I and II programs that discussed the B-1 FIDL program. The GAO also issued a report that assessed weapon programs and the overall trends in DOD acquisition outcomes for decision makers to use as they determine the best ways to invest limited resources in the face of competing demands, such as meeting best practices standards for mature technologies. Unrestricted GAO reports can be accessed over the Internet at <http://www.gao.gov>. Unrestricted DoD IG reports can be accessed at <http://www.dodig.mil/audit/reports>.

### **GAO**

GAO Report No. GAO-08-467SP, "Defense Acquisition: Assessment of Selected Weapon Programs," March 2008

### **DoD IG**

DoD IG Report No. D-2007-047, "Air Force Acquisition Executive's Management Oversight and Procurement Authority for Acquisition Category I and II Programs," January 23, 2007

## Appendix B. Glossary

**Acquisition Program Baseline.** An acquisition program baseline prescribes the key cost, schedule, and performance constraints in the phase succeeding the milestone for which they were developed.

**CLIP Delivery Readiness Review.** A delivery readiness review is an internal milestone for the CLIP software program. The purpose of the delivery readiness review is to assess the readiness of the CLIP software for delivery to CLIP receiving platforms. The delivery readiness review is completed by the contractor before formal delivery of the CLIP software to a platform for integration and operational employment.

**Equitable Adjustment.** An equitable adjustment may be made to contracts when changes in terms impact the cost of performing the contract or its schedule.

**Line-of-Sight.** A line-of-sight is the straight path between a transmitting antenna (as for radio or television signal) and a receiving antenna when unobstructed by the horizon.

**Link 16.** Link 16 (also known as tactical digital information link J) is an improved data link used to exchange near real-time information between various military platforms. Link 16 is a communication, navigation, and identification system that supports information exchange between tactical command, control, communications, computers, and intelligence systems.

**Milestone Decision Authority.** The milestone decision authority is the designated individual with overall responsibility for a program. The milestone decision authority has the authority to approve entry of an acquisition program into the next phase of the acquisition process and is accountable for cost, schedule, and performance reporting to higher authority, including congressional reporting.

**System Development and Demonstration.** System development and demonstration is the third phase of the acquisition process. This phase consists of two efforts, system integration and system demonstration, and begins after the program initiation milestone decision point. At the conclusion of the system integration effort, a design readiness review is held to determine program readiness for system demonstration.

**Technology Development Strategy.** The technology development strategy focuses on the activities of the technology development phase. Where feasible, the strategy should discuss activities associated with the post-program-initiation phases of the planned acquisition. The technology development strategy precedes the formal acquisition strategy and is required to support the technology development decision point. The technology development strategy is updated at subsequent milestones and included in the acquisition strategy.

**Technology Readiness Assessment.** A technology readiness assessment is a regulatory information requirement for all acquisition programs. It is a systematic, metrics-based process that establishes the maturity level of critical technology elements. Appendix C lists the nine technical readiness levels to be used in the technology readiness assessment.

**Technology Readiness Level.** A technology readiness level is a measure of technical maturity of critical program technologies. The use of technology readiness levels enables consistent, uniform discussions of technical maturity across different types of technologies. Decision authorities are to consider the recommended technology readiness levels of critical program technologies before making a determination as to whether a program should progress to the next phase of the acquisition process.

## Appendix C. Technology Readiness Levels and Their Descriptions

Technology readiness levels are a measure of technology maturity of critical program technologies. They enable acquisition managers to hold consistent, uniform discussions of technical maturity across different types of technologies.

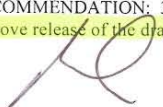
Technology Readiness Level	Description
1. Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.
2. Technology concept or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3. Analytical and experimental critical function or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of technology. Examples include components that are not yet integrated or representative.
4. Component or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.
5. Component or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.

6. System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond that of a technology readiness level 5, is tested in a relevant environment. Represents a major step up in technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in a simulated operational environment.
7. System prototype demonstration in an operational environment	Prototype near, or at, planned operation system. Represents a major step up from technology readiness level 6, requiring demonstration of an actual system prototype in an operational environment such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8. Actual system completed and qualified through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this technology readiness level represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine whether it meets design specifications.
9. Actual system proven through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.



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# Air Force Program Executive Officer for Aircraft Systems Comments

STAFF SUMMARY SHEET						
TO	ACTION	SIGNATURE (Surname), GRADE AND DATE	TO	ACTION	SIGNATURE (Surname), GRADE AND DATE	
1	312 AESW CC	Coord <i>Stanley (28)</i>	6			
2	ASC/CS ASC/CCX	Coord <i>[Signature]</i> 3 Sept	7			
3	ASC/CA	Coord <i>[Signature]</i> 9/4/08	8			
4	ASC/CC	Approve <i>[Signature]</i> 7 Sep 08	9			
5			10	Wing Sec	Coord	
SURNAME OF ACTION OFFICER AND GRADE		SYMBOL	PHONE	TYPIST'S INITIALS	SUSPENSE DATE	
Mr. Artz, YC-02		812 AESG/SYCA	656-5083	jdl	20080905	
SUBJECT					DATE	
Response to DoD IG Recommendation on Draft Report for the "Acquisition of the B-1 Fully Integrated Data Link" (Project No. D2007-D00AE-0253.000)					20280828	
SUMMARY						
PURPOSE: Obtain approval to release the response to the subject DoD IG draft report recommendations.						
BACKGROUND: The DoD IG conducted a comprehensive audit of the B-1 Fully Integrated Data Link program from August 2007 through July 2008. The audit included visits to SAF/AQ, ASC, AFFTC, and Boeing Aircraft Company Long Beach. The Air Force Focal Point for this audit is SAF/AQPB. The audit was self initiated by the DoD IG.						
DISCUSSION: The DoD IG Draft Audit Report (Tab 2) offers two recommendations that are directed to the Air Force Program Executive Officer for Aircraft and include:						
"We recommend that the Air Force Program Executive Officer for Aircraft Systems:						
1. Direct the 326th Aeronautical Systems Group to prepare a technology development strategy to support the program's low rate initial production decision in accordance with DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003.						
2. Not approve the B-1 Fully Integrated Data Link program for low-rate initial production until the Common Link Integration Processing software technology is mature and the B-1 Fully Integrated Data Link has demonstrated, with the inclusion of the Common Link Integration Processing software, acceptable performance in developmental, test and evaluation, and operational assessment in accordance with DoD Instruction 5000.2, "Operations of the Defense Acquisition System," May 12, 2003."						
RECOMMENDATION: 326 AESG (now 812 AESG) concurs with the DoD IG recommendation #1 and recommends AFPEO/AC approve release of the draft responses by signing block 4 above. <i>and #2</i>						
 PHILIP E. LOUDEN JR, Col, USAF Commander 812th Aeronautical Systems Group			2 Tabs 1. Draft Responses 2. DoD IG Draft Audit Report			
<i>The GAO faults a May 2005 decision since FID2 technology was not ready.</i>						

AF IMT 1768, 19840901, V5

PREVIOUS EDITION WILL BE USED.

Draft response to Draft DoD IG Audit Project No. D2007-D000AE-0253.000, dated 29 Jul 08

Recommendation 1. The Air Force Program Executive Officer for Aircraft Systems should direct the 326 Aeronautical Systems Group (AESG) to prepare a technology development strategy to support the program's low-rate initial production (LRIP) decision in accordance with DoD Instruction 5000.2, "Operation of the Defense Acquisition System," May 12, 2003.

Air Force Program Executive Officer for Aircraft Systems (AFPEO/AC) Comments:

Concur. The AFPEO/AC will ensure that the 326 AESG prepares a technology development strategy in support of the FIDL LRIP decision as a part of the documentation package required by DoD Instruction 5000.2 for Milestone C LRIP decisions. This strategy will include documentation of the Common Link Integration Processing (CLIP) software maturity.

Recommendation 2. Air Force Program Executive Officer for Aircraft Systems not approve the B-1 Fully Integrated Data Link program for LRIP until the CLIP software technology is mature and the B-1 Fully Integrated Data Link has demonstrated, with the inclusion of the CLIP software, acceptable performance in developmental, test and evaluation, and operational assessment in accordance with DoD Instruction 5000.2, "Operations of the Defense Acquisition System," May 12, 2003.

Air Force Program Executive Officer for Aircraft Systems (AFPEO/AC) Comments:

Concur. The AFPEO/AC will make the LRIP decision based upon the requirements of the applicable DoD and AF regulations as well as upon the progress of the FIDL program in meeting performance criteria for entrance into LRIP established at Milestone B or as subsequently modified with approval by the milestone decision authority (in the case of FIDL, the AFPEO/AC).

# Team Members

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Inspector General  
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