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Report to the Secretary of Defense

August 1991

COMBAT SYSTEMS

Status of the Navy's Airborne Low Frequency Sonar Program

GAO/NSIAD-91-208

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-244777

August 21, 1991

The Honorable Richard B. Cheney
The Secretary of Defense

Dear Mr. Secretary:

The Navy is developing the Airborne Low Frequency Sonar system to enhance the capabilities of SH-60F and SH-60B antisubmarine warfare helicopters to identify enemy submarine threats. We reviewed the program to determine (1) the impact the system will have on the helicopters' operational effectiveness and (2) the status of the program.

Background

The Airborne Low Frequency Sonar system is being designed to provide a long-range active search capability to detect, localize, and classify subsurface threats. The sonar is a dipping sonar, which is an acoustic sensor that is lowered into the water from a helicopter, searches for submarine sounds, and then is raised back into the helicopter by cable. The sounds detected by the sonar are analyzed by an acoustic processor on board the helicopter. This system can also process and display data obtained from sonobuoys, another device used to detect enemy submarines. The sonar can operate in a passive or active mode. A passive sonar listens for noises generated from submarines, whereas an active sonar transmits sounds that reflect off large objects in the water.

The Navy developed the sonar system primarily to replace the AN/AQS-13F dipping sonar system on the SH-60F helicopter, which is deployed on aircraft carriers. The system was also developed to supplement active and passive sonobuoys on the SH-60B helicopter, which is deployed from surface ships.

These helicopters needed an improved capability to enhance their effectiveness against the anticipated enemy submarine threats. In addition, the Navy plans to install and update other systems on the SH-60B helicopter at the same time that the sonar system is installed.

Contractors demonstrated critical components of their development models before the Navy issued a request for proposal for the sonar system. The contractors' results basically met the system's predicted performance and demonstrated that the critical components have a low technical risk.

The Navy currently plans to acquire 429 sonar systems at an estimated cost of about $1.2 billion. This estimate, which will be revised, includes the costs of spares, training, and retrofit systems for both the SH-60F and SH-60B helicopters.

Results in Brief

The Navy is in the process of increasing the SH-60B helicopter's maximum weight limit to compensate for the added weight of the Airborne Low Frequency Sonar and other systems. However, this weight increase will impact the helicopter's operational effectiveness in carrying out its antisubmarine warfare mission and can limit the potential for adding future systems to the helicopter. In contrast, the weight of the SH-60F helicopter is not expected to change significantly because the sonar system will replace an existing dipping sonar system.

The Airborne Low Frequency Sonar program is more than 1 year behind schedule. The Navy has delayed awarding the sonar system's full-scale engineering development contract until officials decide whether to use the Navy's standard signal processor or a commercially designed signal processor for the system. The $1.2 billion program cost estimate will be revised once the Navy has decided which signal processor to use and the contract has been awarded.

Additional Weight of Systems Will Impact the Operational Effectiveness of the SH-60B

The Navy has not fully evaluated the impact of the additional weight of the Airborne Low Frequency Sonar and other systems (see app. II) on the SH-60B helicopter's operational effectiveness. The addition of these systems could cause the SH-60B to exceed its current maximum weight limit of 21,884 pounds for its antisubmarine warfare mission.

Even though preliminary evaluations of the SH-60B helicopter's structural capabilities have been completed, the Navy does not expect the final results to be available until the end of fiscal year 1991. The Navy is awaiting the results of two studies by the helicopter's manufacturer, Sikorsky Aircraft, that assess the effect of increasing the SH-60B's weight. One study will measure the impact of the increased weight on the helicopter's components. The other study will measure the helicopter's operational limits based on the helicopter's weight and various mission scenarios.

In addition, the Navy contracted with Sikorsky to determine the feasibility of increasing the helicopter's current maximum weight limit to accommodate the weight of the additional systems. In April 1989

Sikorsky completed a survey to determine the limit of the helicopter's gross weight capacity. On the basis of the survey results, the Navy and Sikorsky agreed that the helicopter's maximum operational weight could be increased to 23,500 pounds.

Even if the anticipated maximum weight limit is approved by the Navy, we found that the weight of the SH-60B on an antisubmarine warfare mission could still exceed the maximum weight limit for the helicopter. A typical antisubmarine warfare mission, which includes the Airborne Low Frequency Sonar and other planned systems, a full load of fuel and sonobuoys, and two MK-50 torpedoes, would exceed the anticipated maximum weight limit by 195 pounds. Although antisubmarine warfare missions could require only one torpedo, fewer sonobuoys, or less fuel, trade-offs between capabilities and endurance or range would be necessary.

Since the addition of the Airborne Low Frequency Sonar and other systems would increase the SH-60B helicopter's weight above its anticipated maximum weight capacity, depending on the mission, the potential for adding future systems to the helicopter would be limited. Adding future systems to a SH-60B operating at or above its maximum weight limit is prohibitive without first removing or redesigning existing systems or carrying less fuel.

In addition to the increased weight, the Airborne Low Frequency Sonar and other systems also have specific space requirements. These requirements could affect the operational effectiveness of the SH-60B's other missions. For example, Navy specifications require that space be available for a stretcher on board the helicopter during a search and rescue or medical evacuation mission. However, operators would need to remove the sonar system from the helicopter to accommodate a stretcher before beginning these missions. The sonar is designed to be removed from the helicopter within 30 minutes. We believe that search and rescue and medical evacuation missions could be seriously impaired if they are delayed because the sonar system has to be removed before the helicopter can be equipped with a stretcher.

Program Is Behind Schedule, and Costs Are Not Settled

The Airborne Low Frequency Sonar program is currently more than 1 year behind schedule (see app. III). The Department of Defense recently indicated that the program office expects to award the full-scale engineering development contract in the first quarter of fiscal year 1992 instead of the second quarter of fiscal year 1990. The production

of the sonar system and its subsequent introduction to the fleet will be delayed as well. Appendix IV contains additional information on the program's milestones.

The Navy will delay the award of the sonar system contract until the Assistant Secretary of the Navy for Research, Development, and Acquisition decides whether the Navy should continue using the UYS-2 signal processor, the standard Navy processor for antisubmarine warfare programs (also called the Enhanced Modular Signal Processor), or begin using an alternative signal processor.

The Navy will revise the $1.2 billion program cost estimate. However, the revised estimate will not be completed until a decision on whether to continue using the UYS-2 signal processor has been made and the contract has been awarded.

Recommendation

We recommend that you direct the Secretary of the Navy to assess the trade-offs in the operational effectiveness of the SH-60B helicopter that would be necessary due to the additional weight of the Airborne Low Frequency Sonar and other currently planned systems. This assessment should be used as the basis for decisions on the SH-60B's mission configurations.

Agency Comments

In its comments on a draft of this report (see app. I), the Department of Defense partially concurred with our findings. It agreed that the Airborne Low Frequency Sonar will add weight to the SH-60B, but it added that the upgrade will improve the operational effectiveness of the helicopter. Although the Department commented that multi-mode operations is not a requirement for the SH-60B, our analysis assumed that the helicopter would operate in a typical antisubmarine warfare mission configuration. Information provided to us during our review showed that antisubmarine warfare-only operations with the sonar system could exceed the helicopter's anticipated maximum operational weight limit of 23,500 pounds. As noted earlier in this report, the SH-60B in an antisubmarine warfare mission configuration, which includes the Airborne Low Frequency Sonar and other planned systems, a full load of fuel and sonobuoys, and two MK-50 torpedoes, would exceed the anticipated maximum weight limit by 195 pounds. The Department's comments indicated that the Navy has identified ways to further reduce the SH-60B's weight, in a fully loaded antisubmarine warfare-only configuration, to

below 23,500 pounds. The results of this analysis have not been approved or tested.

The Department agreed that the program was behind schedule. It said that the program was delayed to enable the program office to investigate the potential for life-cycle cost savings using an alternate signal processor, but the competition is now proceeding.

The Department concurred with our recommendation. It said the Navy is in the process of conducting a cost and operational effectiveness analysis of the SH-60B that will assess operational effectiveness trade-offs. We found that although the study has not actually begun, the Navy is preparing to request the study and plans to complete it before a milestone review for the SH-60B in the first quarter of fiscal year 1992.

Scope and Methodology

To develop the information for this report, we reviewed pertinent documents and discussed information on the Airborne Low Frequency Sonar program with officials at the Office of the Chief of Naval Operations, Washington, D.C.; Naval Air Systems Command, Arlington, Virginia; Naval Air Forces, U.S. Pacific Fleet, San Diego, California; and the Sikorsky Aircraft Company, Stratford, Connecticut. We conducted our review from August 1990 to April 1991 in accordance with generally accepted government auditing standards.

As you know, the head of a federal agency is required by 31 U.S.C. 720 to submit a written statement on actions taken on these recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Secretary of the Navy, appropriate congressional committees, and the Director of the Office of Management and Budget. We will also make copies available to others on request.

Please contact me at (202) 275-6504 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix V.

Sincerely yours,

Martin M Ferber
Director, Navy Issues

Comments From the Department of Defense

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301-3010

9 JUL 1991

Mr. Frank C. Conahan
Assistant Comptroller General
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "COMBAT SYSTEMS: Status of the Navy's Airborne Low Frequency Sonar Program," dated May 30, 1991 (GAO Code 394383), OSD Case 8715.

The DoD partially concurs with the report. While it is correct that the Block II upgrade, which includes the Airborne Low Frequency Sonar and other planned systems, will add weight to the SH-60B airframe, the upgrade will improve the overall effectiveness of the SH-60B. Although the system has two designated primary mission areas, the SH-60B currently does not have a defined requirement to conduct concurrent, multi-mode operations. In that respect, the SH-60B can operate, fully equipped with the Block II upgrade, on an antisubmarine warfare mission or on an antisurface warfare mission without exceeding the projected maximum operational gross weight of the aircraft.

The SH-60B program office is in the process of conducting a Cost and Operational Effectiveness Analysis of the Light Airborne Multi-Purpose System SH-60 helicopter that will include the Block II upgrade. That data will provide a basis to assess the operational effectiveness of the system and any trade-offs required for mission accomplishment. Because actions to comply with the recommendation of the GAO report are already underway, specific direction from the Secretary of the Defense is not required.

The detailed DoD comments on each report finding and the recommendation are provided in the enclosure.

Sincerely,

Charles E. Adolph
By Direction of the Secretary of Defense

Enclosure

**GAO DRAFT REPORT - DATED MAY 30, 1991
(GAO CODE 394383) OSD CASE 8715**

"COMBAT SYSTEMS: STATUS OF THE NAVY'S AIRBORNE LOW FREQUENCY SONAR PROGRAM"

DEPARTMENT OF DEFENSE COMMENTS

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FINDINGS

FINDING A: Additional Weight of Systems Will Impact Operational Effectiveness of the SH-60B. The GAO reported that the Navy plans to acquire 429 sonar systems at an estimated cost of $1.2 billion, which includes the costs of spares, training, and retrofit systems for both the SH-60F and SH-60B Navy helicopters. The GAO found, however, that the Navy had not yet fully evaluated the impact of the additional weight of the Airborne Low Frequency Sonar and the other systems on the operational effectiveness of the SH-60B helicopter. The GAO asserted that the addition of the systems could cause SH-60B to exceed its current maximum weight limit of 21,884 pounds for its antisubmarine warfare mission.

The GAO reported that the Navy is currently awaiting the results of two studies by Sikorsky that assess the effect of increasing the weight of the SH-60B. The GAO observed that the Navy, through a separate contract with Sikorsky, determined that the maximum operational weight of the helicopter could be increased to 23,500 pounds. The GAO concluded, however, that even if the anticipated maximum weight limit increase is approved, the weight of the helicopter during antisubmarine warfare missions could exceed the maximum weight limit for the helicopter. The GAO noted that a typical antisubmarine warfare mission (which includes the Airborne Low Frequency Sonar and other planned systems), with a full load of fuel and sonobuoys and two MK-50 torpedoes, would exceed the maximum weight limit by 195 pounds. The GAO further concluded that antisubmarine warfare missions could require trade-offs between capabilities and endurance or range. The GAO also concluded that the addition of the systems would limit the potential for adding future systems to the helicopter.

The GAO reported that the space requirements of the Airborne Low Frequency Sonar could also affect the operational effectiveness of the SH-60B. The GAO noted that, because Navy specifications require space for a stretcher during a search and rescue or medical evacuation mission, the sonar would have to be removed before beginning such a mission. (pp. 4-6/GAO Draft Report)

Now on pp. 2-3.

Enclosure

DOD RESPONSE: Partially concur. While it is correct that the Block II upgrade, which includes the Airborne Low Frequency Sonar and other planned systems, will add weight to the SH-60B airframe, the upgrades will improve the operational effectiveness of the SH-60B. The SH-60B has two designated primary mission areas, antisubmarine warfare and antisurface warfare. The Airborne Low Frequency Sonar will improve the capabilities of the SH-60B to offset the advantages of quieting submarine technology and small-- third world submarines operating in shallow water. Other Block II systems will provide the SH-60B with improved antisurface warfare classification and targeting capability, as well as improved survivability in a hostile environment similar to conditions encountered in Desert Storm.

The GAO analysis of the added systems weight assumed that the SH-60B would conduct all primary and secondary missions simultaneously. Concurrent multi-mode operations is not a defined requirement of the SH-60B. For example, during a typical antisubmarine warfare mission, the Penguin Missile and missile launch provisions would not be installed, reducing the mission weight by 1,000 pounds. That would enable the aircraft to operate with a full load of 25 sonobuoys, the Airborne Low Frequency Sonar and two MK-50 torpedoes without exceeding the projected maximum operational weight (23,500 pounds) of the SH-60B. Similarly, for an assigned antisurface mission, Airborne Low Frequency Sonar and the sonobuoy launcher could be removed to reduce mission weight by 1,500 pounds, enabling the SH-60B to carry a Penguin Missile and a full load of fuel for maximum range and endurance.

In order to maximize the utility of the helicopter without compromising its operational effectiveness, the Block II upgrade is required to be modular in configuration to meet mission requirements. Modular design goals and standardized avionics interfaces at the mission stores stations will facilitate future system upgrades.

FINDING B: Program is Behind Schedule and Costs Are Not Settled. The GAO also reported that the Airborne Low Frequency Sonar program is currently more than one year behind schedule. The GAO noted that the program office expects to award a full-scale engineering development contract in the fourth quarter of FY 1991, instead of the second quarter of FY 1990. The GAO observed that the production of the sonar system and its subsequent introduction to the fleet will be delayed as well. The GAO also reported that the Navy is revising the $1.2 billion program cost estimate. The GAO noted, however, that the revision will not be completed until a decision is made on whether to continue using the standard USY-2 signal processor and the contract has been awarded. (pp. 6-7/GAO Draft Report)

Now on pp. 3-4.

DOD RESPONSE: Partially concur. The Airborne Low Frequency Sonar program was delayed to enable the program office to

investigate the potential for life cycle cost savings using an alternate signal processor. The competition is now proceeding and a contract award for the Airborne Low Frequency Sonar is expected in the first quarter of FY 1992.

* * * * *

RECOMMENDATION

RECOMMENDATION: The GAO recommended that the Secretary of Defense direct the Secretary of the Navy to assess the trade-offs in the operational effectiveness of the SH-60B helicopter that would be necessary due to the additional weight of the Airborne Low Frequency Sonar and other currently planned systems. (pp. 7/GAO Draft Report)

Now on p. 4.

DOD RESPONSE: Concur. The recommendation is essentially moot, however, inasmuch as the Navy is already in the process of conducting a Cost and Operational Effectiveness Analysis of the Light Airborne Multi-Purpose System (LAMPS MK III) SH-60 helicopter to include the Block II upgrade. Mission scenarios have been developed using mission endurance at the estimated maximum gross weights. That data will provide a basis to assess SH-60B operational effectiveness trade-offs. The analysis will be completed in the first quarter of FY 1992 in preparation for the SH-60B Block II upgrade Milestone II review.

Planned System Upgrades for the SH-60B Helicopter

Weight in pounds

System	Description	Net weight increase
Airborne Low Frequency Sonar	Enhances antisubmarine warfare effectiveness.	550
99-Channel receiver	Increases sonobuoy receiver channel capability.	−2
MK-50 torpedo handling system	Modifies the armament system to accommodate the MK-50 torpedo.	0
Global Positioning System hardware and software	Adds hardware and software provisions for the Global Positioning System.	70
System hardware and software for the Penguin missile	Adds hardware and software provisions to accommodate the Penguin missile.	196
Self-defense systems	Adds side door gun, plume detector with flare and chaff launch, and infrared jamming system.	448
Deployed flight incident recorder	Aids in the reconstruction of accidents.	55
Inverse Synthetic Aperture Radar	Permits standoff classification.	62
Tactical data transfer system	Permits rapid, secure transfer of information between air and surface units.	10

Changes in the Airborne Low Frequency Sonar Program Schedule

Milestone	Nov. 1989 schedule	July 1990 schedule	Apr. 1991 schedule
SH-60F helicopter			
Request for proposal	July–Sept. 89	Jan.–Mar. 90	Jan.–Mar. 90
Full-scale engineering development contract award	Jan.–Mar. 90	Oct.–Dec. 90	July–Sept. 91
Development testing	Oct.–Dec. 92	Oct.–Dec. 92	Oct.–Dec. 93
Technical evaluation	Apr.–June 93	Oct.–Dec. 93	Oct.–Dec. 94
Operational testing	Jan.–Mar. 94	Apr.–June 94	Apr.–June 95
Production decision	Oct.–Dec. 94	Oct.–Dec. 94	Oct.–Dec. 95
Production contract	Oct.–Dec. 94	Oct.–Dec. 94	Jan.–Mar. 96
SH-60B helicopter			
Full-scale engineering development option exercise	Oct.–Dec. 90	Oct.–Dec. 90	July–Sept. 91
Development testing	Oct.–Dec. 94	Oct.–Dec. 94	Jan.–Mar. 95

Airborne Low Frequency Sonar Program Milestones

Date	Milestone
June 1985	Operational requirement was issued for the Advanced Light Weight Sonar system to be installed on the SH-60F helicopter.
November 1986	Acquisition plan was approved for Advanced Light Weight Sonar system development.
January 1987	Funding for the Advanced Light Weight Sonar was not included in the President's fiscal year 1988/89 budget.
June 1987	Revised acquisition plan was approved. The program was restructured to include no-cost advanced development model demonstrations. The system was renamed the Airborne Low Frequency Sonar.
February 1988	Operational requirement was issued for the Airborne Low Frequency Sonar system to be installed on the SH-60B helicopter.
September 1988	Advanced development model demonstrations were initiated at the Naval Air Test Center and the Atlantic Underwater Test and Evaluation Center.
June 1989	Advanced development model demonstrations were completed.
February 1990	Request for proposals was issued.
July 1990	Airborne Low Frequency Sonar development schedule was revised.
April 1991	Development schedule was revised again.

Major Contributors to This Report

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