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Report to the Chairman, Committee on Armed Services, House of Representatives

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ELECTRONIC WARFARE

Inadequate Testing Led to Faulty SLQ-32s on Ships

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GAO

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

National Security and
International Affairs Division

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August 19, 1993

The Honorable Ronald V. Dellums
Chairman
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

This is an unclassified version of a classified report we recently provided to you in response to your predecessor's request that we review the capability of the Navy's SLQ-32 shipboard electronic countermeasures system.

We plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to the Secretaries of Defense and the Navy, the Director of the Office of Management and Budget, and other interested parties.

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

Sincerely yours,

Louis J. Rodrigues
Director, Systems Development
and Production Issues

Executive Summary

Purpose

The SLQ-32 is the Navy's primary electronic warfare system to protect ships against threat missiles. The Navy has spent more than $1.7 billion for the SLQ-32 and plans to spend hundreds of millions of dollars to buy more systems. At the request of the Chairman of the House Committee on Armed Services, GAO evaluated the SLQ-32's performance capability.

Background

Antiship missiles, such as the Exocet used by Iraq in 1987 to attack the USS Stark, pose a serious threat to Navy ships. These missiles can be launched from aircraft, other ships, or land sites at great distances from the targeted ship. Because of the missiles' speed, a targeted ship has only a short time to react with its defenses. Antiship missiles can be readily acquired on the world market.

To protect against these missiles, the Navy relies on weapons, such as the Phalanx gun system, and electronic warfare systems. The SLQ-32 is intended to identify the source of electronic emissions associated with threat systems and provide this information to the targeted ship's crew. In addition, the SLQ-32 has other capabilities that are classified.

Results in Brief

The Navy began procuring the SLQ-32 before ensuring that it would perform satisfactorily. As a result, ships were equipped with systems that were later found to be unsatisfactory by fleet commanders. Despite thousands of design changes to correct deficiencies and improve the system, the SLQ-32's performance capability remains questionable.

This problem stems primarily from the Department of Defense's (DOD) lack of control over the Navy's acquisition process and the Navy's failure to fully disclose SLQ-32 deficiencies. The problem will be further exacerbated if the Navy proceeds with its plans to buy more of these flawed or untested systems.

Principal Findings

SLQ-32 Procured Despite Deficiencies

Early operational testing showed that the SLQ-32's performance was seriously flawed. (The specific problems identified during testing are classified.) Yet the Navy, contrary to the recommendations of its test organization, approved low-rate initial production of the system before

correcting the problems and verifying adequate performance in further tests. Furthermore, the Navy continued low-rate production for 6 years and then authorized full-rate production. By that time the Navy had already procured 320 systems, or about 73 percent of the total programmed quantity planned as of fiscal year 1992.

Navy Ships Equipped With Faulty Systems

The Navy deployed the defective SLQ-32 and repeatedly modified it in an attempt to correct deficiencies and improve performance. For example, in 1984 the Navy procured upgrade kits costing $93 million that proved to be defective. Some were installed in the fleet, and others were placed in storage where they remain. In total, the SLQ-32 was modified over 4,200 times at a cost of over $300 million.

In addition, the Navy lost control of the system configuration and became uncertain as to which configuration was on which ships. This compounded the Navy's long-standing problem of being unable to effectively maintain and support the SLQ-32. Finally, in 1989, the Fleet Commanders rejected further system installations until deficiencies were corrected and additional operational tests were completed. However, the SLQ-32 continued to perform poorly in such tests.

Current SLQ-32 Performance Remains Questionable

The SLQ-32's performance remains questionable, despite the testing of two versions of the system in 1992 that led the Navy to conclude that performance was satisfactory. The tests were insufficient to determine whether the SLQ-32's problems had been solved. For example, previous testing was conducted in a multiple-ship environment, whereas the 1992 tests were conducted in an unrealistic single-ship environment. In addition, some system problems were shown to persist.

Despite its prolonged history of performance problems, procurement and modification of the SLQ-32 have continued unabated. The Navy intends to acquire additional systems and modifications at an estimated cost of $463 million through 1995.

DOD Did Not Exercise Adequate Controls

DOD has not exercised sufficient control over the Navy's acquisition process to prevent procurement of defective systems. DOD relinquished program control to the Navy after approving the Navy's decision to begin system production and imposed restrictions on the production quantity pending satisfactory completion of operational testing. DOD never followed

up to verify that problems had been corrected and exercised no further control over the SLQ-32's acquisition. GAO notes that before the full-rate production decision in 1983, the Navy informed DOD that the system was effective and suitable for deployment but failed to disclose the system's numerous problems. Without adequate internal management controls over the program, DOD relied on incomplete data from the Navy and consequently did not have reasonable assurances that the system would work and funds were being well spent.

Recommendation

GAO recommends that the Secretary of Defense impose controls over the Navy's acquisition process to ensure that the SLQ-32 demonstrates satisfactory performance before any more systems are procured.

Agency Comments

GAO provided DOD a draft of this report for its review and comment. However, DOD's written comments had not been completed at the end of the comment period and, thus, do not appear in this report. However, GAO discussed the contents of this report with responsible DOD and Navy program officials and incorporated their comments where appropriate.

Officials acknowledged that problems had been encountered with the SLQ-32's performance but said that in 1992 the Navy's operational test agency concluded that the system was effective and suitable. GAO's review showed, however, that the tests that purportedly demonstrated that the SLQ-32 was effective and suitable (1) were not conducted under representative combat conditions required to determine whether the system's problems had been solved; (2) omitted tests of the system's maintainability, one of the key factors to be considered in assessing a system's suitability; and (3) excluded tests of major modifications, some of which had previously proven to be defective. Other evidence bearing on the system's current capability, such as the system's ineffectiveness during recent naval fleet exercises, also raises serious doubts about the conclusions based on the 1992 tests and, more importantly, the SLQ-32's performance.

Contents

Abbreviations

DOD Department of Defense

Introduction

Antiship missiles pose a serious threat to Navy ships. These missiles, such as the Exocets used by Iraq in 1987 to attack the USS Stark (see fig. 1.1), can be launched from threat aircraft, other ships, or land sites at great distances from a targeted ship. Because of the missiles' speed, a targeted ship has only a short time to react with its defenses. Antiship missiles can be readily acquired on the world market.

To protect its ships against these missiles, the Navy relies on electronic warfare systems and weapons, such as the Phalanx gun system. The Navy's primary electronic warfare system is the SLQ-32. This system is intended to identify electronic emissions from the missiles and radars of threat systems and provide this information for use by the ship's crew to engage the threat. In addition, the SLQ-32 has other capabilities that are classified.

The SLQ-32 system installed on the USS Stark was only capable of identifying threat systems and providing this information to the crew. According to the ship's crew, the SLQ-32 detected the launch aircraft but did not identify the Exocets.

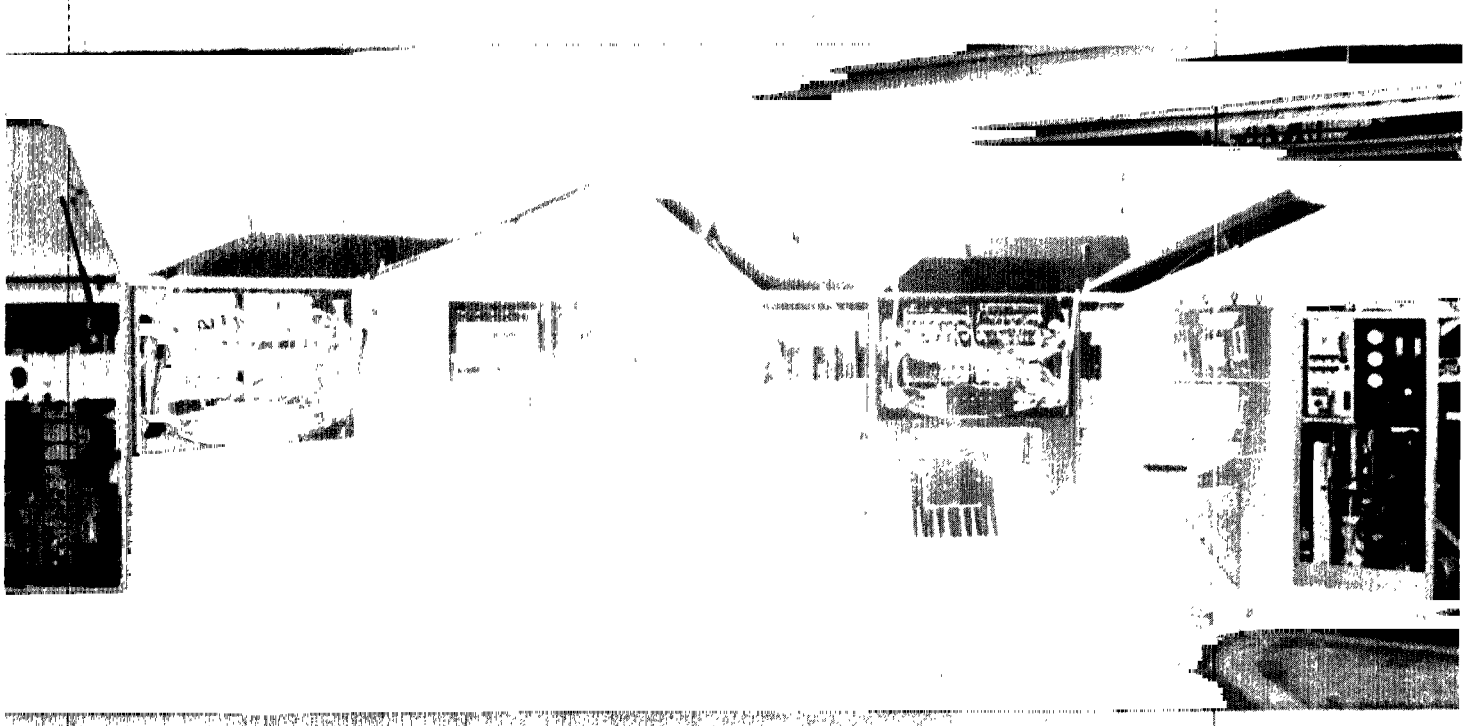
The Navy began developing the SLQ-32 in 1973 and started its production in 1977. The first systems were installed on ships in 1979. The Navy approved the SLQ-32 for full-rate production in 1983. Through fiscal year 1992, the SLQ-32 program cost exceeded $1.7 billion. Additional program costs through fiscal year 1995 are estimated to be about $463 million.

Figure 1.1: USS Stark After Exocet Missile Attack

Source: U.S. Navy.

The SLQ-32 is installed on various classes of ships in five configurations, designated as variants (V)1 through (V)5 (see fig. 1.2). The variants are capable of operating in from one to three frequency bands. For example, (V)1 operates only in band 3 while the (V)3 operates in bands 1, 2, and 3. Bands 1 and 2 provide frequency coverage associated primarily with surface based surveillance radars. Band 3 provides frequency coverage associated with airborne surveillance radars and antiship missiles.

Figure 1.2: SLQ-32 (V)3 System Components



Source: U.S. Navy.

Prior Audit Work

In May 1992, we issued a report focusing on the Navy's planned expenditures in continuing to upgrade the SLQ-32. We reported that the Navy was acquiring SLQ-32s that had not been demonstrated to be effective, that some systems on combat ships were not operationally

ready, and that some equipment was being stored because of performance deficiencies.

We recommended that the Secretary of Defense stop further contract awards until the Navy had completed successful operational tests of the system. The Department of Defense (DOD) partially concurred with our findings but did not agree with the recommendation because a test report published in July 1992, after our interim report, recommended the systems for fleet introduction.

Objective, Scope, and Methodology

The Chairman of the Committee on Armed Services, House of Representatives, requested that we evaluate the performance of the SLQ-32. This report is a follow-on to our May 1992 report on the SLQ-32's performance and focuses on the causes of the SLQ-32's problems.

We conducted our review primarily at the Naval Sea Systems Command in Washington, D.C., and at the Navy Operational Test and Evaluation Force in Norfolk, Virginia. We also visited selected ships in the Atlantic and Pacific Fleets that were equipped with the SLQ-32 (see app. I).

We reviewed test plans and reports, performance requirements documents, acquisition plans, and other records dealing with the acquisition and performance of the SLQ-32. We also discussed the system's performance with Navy personnel aboard the ships and with other responsible Navy and DOD representatives. In addition, we reviewed DOD and Navy policy directives bearing on the management of the program.

Our review was performed from March 1992 through February 1993 in accordance with generally accepted government auditing standards. As requested, we did not obtain written DOD comments on this report. However, we discussed the results of our work with responsible DOD and Navy program officials and incorporated their comments as appropriate.

SLQ-32 Effectiveness and Suitability Not Adequately Demonstrated

The Navy procured the SLQ-32 prematurely without demonstrating that its performance was satisfactory. As a result, ships were equipped with deficient systems. Despite extensive and costly modifications to correct the problems and improve performance, the system was later found unsatisfactory by Fleet Commanders. Although modifications have continued, the current system's performance remains questionable.

This situation resulted primarily from DOD's lack of control over the Navy's acquisition process. The Navy's failure to disclose the system's deficiencies also may have contributed to DOD's lack of control. Unless controls are strengthened, additional unsatisfactory or unproven systems will be acquired.

SLQ-32 Procured Prematurely

Initial operational testing of the SLQ-32 in 1976 showed that its performance was seriously flawed. Yet the Navy, against the recommendation of its test agency, began system production. Even though additional testing showed that modifications to solve the problems were unsuccessful, the Navy continued production and had already procured 73 percent of its fiscal year 1992 programmed quantity when full-rate production was approved in 1983.

Initial Operational Testing Showed Serious System Flaws

The specific serious deficiencies noted during the 1976 operational tests are classified. Despite these deficiencies, the Navy's test agency concluded that the SLQ-32 was effective in that it increased the ship's capability to defeat threat missiles. However, the test agency recommended immediate action to correct design deficiencies and retesting the modified system before starting production.

System Approved for Production Despite Deficiencies

Contrary to the test agency's recommendation, the Navy decided in 1977 to approve production without first correcting the deficiencies primarily because it wanted to allow use of available production funds and avoid a delay in the program schedule. Thus, with DOD's approval, the Navy awarded a 4-year contract with the stipulation that production would be limited to six systems a month pending successful completion of operational testing.

In justifying the decision to award the 4-year contract, the program manager pointed out that the contractor's proposal was based on receiving funds promptly and that waiting until the redesigned system could be

tested to verify correction of performance deficiencies would delay the program at least a year. The program manager also expressed confidence that adequate information on the correction of deficiencies would be available after the first 2 years of production to permit another decision on whether to continue production for the second 2 years. However, by late 1978, no additional operational tests had been conducted. So, the Navy requested funding for the second 2 years of production to avoid having to renegotiate the production contract.

Production Continued Despite Deficiencies Revealed in Follow-on Testing

A series of follow-on operational tests of the SLQ-32 (V)1, (V)2, and (V)3 began in 1979 and was completed in 1982. These tests showed that modifications that were expected to solve the system's problems had not been successful. (Details of the test results are classified.) By then, however, the Navy was already committed to the SLQ-32's production.

On the basis of follow-on testing of the SLQ-32(V)1, the Navy's test agency concluded that the system was not effective as a replacement for systems that the Navy already had. Similarly, follow-on testing of the SLQ-32 (V)2 showed that it was not effective as a replacement for existing surveillance systems.

The Navy's test agency also attempted to conduct follow-on testing of the SLQ-32(V)3 but terminated the tests because of system deficiencies. Testing resumed 14 months later and showed that numerous deficiencies continued to exist. The details about the deficiencies are classified.

The Navy's test agency subsequently conducted additional testing to evaluate the suitability of the SLQ-32 (V)1 and (V)3. The test agency concluded that the systems were suitable and recommended them for full-fleet introduction. However, the tests did not address critical factors, such as the systems' reliability or the numerous performance deficiencies disclosed in prior testing.

No further testing was done on the SLQ-32, and in November 1983 the Navy approved full-rate production of the system. By that time, the Navy had already procured 320 systems, 73 percent of its 430 programmed quantity through fiscal year 1992. Since the full-rate production decision, the Navy has continued to buy new SLQ-32s and major improvements, adding to its inventory additional (V)3s, a newly developed (V)4 for aircraft carriers, and the (V)5 for frigates.

Fleets Equipped With Faulty SLQ-32 Systems

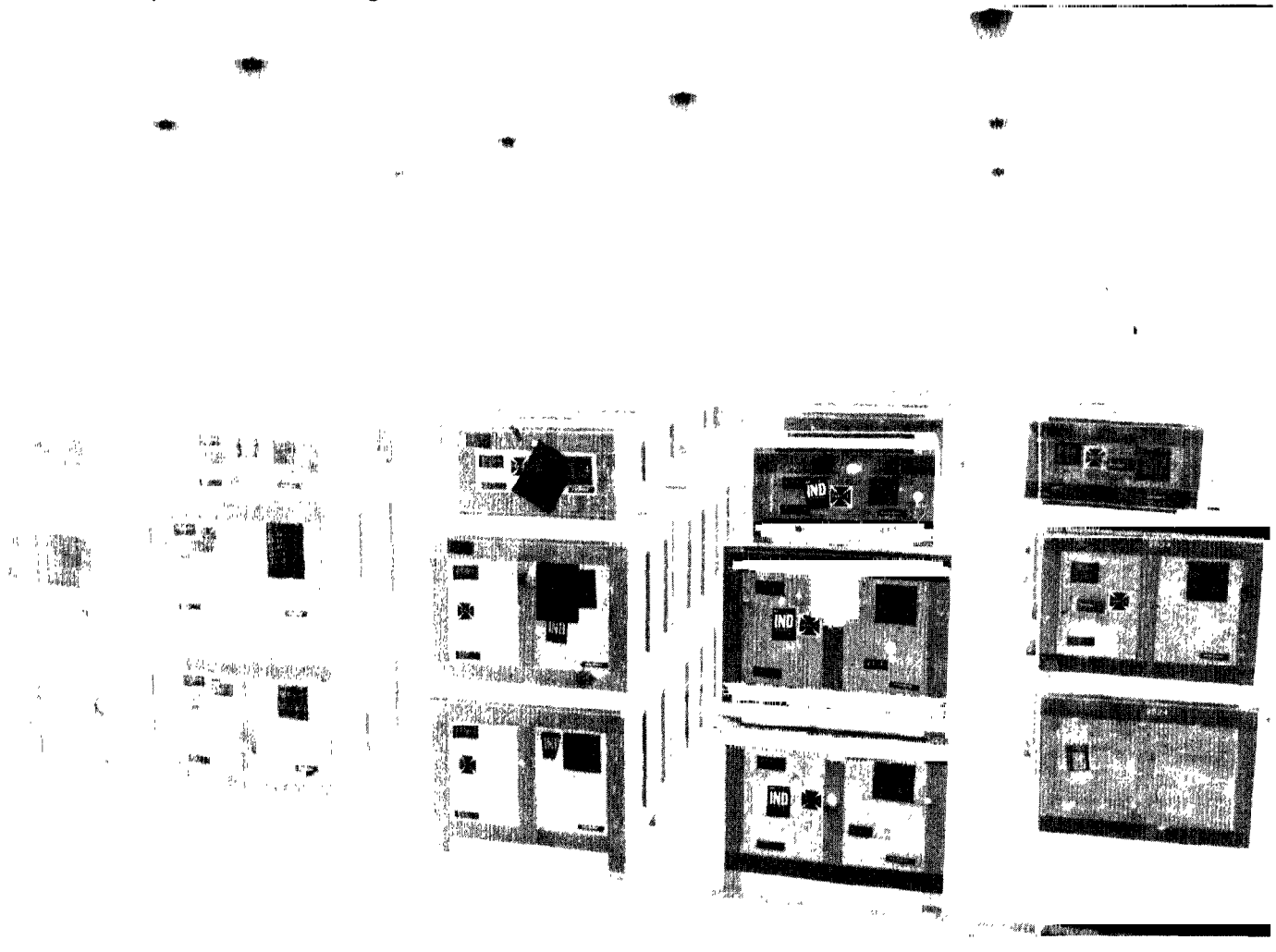
As a result of procuring the SLQ-32 before demonstrating that its performance was satisfactory, the Navy equipped its ships with deficient systems and continued to develop and install modifications without properly testing them. For example, the Navy procured modification kits in 1984 costing $57.5 million for the SLQ-32 (V)1, (V)2, and (V)3 and began installing them on ships even though their performance had not been proven in operational testing.

Similarly, the Navy procured additional Band 1 modification kits costing $35.5 million for the SLQ-32 (V)2 and (V)3 before properly testing them. The Navy began installing them on ships but after discovering numerous deficiencies during developmental tests, halted further installation until tests could be successfully completed. However, some of the kits are being incorporated into systems as they are produced for installation on newly constructed ships. Other kits to be retrofitted on systems already installed on ships are being held in storage (see fig. 2.1). The Navy has not yet scheduled operational testing of the modified system because it is still under development.

Over the years, the Navy has made over 4,200 modifications to the SLQ-32 at a cost of over $300 million. In addition, the Navy has bought 15 of the newly developed SLQ-32 (V)4 systems for aircraft carriers and has installed 11 of them.[1] It does not plan to start operational testing on them until the fourth quarter of fiscal year 1993.

[1]Includes 13 to be installed on ships and 2 to be used for land-based training.

Figure 2.1: Band 1 Improvements In Storage



Source: U.S. Navy.

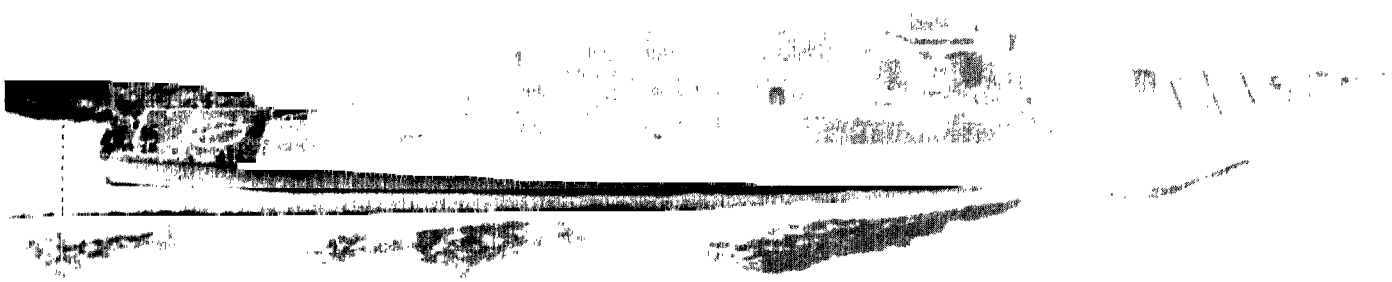
In addition to the performance problems associated with some of these modifications, the large number of modifications caused the Navy to lose track of which configuration of the SLQ-32 was installed on the various ships. The many different system configurations (even within the same variant) installed on ships adversely affected spare parts control, operator training, and technical documentation needed to operate and maintain the system. For example, some ship technicians did not know what parts to

order or how to repair their system because technical manuals and operator training were not updated to reflect the many modifications. This compounded the Navy's long-standing problem of being unable to effectively maintain and support the SLQ-32.

Fleet commanders called a halt to further system installations and modifications in June 1989. Citing unsatisfactory levels of readiness and other major deficiencies, they recommended that modifications that changed the SLQ-32's capability be tested and technical documentation, logistic support, and training be in place before any more installations were made.

Meanwhile, the SLQ-32 continued to perform poorly during subsequent testing. In addition, the system was reported as being deficient during fleet exercises in 1991 and 1992 and during operational testing of a new Navy ship, the USS Arleigh Burke (see fig. 2.2). The detailed results of these tests and exercises are classified.

Figure 2.2: USS Arleigh Burke Guided Missile Destroyer



Source: U.S. Navy.

Current System Performance Remains Questionable

The Navy's test agency conducted an additional operational test of the SLQ-32 (V)3 during 1992. The system demonstrated improved performance over that achieved in prior tests, and the Navy's test agency concluded that it was effective and suitable. However, the tests were too limited to determine whether all of the system's problems had been solved. The tests were not conducted under representative combat conditions as required by DOD policy, omitted tests of the system's maintainability, and excluded defective modification kits now being installed in new production systems.

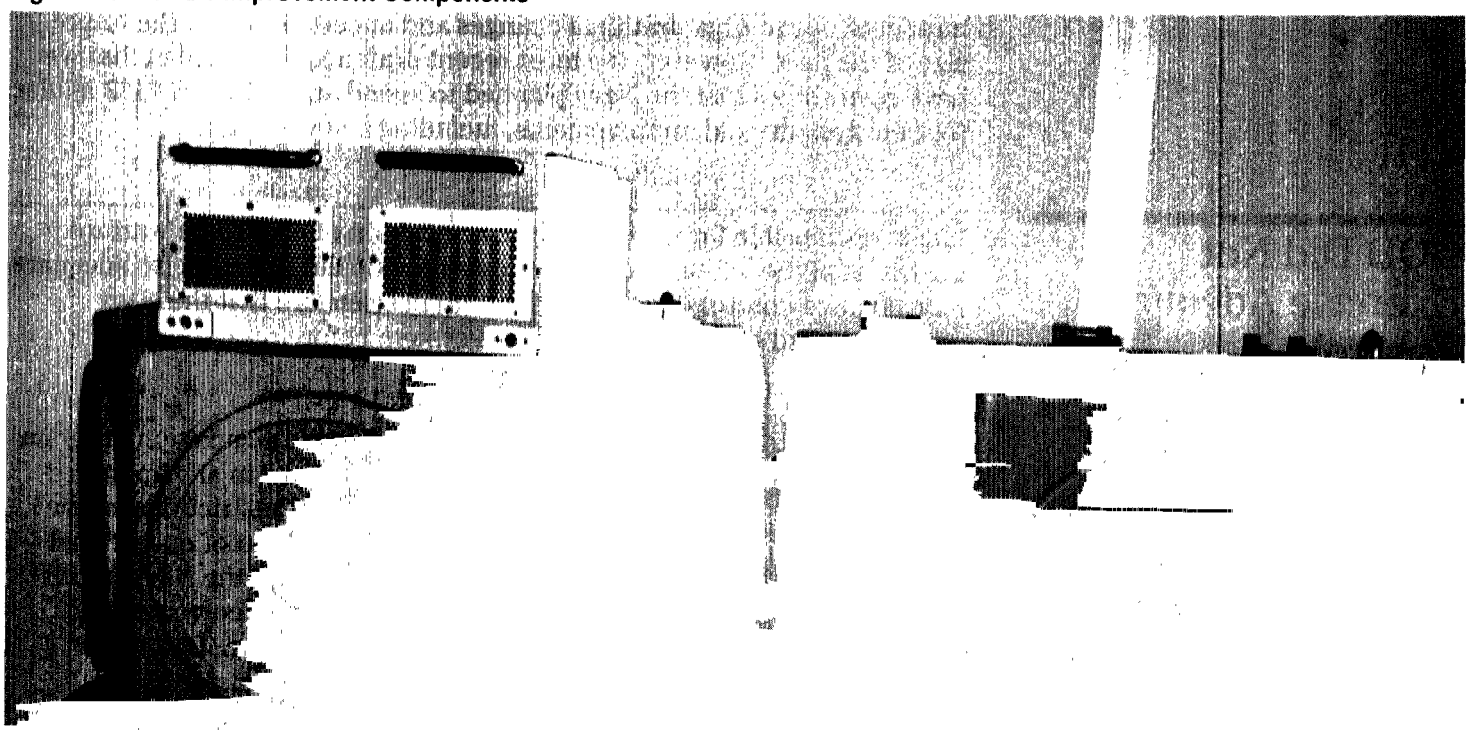
Earlier operational testing of the SLQ-32 (V)3 was conducted in a multiple-ship environment, including friendly and simulated threat ships, aircraft, and land-based missile sites participating in the exercise. These tests created a dense electronic signal environment intended to approximate combat conditions under which the SLQ-32 would be expected to operate. However, the 1992 tests that showed the SLQ-32 (V)3 to be effective and suitable were conducted in a single-ship environment that did not approximate combat conditions or stress the system.

The Navy's experience during Operation Desert Storm demonstrated the importance of operating in a dense signal environment when judging the system's capability. (The SLQ-32's performance in Desert Storm is classified.)

In addition to being conducted in an unrealistic environment, the 1992 tests did not fully resolve issues concerning the system's maintainability, one of the key factors in assessing a system's suitability. Thus, the Navy test agency's conclusion regarding the SLQ-32 (V)3's suitability is questionable. The test agency called for maintainability testing to be conducted in the future.

The 1992 tests also excluded evaluation of Band 1 modifications already installed on some ships and being incorporated into new production systems (see fig. 2.3). The Navy has encountered continuing developmental problems with the modification since procuring it in 1984 and has not yet scheduled operational testing because it is still under development. Despite the test limitations, the 1992 tests showed that some of the SLQ-32 (V)3's problems persist.

Figure 2.3: Band 1 Improvement Components



Source: U.S. Navy.

During 1992, the Navy also conducted initial operational testing of the new SLQ-32 (V)5. This variant consists of the SLQ-32 (V)2 and a jammer. The Navy's test agency concluded that the system was effective and suitable. However, as with the SLQ-32 (V)3, the testing was done in a single-ship environment and excluded full evaluation of the system, the details of which are classified.

The Navy told us that, as of February 1993, its acquisition plans were indefinite due to organizational changes and uncertainties on the future size of the fleet. However, the most recent draft acquisition plan that we have seen shows that the Navy planned to spend an additional $463 million for new systems and improvements, including a new variant.

DOD Did Not Exercise Adequate Controls

DOD is responsible for overseeing the acquisition of electronic warfare programs of the military services. However, DOD did not exercise adequate management control of the SLQ-32 program to ensure that the Navy adequately and successfully tested the system before procuring and deploying it.

In 1977, the SLQ-32 was classified as a major defense acquisition program subject to DOD oversight. Accordingly, DOD participated in and approved the Navy's decision to begin production but imposed restrictions on the quantity to be produced pending satisfactory completion of operational testing. DOD then relinquished control of the program to the Navy in 1983. DOD never followed up to verify that problems had been corrected and exercised no further control over the system's acquisition. Before the full-rate production decision, the Navy informed DOD that additional testing had shown the system to be effective and suitable but did not disclose the system's numerous problems. DOD relied on the Navy when making its decision. However, the ultimate responsibility for good internal controls rests with DOD. Internal controls should provide reasonable assurances that resources are safeguarded against waste, loss, or misuse.[2] In this case, DOD placed undue reliance on the Navy, which did not provide all the information it had.

Conclusions

The Navy procured the SLQ-32 prematurely before demonstrating that its performance was satisfactory. Although additional testing showed that modifications had not solved the problems, the Navy was fully committed to the system's acquisition. As a result, the fleet was equipped with defective systems. After over a decade of procurement and modification, the system's performance is still questionable. Without adequate internal management controls over the program, DOD relied on incomplete data from the Navy and consequently did not have reasonable assurances that the system would work and funds were being well spent. The problem will be further exacerbated if the Navy proceeds with plans to buy more flawed or unproven systems.

[2]Standards for Internal Controls in the Federal Government (GAO 1983).

Recommendation

We recommend that the Secretary of Defense impose adequate controls over the Navy's acquisition process to ensure that the SLQ-32 performs effectively before more systems are procured.

Department of Defense Organizations Visited

Washington, D.C.	Office of the Under Secretary of Defense Chief of Naval Operations Naval Sea Systems Command Naval Research Laboratory Naval Maritime Intelligence Center
Norfolk, Virginia	Commander-in-Chief, U.S. Atlantic Fleet Commander, Naval Surface Force, U.S. Atlantic Fleet Commander, Operational Test and Evaluation Force Surface Warfare Development Group Norfolk Naval Base: USS Bowen (FF-1079) USS Comte De Grasse (DD-974) USS Conolly (DD-979) USS Harry E. Yarnell (CG-17) USS Mississippi (CGN-40) USS San Jacinto (CG-56)
Dahlgren, Virginia	Naval Surface Warfare Center, Dahlgren Division
Crane, Indiana	Naval Surface Warfare Center, Crane Division
San Diego, California	Commander, Naval Surface Force, U.S. Pacific Fleet San Diego Naval Station: USS Cowpens (CG-63) USS Harry Hill (DD-986) USS John Young (DD-973) USS Reid (FFG-30)
Corona, California	Naval Warfare Assessment Center
Honolulu, Hawaii	Commander in Chief, U.S. Pacific Fleet Pearl Harbor Naval Base: USS O'Brien (DD-975) USS Ouellet (FF-1077) USS Rueben James (FFG-57) USS Worden (CG-18)

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