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REPORT TO THE CONGRESS

Improvements Needed In Development Testing

B-163058

Department Of The Navy

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This is our report on improvements needed in the Department of the Navy's development testing.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Defense; and the Secretaries of the Navy, Army, and Air Force.

Comptroller General
of the United States

Contents

ABBREVIATIONS

ASW	antisubmarine warfare
DOD	Department of Defense
DCP	development concept paper
DSARC	Defense Systems Acquisition Review Council
GAO	General Accounting Office
IOT&E	initial operational test and evaluation

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

IMPROVEMENTS NEEDED IN DEVELOPMENT TESTING Department of the Navy B-163058

D I G E S T

WHY THE REVIEW WAS MADE

The General Accounting Office (GAO) made this review to assess development testing on several systems and subsystems essential to the Department of the Navy's airborne antisubmarine warfare mission and the effect of such testing on later phases of system acquisitions.

Airborne antisubmarine warfare systems and subsystems were selected for this assessment because of congressional concern over the threat posed by nuclear submarines and the significant resources committed to meeting this threat.

GAO reviewed one helicopter system and five aircraft sensor systems with estimated total development and production costs of $536 million. The sensors are and will, for years to come, be essential to the mission effectiveness of more than $6 billion worth of antisubmarine warfare aircraft.

Basic facts

The Department of Defense (DOD) classifies two basic types of test and evaluation which provide management with the basis for key program decisions before producing weapon systems.

Development test and evaluation involving development and engineering tests and evaluations conducted or monitored by agencies responsible for development.

Operational test and evaluation involving tests performed by the military operational forces to determine suitability of equipment for service use.

In recent years congressional attention has focused on problems in meeting cost, schedule, and performance targets established for major weapon systems. DOD has responded by stressing the importance of testing hardware before a decision is made to produce it.

Latest DOD policies emphasize the need to improve the operational test and evaluation of major weapon systems. Implementing policies and procedures proposed in the Navy also stress the importance of operational test and evaluation.

FINDINGS AND CONCLUSIONS

GAO found that development testing is capable of disclosing problems and risks early in the acquisition cycle, but the problems were often not resolved and continued into operational testing of the equipment.

Weaknesses were found in the planning, performing, and reporting of development testing and in the use made of the test results. These

weaknesses limited the capability of the equipment and related systems to accomplish their assigned missions.

Development agency managers tended to push successful aspects of test results to justify the decisions to move the development forward, but the problems noted during testing were considered insignificant or best handled later in development.

The Navy often cited pressures exerted by cost and schedule constraints as reasons why (1) development tests were not performed or reduced in coverage and (2) projects were advanced further in development, although solutions to problems identified had not yet been found. GAO also found that:

--Some development tests were performed without plans, and others having plans often lacked a meaningful statement of objectives and criteria describing the technical and performance capability expected at the stage of development being evaluated. (See p. 11.)

--Tests did not always sufficiently cover technical and performance issues related to the operational requirement. (See p. 11.)

--Necessary tests were not always performed or their planned coverage was substantially reduced. (See p. 11.)

--Development test reporting was often divided in a series of memorandums, which, individually or collectively, presented management with little succinct or cohesive information on project status or an assessment of problems and risks relating to the operational requirement for the development. (See p. 22.)

--The test reports often did not clearly state the issues yet to be resolved and the remaining testing required before a given stage of development could be considered successfully completed. (See p. 22.)

GAO recognizes the problems of cost and schedule constraints but believes more attention should be given to allocating resources to deal with technical and performance problems when identified, even if they cause schedule interruptions.

When problems are postponed until later in development or in production, more resources will almost certainly be needed to solve the problems.

Improved management and performance of development test and evaluation would have resulted in better performing, less costly equipment which could have been available to the fleet earlier.

Need for better management is evidenced by the fact that most of the systems have inherent limitations for countering the high-performance nuclear submarine threat--the essential purpose of their development.

Chapters 2, 3, and 4 detail the weaknesses found and their associated effects.

RECOMMENDATIONS

GAO recommends that the Navy take a series of actions to implement a fully responsive control system to

improve development test and evaluation and apply its results early in the decisionmaking process.

--The planning, performing, and reporting of development testing should be directly related to the operational requirement.

--The reporting should identify the problems noted and should provide a clear statement assessing the risks associated with the problems and implications on achieving the operational requirements.

--A method should be developed to track the problems noted in development testing and to fix responsibility for their resolution.

--A lower level review process should be established to control and manage critical systems which do not meet DOD's classification of major systems.

--When less than major systems are essential to the mission effectiveness of a major system, the test and evaluation issues should be related to the review process for the major system.

--Adequate controls should be established over granting waivers from required testing and evaluation for subsystems as well as overall weapon systems.

GAO also recommends that development activities, such as the Naval Air Development Center, establish a test and evaluation section in their organizations. These sections should be independent of the project engineers and be responsible for

--reviewing test plans to insure that they provide full coverage of technical and performance areas set out by the operational requirement and

--reviewing test results and reports to insure that results are clearly stated and that risks associated with the system are presented.

These sections could also provide a focal point for coordinating operational requirements with the Operational Test and Evaluation Force and the development agencies.

AGENCY ACTIONS AND UNRESOLVED ISSUES

In commenting on the GAO report, the Navy agreed with GAO's views on the need for and value of development testing and the importance of sensor performance in airborne antisubmarine warfare.

According to the Navy, DOD's and the Navy's new instructions, increased management scrutiny of acquisition programs, and early involvement of the Operational Test and Evaluation Force will correct many of the problems.

GAO found the Navy's new instructions similar, in terms of basic policy, to those recently superseded. These instructions rely heavily on the early involvement of the Operational Test and Evaluation Force in the development cycle.

There is considerable merit to a policy of early involvement of user representatives--the Operational Test and Evaluation Force. However, it must be put into practice and its success will depend largely on the quality and use made of information received from the development agency.

Additional emphasis will be necessary on the part of the

development agencies to improve their test and evaluation.

Primary areas are the planning, performing, and reporting of test results; attention to proper use of test reports; and greater recognition in test planning to sufficient funding, schedules, and criticality of initial operational capability dates.

The Navy also described actions in process or under consideration to improve test and evaluation management. (See pp. 32 and 33.) These actions seem responsive to several GAO recommendations, but many are not yet operational. The Navy should emphasize these areas and provide controls and reviews necessary to insure compliance at all levels.

The Navy said the practice of indiscriminate granting of waivers was effectively curtailed. However, GAO noted that problems persisted in this area. GAO maintains its belief, as expressed in previous reports, that greater effort is required to control waivers of required test and evaluation.

For detailed discussion of the Navy's reply, see chapter 6.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Some reordering of priorities may be desirable to reduce cost and schedule pressures on the development and testing of sensors caused by the pace of new antisubmarine warfare aircraft programs.

Because of the important role which sensors play in the effectiveness of these aircraft and the inherent limitations of current sensor systems against high-performance nuclear submarines, the Congress may want to question whether DOD is placing appropriate emphasis on development of needed sensor capabilities compared with the production of new antisubmarine warfare aircraft.

CHAPTER 1

INTRODUCTION

The investment to acquire weapon systems and equipment requires a large allocation of the Nation's resources. Weapon systems flow from a highly structured and complex development process which involves substantial interaction between users and developers. Since past efforts of the Department of Defense (DOD) in developing new weapon systems and equipment have often fallen short of complete success, many studies have been and are being made to identify the problems and find solutions to improve the acquisition process.

In response to congressional requests we began a program to provide annual reports on weapon systems. From this ongoing work, we have identified specific areas for special attention. We reported on one of these areas, "The Importance of Testing and Evaluation in the Acquisition Process for Major Weapon Systems" (B-163058, Aug. 7, 1972), we also reported on the importance of adequate testing for other weapon systems and subsystems, "Better Management Needed Over Decisions to Start Full-Scale Development of Minor Weapons Systems" (B-163058, Oct. 6, 1972).

This report presents the results of our review of a number of related systems and subsystems, most of which do not fall into the category of major weapon systems, and is limited in scope to development test and evaluation.

We examined the Department of the Navy's development testing at activities responsible for developing and testing airborne antisubmarine warfare (ASW) weapon systems and equipment, particularly the electronic sensors used by ASW aircraft to detect submarines and provide vital targeting data. We selected the ASW area for test and evaluation because:

--Congressional interest in ASW is high.

--A submarine threat exists, which is claimed to be extremely menacing.

--The problems faced in the ASW area are difficult and their solutions are important to the Navy's success in dealing with the threat.

--Improvements in ASW capability have been costly and gradual.

The items selected for review were mission essential systems and subsystems whose performance has affected and will affect the Navy's overall ASW capabilities. The items reviewed and the ASW aircraft and ships affected by these items are shown on page 36.

TEST AND EVALUATION

Test and evaluation plays an important role throughout the development process. It also continues after the weapon system has been produced and provided to the various users. The test and evaluation function is one of management's key controls during the development process. It provides a basis for measuring progress in achieving technical and performance goals, exposes weaknesses, and helps define needed improvements. If test and evaluation is properly planned, performed, and reported, it provides visibility to areas requiring more or less concentration of resources.

The Chief of Naval Material, usually through his development agency, the Naval Air Systems Command, sponsors the development testing of airborne ASW equipment. This testing is done to find out how well development is progressing; whether development should continue and, if so, how; and whether the equipment can be mass produced. It begins with tests of feasibility and initial design. It culminates late in development with the technical evaluation performed by the Naval Air Development Center or by the development agency's field activity for aircraft test and evaluation, the Naval Air Test Center. The technical evaluation determines whether a system or equipment meets design specifications and is functioning in an acceptable manner. This evaluation should demonstrate a high level of probability that minimum requirements for the development

will be met. On this basis the development agency certifies the equipment ready for operational testing.

Operational test and evaluation provides the basis for a production decision. This testing is performed on weapon systems or equipment under operational conditions to determine (1) whether an item meets performance requirements, (2) its suitability for service use, and (3) appropriate tactics. The primary form of operational test in the Navy is the operational evaluation. The Operational Test and Evaluation Force makes this test independently of the development agency, and reports to the Chief of Naval Operations concerning the acceptability of the system or equipment for service use. The final decision, however, rests with the Chief of Naval Operations.

Appendix I shows the organization of Navy activities involved in airborne ASW research, development, test, and evaluation.

TEST AND EVALUATION IN DEVELOPMENT PROCESS

The normal plan for developing equipment involves several steps.

1. Establishing the requirement involves determining why the development is needed and what is required to satisfy the need. The "why" concerns a present or an anticipated problem, such as a threat, an operational deficiency, or an opportunity to take advantage of a new technology found during earlier research and development. The "what" concerns basic performance characteristics needed to insure acceptable mission performance, such as range, detection or kill probability, speed, and accuracy. Minimum performance levels are set for acceptance to restrain spending for marginal increases in capability at the end of development.

2. Performance specifications evolve from the operational requirement. Prototype equipment is developed and tested in environmental chambers and under other controlled laboratory conditions. Although still early in development,

this equipment is usually tested at sea or installed in "test bed" aircraft to evaluate performance against submarines or simulated targets.

3. After the design has advanced enough to represent the final product, models are built for technical evaluation, which involves engineering tests of technical and performance characteristics. These evaluations usually include flight tests against submarines to determine the level of probability that the equipment will fulfill the operational requirement.

ROLE OF ASW DEVELOPMENT LABORATORY

The Naval Air Development Center plays a key role in developing airborne ASW equipment for the systems command, especially the sensors and other aviation electronics used for detecting, tracking, and targeting submarines. The Center has no organizational element having overall responsibility for the planning, performing, and reporting of development testing. Rather, engineers assigned to development projects determine the scope, objectives, and specific points to be tested as well as the test conditions. They also perform the tests and prepare test reports. The Naval Air Systems Command program or project managers provide overall guidance on these matters.

This laboratory conducts the testing as an integral part of developing an equipment or system to

--demonstrate scientific and engineering concepts and corroborate laboratory effort,

--evaluate feasibility and performance of equipment of through laboratory and flight testing at various stages of development, and

--make technical evaluations for the systems command after the feasibility stages of development are completed.

VALUE OF DEVELOPMENT TEST AND EVALUATION

Since this testing is performed from the beginning of the development process until the operational evaluation, information can be available before commitments have become too large and schedules too fixed and when options are at a maximum and changes are least costly. Also, when development testing is performed early, it identifies problems which otherwise may continue for years and adversely affect cost, schedule, and performance at a time when adjustments are difficult.

An important point is that development tests and evaluations, if properly planned and performed, should provide insights into the eventual operational suitability of equipment. In fact, the development agency should predict the extent of deviations from the operational requirement when it certifies equipment ready for operational evaluation.

The value of development test and evaluation of airborne ASW equipment should flow from answers to several questions.

How good is development test and evaluation?

--Does it relate technical progress to the operational need which dictated the development and does it assess that progress?

--Is it planned, performed, and reported in a way which identifies weaknesses and risks as well as strengths?

How well is development test and evaluation used in managing the development?

--Does management insure that sufficient tests are performed?

--Are management decisions directed to solving problems identified by testing?

Chapters 2, 3, and 4 discuss our assessment of development testing of one helicopter program and five aircraft subsystems which represent many of the latest developments in primary mission sensors for current and near-future ASW aircraft. The methods used to approach the review and select cases, as well as the scope, are described in chapter 7.

CHAPTER 2

IMPROVEMENTS NEEDED IN PLANNING AND PERFORMING DEVELOPMENT TESTING

Testing is capable of disclosing problems and risks early in the development cycle, but the issues were often not resolved and continued into operational testing. The development projects we reviewed needed improvements in

--planning and performing development testing and

--reporting and using development test results.

Weaknesses in these areas adversely affect the development and the mission capability of new ASW items, increase development and production costs, and/or delay the availability of new equipment to the fleet.

The effects associated with weaknesses in development test and evaluation and the impact of cost and schedule pressures are covered in chapter 4.

Some development tests were performed without plans, and others having plans often lacked a meaningful statement of objectives and criteria describing the technical and performance capability expected at the stage of development being evaluated. Tests did not always sufficiently cover the technical and performance issues related to the operational requirement; sometimes they were not performed at all; and, in other cases their planned coverage was substantially reduced.

Planning and performing development testing could be improved by placing more emphasis on the relationship of the development's operational requirement to the evaluation criteria which should be included in test plans when design feasibility studies and technical evaluations are made. Equipment may not satisfy all operational requirements during early development testing; however, testing should be directed to measuring performance against operational requirements so that the development's potential can be assessed and its strengths and weaknesses can be identified.

AN/SSQ-50 SONOBUOY SYSTEM

This system consists of aircraft electronic equipment and expendable sensor units called sonobuoys. Sonobuoys are launched from aircraft and radio submarine target information back to the aircraft. Since the sonobuoy is commanded from the aircraft and sound is radiated into the water by the sonobuoys to detect targets, the system is referred to as the Command Active Sonobuoy System. (See p. 14.)

This system was originally developed to provide ASW aircraft with the capability to detect, track, and attack high-speed, deep-diving, quiet-running submarines--the expected nuclear submarine threat from 1965 to 1975. The AN/SSQ-50 sonobuoy is not yet operational.

The total system's ability to locate, track, and target submarines hinges on several important areas stipulated by its operational requirement. For example, it must be able to detect and track submarines at various speeds and depths, to attain specified detection ranges and reliability, and to operate in a wide range of sea conditions.

The development laboratory prepared a test plan for studying the sonobuoy's design feasibility and technical evaluation. The plan's stated objective was "Evaluation of Command Active Sonobuoy System." However, it did not include a statement of the evaluation criteria to be applied or set out the critical issues which would have to be addressed during the testing.

Although the planned tests were not completed because of schedule pressures, the Naval Air Systems Command certified the sonobuoy ready for operational evaluation. At this point the tests had not fully covered several areas of the operational requirement, including performance in heavy sea conditions and against high- and low-speed targets. The sonobuoy's performance was degraded by many technical problems, and its reliability of 69 percent was far below the operational requirement. Also the system's technical performance could not be evaluated because its airborne unit intended for processing radio signals was unavailable during the technical evaluation and a substitute processor had to be used. Therefore it was difficult to attribute the technical problems to the sonobuoy or to the substitute processor.

The system's operational evaluation was started but had to be interrupted for 7 months because of its poor performance under conditions which were not adequately tested during development testing and because of problems which were identified in earlier tests but which were not corrected.

AN/SSQ-62 SONOBUOY SYSTEM

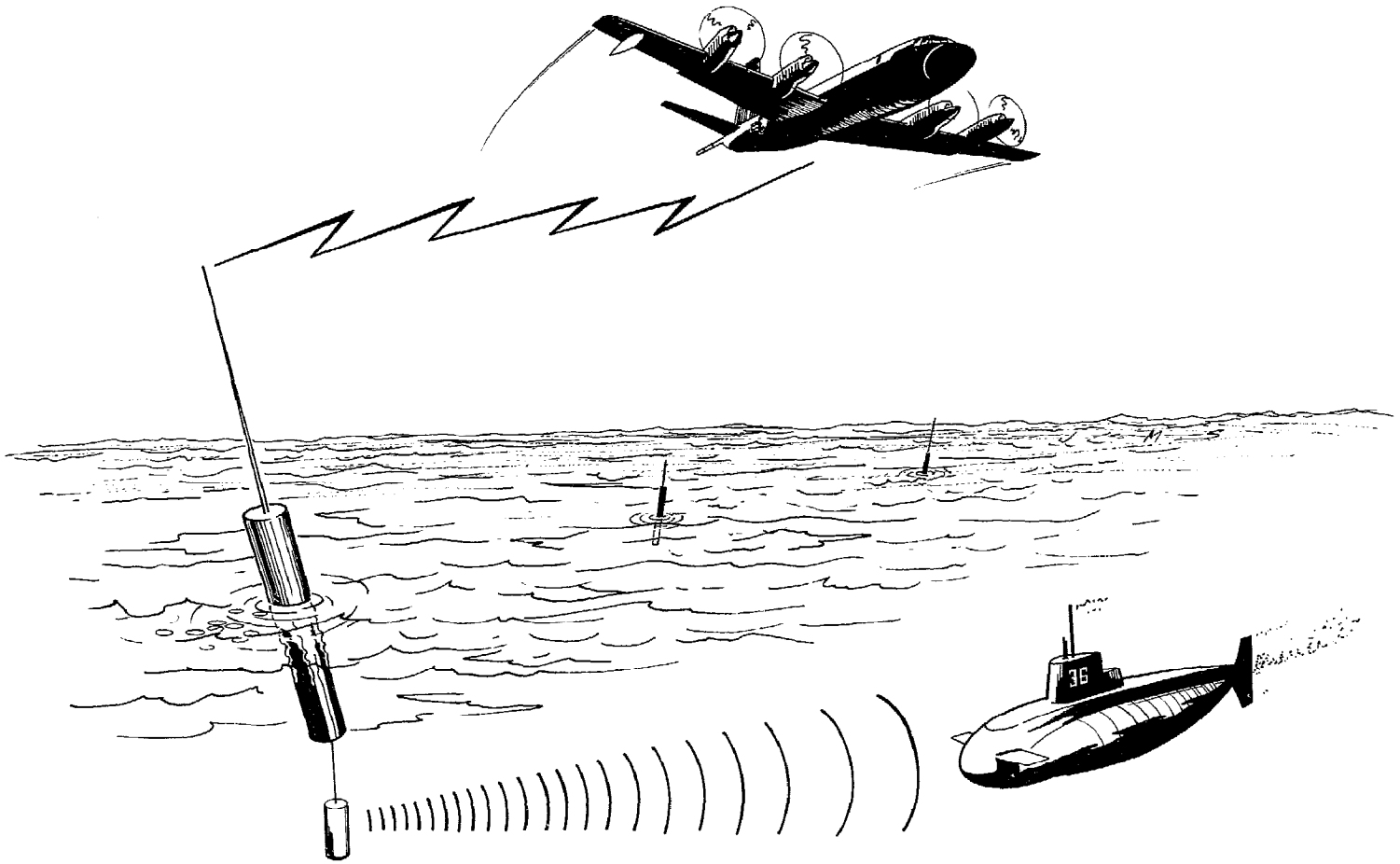
This sonobuoy is the sensor portion of the Directional Command Active Sonobuoy System. It is a follow-on development to the AN/SSQ-50 sonobuoy since it provides range and direction information. (See p. 14.) When development began in 1967, the system was intended to cope with the Soviet submarines which were expected to become a threat during 1972-77. Its design feasibility is still being tested by the Naval Air Development Center, although contracts have been awarded for technical and operational evaluation models.

Testing before contract award did not fully address the critical operational requirements. The development laboratory's testing of design feasibility models primarily concerned the directional feature of the system's sonobuoy on the premise that other operational requirements for detection range and the ability to operate in a broad range of sea conditions against submarines operating at various speeds and depths had been proven feasible by the AN/SSQ-50 sonobuoy's performance. Therefore the feasibility testing did not cover the complete range of sea conditions or target speeds and depths stipulated by the operational requirement. This appears questionable since (1) the AN/SSQ-62 design is different from the AN/SSQ-50 design and (2) the Operational Test and Evaluation Force was not satisfied with the AN/SSQ-50 system's performance capabilities for several of the AN/SSQ-62's characteristics which were not tested.

SH-2D LIGHT AIRBORNE MULTIPURPOSE HELICOPTER

This system was developed to extend the range capabilities of destroyer-type ships by having helicopters operate from their decks against submarines and vessels carrying antiship missiles. (See p. 16.) The helicopter was developed by reconfiguring an existing aircraft, primarily by adding ASW and antiship missile defense avionics, such as radar, a threat-warning receiver, magnetic airborne

COMMAND ACTIVE SONOBUOY SYSTEM AND DIRECTIONAL COMMAND ACTIVE SONOBUOY SYSTEM



NOTE: COMMAND ACTIVE SONOBUOY SYSTEM (CASS) PROVIDES DATA ON RANGE TO THE TARGET, WHILE DIRECTIONAL COMMAND ACTIVE SONOBUOY SYSTEM (DICASS) PROVIDES RANGE AND DIRECTION INFORMATION.

detection equipment, sonobuoys, and air and ship communication equipment.

The system's history shows the adverse effect of schedule pressures on development testing and the lack of evaluation criteria describing its expected performance capability. The preliminary evaluation testing[1] to determine the readiness of the helicopter to undergo service acceptance trials[2] lasted only 2 weeks. This testing identified numerous deficiencies in equipment which had not been previously technically evaluated. Reliability and maintainability could not be evaluated sufficiently because of the limited number of operating hours during the testing period and major differences between the testing environment and the planned shipboard environment. The Naval Air Test Center concluded that the helicopter was not ready to undergo formal acceptance trials and recommended that certain items be replaced by more current equipment.

The Navy began acceptance trials a month after the preliminary evaluation and before the deficiencies were corrected. These tests, performed from August to October 1971, also disclosed major deficiencies in the helicopter. According to the Board of Inspection and Survey, the trials were hindered by the lack of meaningful evaluation criteria for the individual equipment and the total helicopter system. As a result those involved in the testing were forced to rely on their judgment in establishing performance goals for assessing the helicopter's mission capability. The Board concluded the system would not achieve a satisfactory level of mission effectiveness because of major deficiencies in the weapon system and its equipment.

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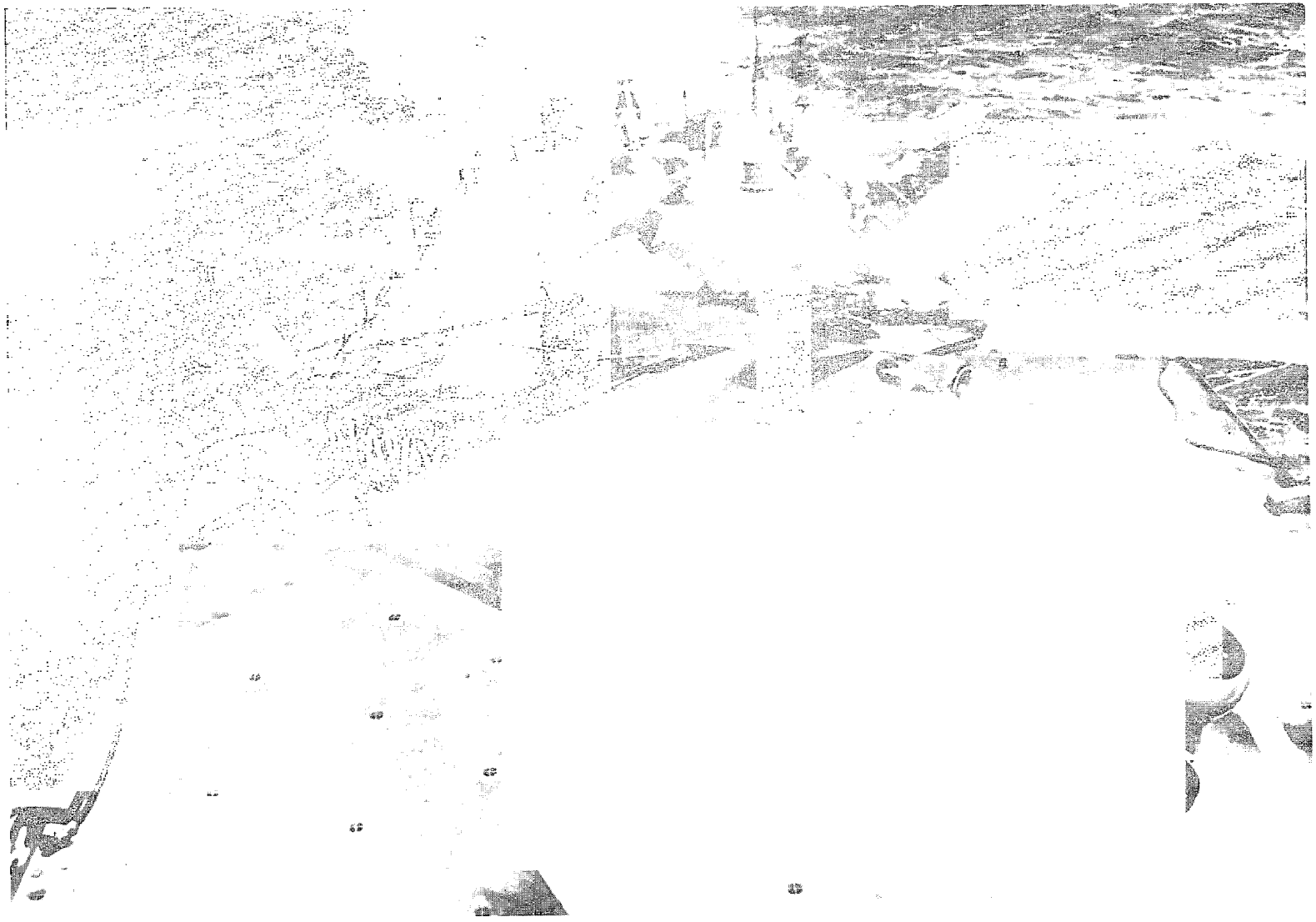
[1]A term used to denote a series of development tests on Navy aircraft which are analogous to a technical evaluation.

[2]The Board of Inspection and Survey conducts these trials to determine (1) if contract requirements are fulfilled, (2) whether the aircraft is able to carry out its intended mission, and (3) which design features should be avoided.



INTEGRATED MAGNETIC AIRBORNE DETECTION SYSTEM

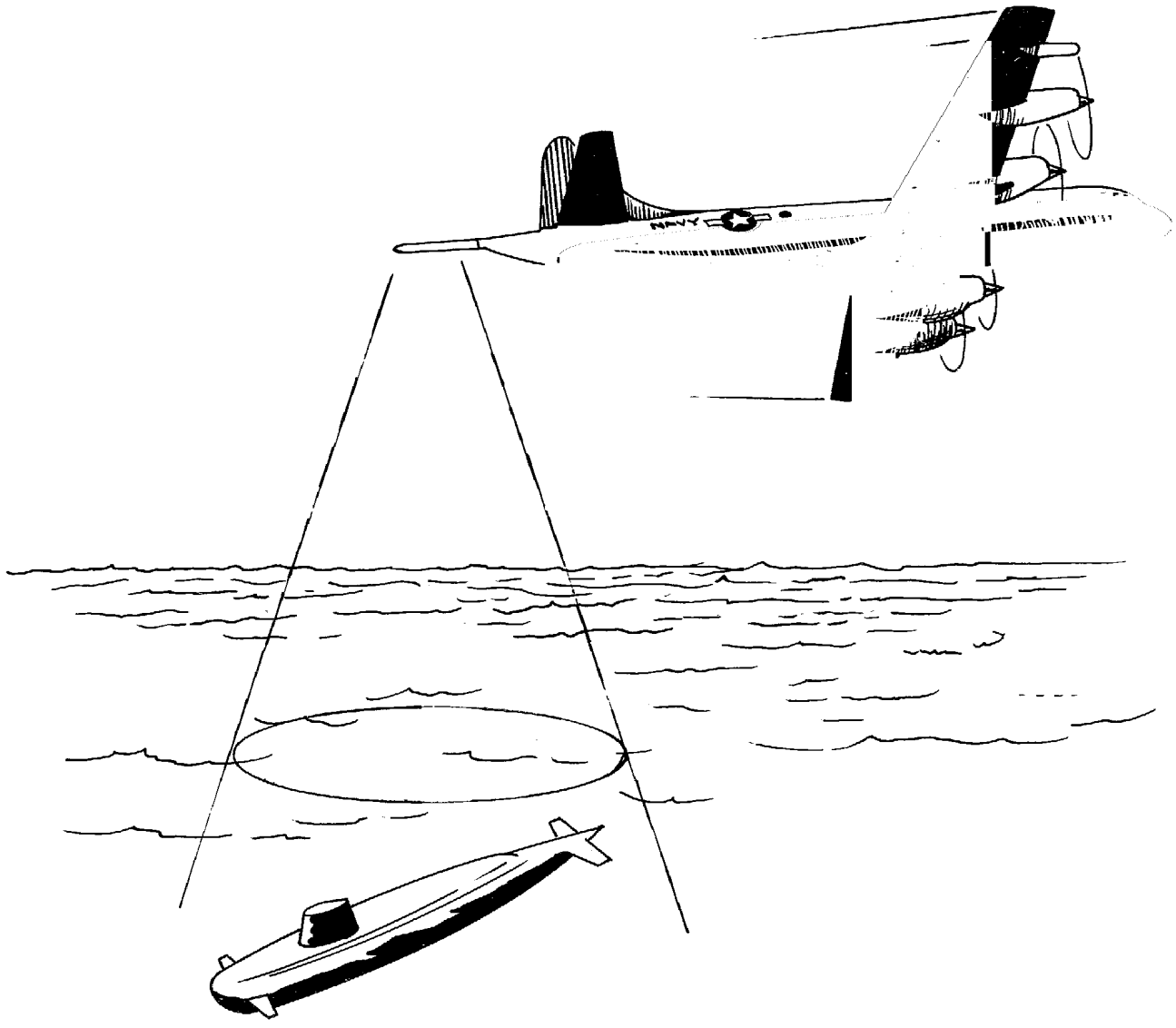
This system detects targets by measuring the variation in the earth's magnetic field caused by the submarine's presence in the area. (See p. 18.) It was developed to provide ASW aircraft with increased detection capability over previous magnetic detection systems, primarily against deep-diving, fast submarines. The operational requirement dictated the need for a specific minimum detection range to operate satisfactorily against a high-performance submarine.

The system's detecting unit, the AN/ASQ-81, measures and records variations in the earth's magnetic field, and other units compensate for magnetic variations caused by aircraft maneuvers and provide automatic recognition of submarine contacts. One of these units is expected to be replaced in a few years with a more advanced processor. Until this is done, the system will not satisfy its minimum performance requirements.

The system's development testing history shows a lack of planning and insufficient testing. The development laboratory did not prepare a test plan for the technical evaluation leading to the system's certification for operational evaluation. Flight testing during the technical evaluation did not cover a full range of severe operational environments known to affect technical performance, although it did show that without design improvements the performance requirements could not be met. Development engineers said that they were not able to make all desirable testing because of cost and schedule pressure. The system was certified ready for operational testing, even though there were known performance problems. As a result, operational testing was suspended for about a year, while the equipment was being redesigned.

One problem was the inability to adjust the system to compensate for changes in magnetic noise. The Naval Air Development Center was aware of this problem during the technical evaluation but considered it minor because the technical experts were able to make the adjustment. Another problem was unsatisfactory operation in certain geological areas. This problem was not fully explored during development testing. Although the system is being installed in

INTEGRATED MAGNETIC AIRBORNE DETECTION SYSTEM



current aircraft, planning studies for a future ASW aircraft show that the system's performance capability will have to be increased significantly to handle the high-performance submarine threat for which it was designed.

AN/APS-116 AIRBORNE ASW RADAR SYSTEM

The planning and performance of development testing for this radar seemed to be adequately managed. This radar will be used in the S-3A aircraft. (See p. 20.) From one development stage to the next, testing was directed to identifying problem and risk areas and evaluating technical and operational performance against the system's operational requirement. The development test program progressed from shore tests of an experimental model to shore and flight tests of a more advanced design and finally to flight tests of the service test model during technical evaluation. Planned tests were not canceled or reduced in coverage.

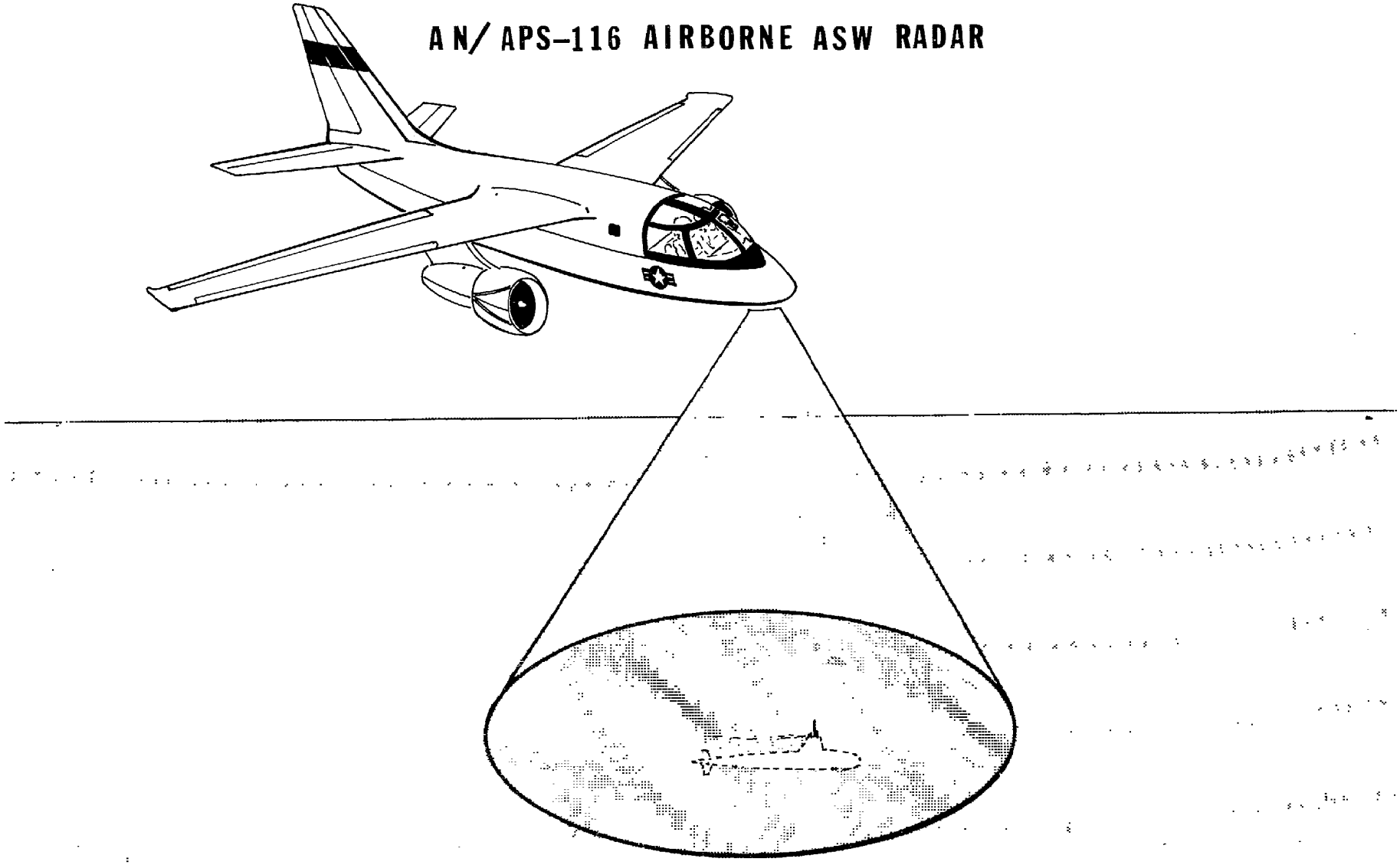
The following comments concern the Naval Air Development Center's test plan for the experimental model. They are indicative of the adequacy of the development laboratory's planning throughout the testing program for this system.

1. The plan included a meaningful objective statement pointing out that, to properly assess performance and the technical feasibility of further development, performance of the system would have to be compared with its operational requirement and technical specifications.

2. Evaluation criteria were specified and based on important performance characteristics of the operational requirement. The plan detailed tests and conditions necessary for covering the various performance characteristics.

3. Proficiencies and deficiencies would be clearly identified, and test emphasis would be placed on analyzing areas of unsatisfactory performance. Recommendations for correction were required for all deficiencies noted.

AN/APS-116 AIRBORNE ASW RADAR



For the experimental model tests, the radar was placed on a cliff overlooking the ocean to simulate its eventual airborne environment. Although early in development, the radar was tested against the types of targets and ranges stipulated by the requirements for the development.

CHAPTER 3

IMPROVEMENTS NEEDED IN REPORTING AND USE OF DEVELOPMENT TEST RESULTS

Development test reporting was often divided in a series of memorandums. Individually or collectively, the memorandums presented management with little succinct or cohesive information on project status or an assessment of problems and risks relating to the operational requirements for the development. Test reports often did not clearly state the issues yet to be resolved and the remaining testing required before a given stage of development could be considered successfully completed.

Development agency managers tended to push successful aspects of test results to justify decisions to move the development forward, but the problems noted during testing were considered insignificant or best handled later in development. Often these problems which were not resolved took on major significance during operational testing and halted the evaluations for many months while equipment redesigns were attempted.

Reporting and use of test results should be improved, to place emphasis on the problems and risk areas in the development and to insure the concentration of effort in tracking the status of problems and assuring their resolution.

AN/SSQ-50 SONOBUOY SYSTEM

The Naval Air Development Center's technical evaluation reporting for this system consisted of several trip reports pertaining to periodic at-sea tests conducted during development. The individual test reports identified technical problems for each unit considered unsatisfactory. However, the reports generally did not summarize the status of test results relating to the various operational requirements for the development and did not assess the significance of performance problems which were encountered. In fact, the reports did not provide the basis for classifying the performance of units as satisfactory.

Some problems that were noted during development testing, but not solved, continued into operational testing. The sonobuoy's reliability was substantially below the 80-percent prerequisite set for technical evaluation approval, and a number of other problems still existed. However, the development laboratory expressed confidence that the deficiencies could be corrected and concluded that completing all the technical evaluation testing would unnecessarily delay the operational evaluation. Although the Naval Air Systems Command recognized this and knew that only half of the units acquired for technical evaluation had been tested, it certified the sonobuoy ready for operational testing.

The operational evaluation was started but had to be suspended for 7 months because of problems with the sonobuoy and its related aircraft equipment. Reliability was poor, and the sensor's performance was degraded in certain ocean environments. Some of these problems were known during development testing. A program was started to investigate the deficiencies, and some remedial action was taken. Although the cause of poor performance was not fully determined, the development agency recommended that operational testing be restarted.

The operational evaluation was restarted, but, when it was concluded, the Operational Test and Evaluation Force found that essentially the same problems which led to suspending testing were still present in the system. The Force concluded that the system could not fully meet its performance requirements for tracking submarines. It also concluded that the system provided significant tactical advantages over the sensor currently used. However, the Force recommended that the system not be accepted for service use until its reliability was improved and demonstrated.

AN/SSQ-62 SONOBUOY SYSTEM

The development agency used those portions of test results which seemed to push the successful aspects of limited testing to justify moving the development forward. In February 1972, when the decision was made to purchase models for the technical and operational evaluations, the AN/SSQ-62

sonobuoy's design feasibility testing had not been completed. Also two versions of this sonobuoy had been built, and each had a different method of data transmission within the sonobuoy. The version purchased for later technical and operational evaluation comprised less than 10 percent of the units tested during the feasibility study, and none of these met all of the limited requirements. Nevertheless, the Naval Air Systems Command justified the purchase on the basis that preliminary testing supported the new design and the performance of the other version of the sonobuoy met the operational requirements. However, as mentioned earlier, neither version had been tested against all operational requirements.

AN/APS-116 AIRBORNE ASW RADAR SYSTEM

As found with test planning and performance for this system, the development laboratory's reporting of test results was appropriately handled. At the end of each major test program during development, test data was analyzed and incorporated in formal reports. These reports contained clear statements on the program's status and on conditions under which the development should proceed. Problems and risk areas were summarized, and recommendations were made for improvements to the system.

The reporting was oriented to assessing the technical and operational performance against evaluation criteria provided by the operational requirement specifications. For example, the operational requirement did not clearly state detailed criteria for one important characteristic to be used in evaluating radar performance capabilities. However, the technical evaluation fully covered this characteristic and showed the degradation of this variable on the system's performance capability.

CHAPTER 4

EFFECTS OF WEAKNESSES IN DEVELOPMENT TEST AND EVALUATION

It is difficult to measure the effects of weaknesses in development test and evaluation. However, the effects are significant, and better management and performance of the development test and evaluation would have resulted in better performing, less costly equipment which could have been available to the fleet earlier. Increased management attention is warranted even for the relatively inexpensive systems since they can seriously affect the ASW mission capability of multi-million-dollar aircraft. The added effect can be seen from investment estimates for the sensor systems reviewed. Estimated development costs are about $64 million, and production costs are about $202 million; however, the performance of these sensors will directly affect more than $6 billion worth of ASW aircraft.

The AN/SSQ-47 sonobuoy has had extensive use in ASW fleet operations. Reliability problems noted early in development testing were not resolved and continued throughout development and operational testing. Shortly after this sonobuoy was put into use, the fleet expressed concern over its unsatisfactory reliability since the P-3C aircraft depended greatly on this sensor. The aircraft's cost is a many-thousand multiple of the sonobuoy's cost. In this case, the Navy undertook an intensive program to improve the sensor's reliability.

Since the remaining projects reviewed either have not been delivered to the fleet or have not been in use very long, the best performance yardsticks available are the results of recent operational testing. These tests show that, except for the AN/APS-116 radar, the systems have shortcomings when measured against operational requirements.

Operational test reports show that the AN/SSQ-50 sonobuoy system could not fully meet its performance requirements. The Operational Test and Evaluation Force found

--severe performance degradation in certain ocean environments,

--average maximum detection range below the operational requirement,

--unsatisfactory reliability for the sonobuoy, and

--unsatisfactory mean-time-between-failure for the signal processor.

The integrated magnetic airborne detection system was not adequately tested in development to determine the severity of the problems. After initial operational tests showed a need for redesign, the improved equipment did not meet minimum performance requirements, even under favorable test conditions. Although the system is being installed in current aircraft, planning studies for a future ASW aircraft show that the system's performance capability will have to be increased significantly to handle the high-performance submarine threat for which it was designed.

Since the SH-2D helicopter was deployed in December 1971, the results of operational testing confirmed the unfavorable conclusions of earlier acceptance testing.

Although it can be argued that each item represents a performance advancement, the systems have inherent limitations for countering the designated threat. Needed improvements are underway or being developed for most of the systems.

COST AND SCHEDULE CONSTRAINTS

The problems of cost and schedule constraints in the weapon system acquisition process have long been recognized and frequently have been reported. Pressures exerted by these constraints were often cited by the Navy as reasons why

--development tests were not performed or were reduced in coverage or

--projects were advanced further, although solutions to problems identified had not yet been found.

Although these constraints are real problems, more attention should be given to allocating resources to deal with

technical and performance problems when identified, even if they cause schedule interruptions. When problems are postponed until later in development or in production, more resources will almost certainly be needed to solve the problems.

Under unusual circumstances, a serious threat may require condensing test schedules and accepting some risks to lessen the time that normally would be spent in development. Such action was not warranted for the situations discussed in this report. When such situations do occur, the risks of limited testing should be clearly disclosed to top level management in terms of cost, capabilities, and effects on related systems and the condensed program should be formally approved at the appropriate level.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

If problems are not disclosed by development testing or if they are disclosed but not properly assessed and afforded the visibility necessary to insure their resolution, they are passed over to be faced later when correction is more difficult and costly. More important, if equipment problems are not resolved before delivery to the fleet, ASW operations can be adversely affected. Costly programs often follow to identify necessary improvements for systems already deployed, or the Navy may consider a new development program to better handle the same threat.

We believe that improving development test and evaluation should be emphasized, particularly for mission essential subsystems not afforded the status and visibility of DOD's review process[1] for major systems.

RECOMMENDATIONS

We recommend that the Navy take a series of actions to implement a fully responsive control system to improve development test and evaluation and apply its results early in the decisionmaking process.

--The planning, performing, and reporting of development testing should be directly related to the operational requirement.

--The reporting should identify the problems noted and should provide a clear statement assessing the risks associated with the problems and implications on achieving the operational requirement.

---

[1]This process basically consists of a senior level review council, the Defense Systems Acquisition Review Council (DSARC), and a key program document, development concept papers (DCPs), which provide information for decisions on whether to proceed further at two points during development and, finally, on whether to go into production.

--A method should be developed to track the problems noted in development testing and fix responsibility for their resolution.

--A lower level review process similar to DCP and DSARC should be established to control and manage critical systems which do not meet DOD's classification of major systems.

--When less than major systems are essential to the mission of a major system, the test and evaluation issues should be related to DCP and DSARC review processes for the major system.

--Adequate controls should be established over granting waivers from required testing and evaluation for subsystems as well as overall weapon systems.

We also recommend that development activities, such as the Naval Air Development Center, establish a test and evaluation section in their organizations. These sections should be independent of the project engineers and should be responsible for

--reviewing test plans to insure that they provide full coverage of the technical and performance areas set out by the operational requirement and

--reviewing test results and reports to insure that results are clearly stated and that risks associated with the system are presented.

These sections could also provide a focal point for coordinating operational requirements with the Operational Test and Evaluation Force and the development agencies.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Some reordering of priorities may be desirable to reduce cost and schedule pressures on the development and testing of sensors caused by the pace of new ASW aircraft programs.

Because of the important role which sensors play in the effectiveness of these aircraft and the inherent limitations

of current sensor systems against high-performance nuclear submarines, the Congress may want to question whether DOD is placing appropriate emphasis on the development of needed sensor capabilities compared with the production of new ASW aircraft.

CHAPTER 6

AGENCY COMMENTS AND OUR EVALUATIONS

The Navy commented on behalf of the Secretary of Defense. (See app. II.) It expressed basic agreement on

--the need for and value of development testing in system acquisitions and

--the importance of sensor performance in airborne ASW.

The Navy pointed out that the test programs we investigated were conducted before and during the early phases of the new test and evaluation management procedures and in no way indicated a lack of support for new test and evaluation directions.

The Navy told us that it was in the process of upgrading test and evaluation management to carry out new DOD policies. It said that improvements will result from new instructions, increased management scrutiny of acquisition programs, and the Operational Test and Evaluation Force's early involvement in the planning stages of new programs. It believes these factors answer many of our criticisms and will yield substantial improvement in the area of viable testing and test assessment. However, it recognizes that development test and evaluation policy is currently undergoing change and that implementing directives will be forthcoming.

Specifically, the Navy cited several actions planned or in process to correct deficiencies. These actions and our evaluations follow.

1. The Navy said that test and evaluation project assignment procedures were revised to assign a Chief of Naval Operations' project to the Operational Test and Evaluation Force at the beginning of advanced development. This testing organization will have access to development projects in the early stages and will be required to participate in development test planning and monitoring of tests performed by the development agency.

We reviewed the Navy's new instructions and found that, in terms of basic policy, they were similar to those recently superseded. These instructions rely heavily on the Operational Test and Evaluation Force's early involvement in the development cycle referred to as the initial operational test and evaluation (IOT&E). As early as 1967 Navy procedures provided for similar functions by the Force, but generally the operational testing agency was not significantly involved in early testing. Consequently, we are concerned with the Navy's implementing the revised policies.

There is considerable merit to a policy of the Force's early involvement. However, the success of IOT&E will depend largely on the quality of the information received from the development agency which is in the best position to know the risks of a development program. We believe that, in view of this dependence and the problems noted with development testing, additional emphasis will be necessary on the part of development agencies to improve their test and evaluation.

2. The Navy described actions in process or being designed at several organizational levels.

   A procedure has been initiated to provide periodic reviews of less than major programs at the Chief of Naval Operations level. During these reviews, test and evaluation management is to be examined with emphasis on adequate testing before the production decision.

   The Chief of Naval Material is in the process of revising his management of the test and evaluation cycle to require a test and evaluation master plan for each development project. Also this plan is to address operational characteristics, critical testing issues, and milestones for the achievement and validation of program objectives to permit management monitoring of progress.

   The Naval Air Systems Command is taking steps to require more definitive test objectives during the planning process and more formalized reporting of development test results.

The Naval Air Development Center is establishing a group responsible for reviewing development test planning and performance and for supervising test reporting. The Center's action also provides a focal point for coordinating IOT&E matters with the Operational Test and Evaluation Force and development agencies.

These actions, when implemented, should be responsive to our recommendations.

3. According to the Navy, the practice of indiscriminate granting of waivers has been effectively curtailed since SECNAV Instruction 5000.1 was published in March 1972. This instruction was in response to Defense Directive 5000.1 issued in July 1971. Both require that waivers of major DSARC programs be obtained from the Office of the Secretary of Defense and that waivers for less than major programs be obtained from the service secretary.

Regardless of numerous assurances that waivers are under control, problems persist in this area. In the SH-2D helicopter program, the development agency, not the Secretary of the Navy, approved the waivers for producing essential subsystems before their service approval some 7 months after SECNAV Instruction 5000.1 and some 15 months after Defense Directive 5000.1. As expressed in our previous reports, greater effort is required to control waivers of required test and evaluation.

4. In agreeing with our assessment of the importance of sensors in airborne ASW, the Navy stated that a major portion of its sensor program had been structured to be managed within the DCP and DSARC process. The Navy also stated that, during a recent review of the program, the adequacy of sensor development effort was identified by the DSARC as an area of concern.

We agree with the action to give certain airborne ASW sensors top management attention of the DCP and DSARC

process. Although managed under a DCP covering a group of sensor subsystems, the test and evaluation issues for each subsystem should be related to the DCP and DSARC process for major systems whose mission performance would be affected.

CHAPTER 7

SCOPE AND BASIS FOR EQUIPMENT SELECTION

SCOPE

We interviewed officials and examined records at various levels including:

--The Office of the Chief of Naval Operations, Washington, D.C.

--The Naval Material Command, Arlington, Virginia.

--The Naval Air Systems Command, Arlington, Virginia.

We also examined the planning, performance, and reporting of development and operational testing and interviewed officials at:

--The Naval Air Development Center, Warminster, Pennsylvania.

--The Office of the Naval Air Systems Command Test and Evaluation Coordinator, Patuxent River, Maryland.

--The Naval Air Test Center, Patuxent River, Maryland.

--The Sub-board of Inspection and Survey, Patuxent River, Maryland.

--Headquarters, Operational Test and Evaluation Force, Norfolk, Virginia.

--Air Test and Evaluation Squadron One, Key West, Florida.

We relied extensively on Navy engineers for interpreting and assessing the technical aspects of the development cases studied. The engineers reviewed the conclusions which we made on these matters for reasonableness. We made no attempt to assess the military threat or to develop technological approaches.

BASIS FOR EQUIPMENT SELECTION

The systems were selected from among development tasks involving planned effort by the Naval Air Development Center in excess of $1 million. This effort was undertaken in response to the needs of development agencies during fiscal year 1971. These selections were made without beforehand knowledge of the relative success of the project, and included a group of items (1) representative of ASW development efforts of the Naval Air Development Center, (2) broad enough in scope to involve testing at various stages of the development process, and (3) involving a significant amount of development test and evaluation by Government activities.

The items were also selected on the basis of their importance to the Navy's overall ASW capability. The major weapon systems whose performance depends on the systems or subsystems reviewed follow.

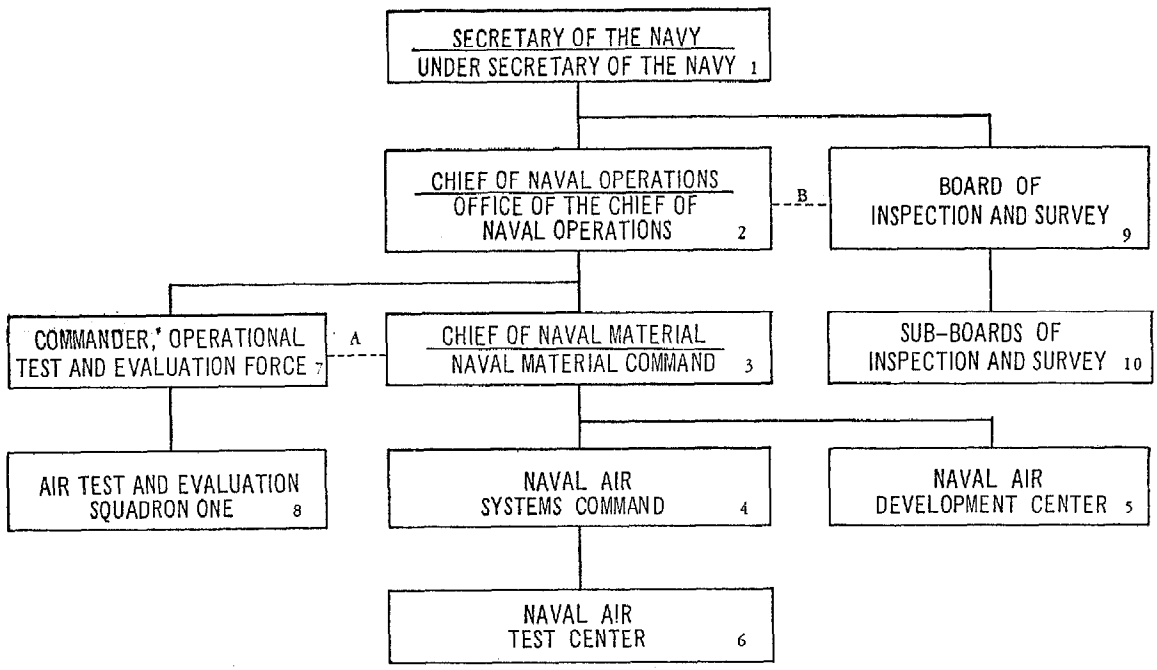
System or subsystem reviewed	Major weapon system
	Aircraft
Sonobuoy systems:	
AN/SSQ-47	P-3; S-2; S-3; SH-2D and SH-3H
AN/SSQ-50	P-3; S-2; S-3; SH-2D and SH-3H
AN/SSQ-62	P-3; S-2; S-3; SH-2D and SH-3H
Integrated magnetic airborne detection system	P-3; S-3; SH-2D and SH-3A/D/H
AN/APS-116 airborne ASW radar system	S-3
	Ship class
SH-2D light airborne multipurpose helicopter	DLG-26; DLGN-35; DE-1040; DE-1052; DEG-1; CG-10; CGN-9; CLG-5 and AOE-1

The following schedule shows the testing and operational deployment status of the items during our review.

Systems	Testing status	Fleet status
Sonobuoy systems:		
AN/SSQ-47	Completed	Deployed
AN/SSQ-50	[a]Completed	Not deployed
AN/SSQ-62	Developmental	Not deployed
Integrated magnetic airborne detection system	Operational	Deployed
AN/APS-116 airborne ASW radar system	Operational	Not deployed
SH-2D light airborne multipurpose system helicopter	Operational	Deployed

[a]The Operational Test and Evaluation Force recommended additional development and testing for the system before service approval was granted.

ORGANIZATION FOR AIR ASW DEVELOPMENT



NOTES:

1. THE SECRETARY OF THE NAVY IS RESPONSIBLE FOR THE POLICIES AND MANAGEMENT OF THE DEPARTMENT OF THE NAVY, INCLUDING ITS ORGANIZATION, ADMINISTRATION AND OPERATIONS.

2. THE CHIEF OF NAVAL OPERATIONS' RESPONSIBILITIES INCLUDE PROVIDING THE MATERIAL NEEDS OF THE OPERATING FORCES OF THE NAVY, SUCH AS, EQUIPMENT, WEAPONS AND WEAPONS SYSTEMS. THIS RESPONSIBILITY INCLUDES THE DETERMINATION OF THE MILITARY PERFORMANCE REQUIREMENTS OF AND PRIORITIES FOR THINGS TO BE DEVELOPED OR PROCURED.

3. THE CHIEF OF NAVAL MATERIAL HAS OVERALL TECHNICAL RESPONSIBILITY FOR THE ACQUISITION OF ASW SYSTEMS. OTHER RESPONSIBILITIES INCLUDE THE PLANNING AND DEVELOPING OF RESOURCE CAPABILITIES AND READINESS TO MEET THE NEEDS OF THE OPERATING FORCES OF THE NAVY.

4. THE NAVAL AIR SYSTEMS COMMAND'S RESPONSIBILITIES INCLUDE PROVIDING THE MATERIAL NEEDS OF THE NAVY FOR AIRCRAFT SYSTEMS. THIS RESPONSIBILITY INCLUDES THE RESEARCH, DESIGN, DEVELOPMENT, TEST, AND TECHNICAL EVALUATION OF AIRCRAFT MATERIAL.

5. THE NAVAL AIR DEVELOPMENT CENTER'S RESPONSIBILITIES INCLUDE CONDUCTING RESEARCH, DEVELOPMENT, TEST AND EVALUATION OF AERONAUTICAL SYSTEMS AND COMPONENTS.

6. THE NAVAL AIR TEST CENTER'S RESPONSIBILITIES INCLUDE CONDUCTING TESTS AND EVALUATIONS OF AIRCRAFT, AIRCRAFT COMPONENTS AND ASSOCIATED EQUIPMENT.

7. THE COMMANDER, OPERATIONAL TEST AND EVALUATION FORCE'S RESPONSIBILITIES INCLUDE TESTING AND EVALUATING SYSTEMS, TACTICS AND PROCEDURES.

8. THE AIR TEST AND EVALUATION SQUADRON ONE'S RESPONSIBILITIES INCLUDE TESTING AND EVALUATING AIRBORNE ASW SYSTEMS AND EQUIPMENT.

9. THE BOARD OF INSPECTION AND SURVEY'S RESPONSIBILITIES INCLUDE CONDUCTING ACCEPTANCE TRIALS OF AIRCRAFT AND SHIPS AND MAKING RECOMMENDATIONS ON THEIR ACCEPTANCE BY THE NAVY.

10. THE SUB-BOARD OF INSPECTION AND SURVEY IS RESPONSIBLE FOR PERFORMING BOARD OF INSPECTION AND SURVEY FUNCTIONS.

A. DIRECT LIAISON WITH THE NAVAL MATERIAL COMMAND ON TECHNICAL MATTERS.

B. ADVISES THE CHIEF OF NAVAL OPERATIONS ON BOARD MATTERS.

DEPARTMENT OF THE NAVY
OFFICE OF THE COMPTROLLER
WASHINGTON, D.C. 20350

In reply refer to
SER: 04305
7 AUG 1973

Mr. Andrew B. McConnell
Assistant Director in Charge
Procurement and Systems Acquisition Division
U. S. General Accounting Office
441 G. Street N. W.
Washington, D. C. 20548

Dear Mr. McConnell:

The Secretary of Defense has asked the Department of the Navy to reply to your draft report (GAO review code 77107) of May 14, 1973 on Improvements Needed in the Navy's Development of Airborne Anti-Submarine Warfare Systems and Subsystems (OSD Case #3626). I am enclosing the Navy reply with the security classification indicated for each paragraph.

The result of the Navy review of the GAO tentative security classification of the report has been furnished separately. The GAO is authorized in accordance with DOD Directive 5200.1, to distribute the final report to appropriate Congressional Committees and individual members of Congress.

Sincerely yours,

S. H. MOORE
Deputy

Encl:
(1) Department of the Navy comments

Department of the Navy Reply

to

GAO Draft Report of 14 May 1973

on

Improvements Needed in Navy's

Development Testing of Airborne Anti-Submarine

Warfare Systems and Subsystems

(OSD Case #3626)

I. GAO Findings and Recommendations

GAO made this review to provide a detailed assessment of: (1) development testing in the Navy on a number of related "mission essential" systems and subsystems, and (2) the effect of such testing on the later phases of system acquisitions in the Navy. Airborne anti-submarine warfare (ASW) systems and subsystems were selected as the vehicle for making this assessment because of congressional concern over the threat posed by the nuclear submarine and the significant resources committed to meeting this threat. GAO reviewed one helicopter program and five aircraft sensor systems with estimated total development and production costs of $536 million. The sensors are and will be essential to the mission effectiveness of more than $6 billion of ASW aircraft for years to come.

GAO found development testing capable of disclosing problems and risks early in the acquisition cycle, but the issues were often not resolved and continued to plague the equipment into operational testing. Weaknesses were found in the planning, performing, and reporting of development testing, and in the use made of the test results. These weaknesses have contributed to limitations in the capability of the equipment as well as deployed and future ASW aircraft to accomplish their assigned mission.

GAO is convinced that better management and performance of the development test and evaluation function would have resulted in better performing, less costly equipment which could have been available to the fleet earlier. The need for better management is evidenced by the fact that most of the systems have inherent limitations for countering the high performance nuclear submarine threat--the essential purpose of their development.

(U) GAO recommends: (1) a series of actions be taken by the Navy in implementing a fully responsive control system to improve development test and evaluation and the application of its results early in the decision-making process, and (2) that development agencies in conjunction with the activities responsible for test and evaluation exploit the possibilities of computer simulation as a tool to improve development test planning and evaluation.

(U) In addition, GAO states that Congress should question whether DOD is placing appropriate emphasis on the development of needed sensor capabilities vis-a-vis the production of new ASW aircraft.

II. Navy Position

(U) There is no basic disagreement with the GAO concerning the need and value of developmental testing and evaluation in system acquisition. The Navy has been in the process of upgrading its management of test and evaluation over the past several years to carry out the new DOD T&E policies. The improvements in Navy development testing and evaluation answer many of the GAO criticisms. New DOD, SECNAV and OPNAV instructions have been promulgated which address these problems. Increased scrutiny of all acquisition programs by OPNAV is being exercised. It is felt that this increased attention as well as the insertion of the Navy's independent testing agency, OPTEVFOR, into the very early planning stages of new programs will yield substantial improvement in the area of viable testing and test assessment.

(U) Specifically some of the Navy actions designed to correct deficiencies in DT&E are:

a. OPNAV has revised its T&E project assignment procedures so that, at the commencement of advanced development, a CNO project is assigned to COMOPTEVFOR which gives the independent operational test and evaluation authority access to development projects in the early stages and requires OPTEVFOR participation in DT&E planning and OPTEVFOR monitoring of the execution of development testing.

b. OPNAV has instituted a procedure which provides for periodic review within OPNAV of "Less Than Major" (LTM) programs. During these reviews management of LTM programs is examined with emphasis on adequate T&E planning and prosecution in preparation for production decisions. This "Less Than Major Program Review" is for all projects not in the DCP/DSARC review cycle. This review is chaired by the OPNAV, Director Test and Evaluation Division, RDT&E and is weighted heavily in the area of T&E planning and execution.

c. The Chief of Naval Material is in the process of revising the Material Command's management of the T&E cycle. A new Test and Evaluation Master Plan (TEMP) will be required for each project in development. This TEMP must address Operational Characteristics and Objectives, critical T&E issues, Desired Characteristics and milestones for the achievement/validation of the objectives at an early stage in development and will permit higher levels of management to monitor a project's T&E progress.

d. The Naval Air Systems Command is taking steps to refine the specific execution of Development Testing, within the guidance from higher authorities, by requiring more definitive test objectives during the planning process and requiring more formulized reporting of test results.

e. The practice of indiscriminate granting of waivers has been effectively curtailed since SECNAV 5000.1 requires that waivers in the case of Less Than Major programs must be obtained at the SECNAV level. Waiver of major (DSARC) programs must be obtained at the OSD level.

(U) Although the application of computer simulation for Test and Evaluation is relatively new, limited computer simulation in support of ASW sensors has been used for the last four years. It is fully intended to use computer simulation techniques and analysis throughout development and production, within the constraints of resource allocation. At the same time, we cannot rely solely on computer simulations. While valuable and being increasingly used by the Navy, it must be realized that the results of computer simulations directly depend upon how well the real world has been simulated. Therefore, some field testing must be done in conjunction with computer simulations.

(U) The Navy agrees with the GAO's assessment of the importance of sensors in Air ASW. In recognition of this importance, a major portion of the Navy's Air ASW Sensor Program has been structured to be managed within the DCP/DSARC process. Moreover, during a recent review of the program, the adequacy of the sensor development effort was identified by the DSARC as an area of concern, and it is being addressed.

(U) It must be emphasized that the Test programs investigated by GAO were conducted prior to and during the early implementation phases of the new test and evaluation management procedures and in no way indicates less than complete support for the new T&E directions.

GAO Note: In addition to their position statement, the Navy's response included detailed comments on the systems discussed in this report. We discussed these comments with Navy officials and made changes in the body of the report where appropriate. The Navy's detailed comments are not included because they are lengthy and technical and did not take exception to the basic report issues. We believe there are no residual differences in fact.

PRINCIPAL OFFICIALS OF THE DEPARTMENTS OF DEFENSE AND THE NAVY RESPONSIBLE FOR ADMINISTRATION OF ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
James R. Schlesinger	July 1973	Present
Vacant	May 1973	June 1973
Elliot L. Richardson	Jan. 1973	May 1973
Melvin R. Laird	Jan. 1969	Jan. 1973
Clark M. Clifford	Mar. 1968	Jan. 1969
DEPUTY SECRETARY OF DEFENSE:		
William P. Clements, Jr.	Jan. 1973	Present
Kenneth Rush	Feb. 1972	Jan. 1973
Vacant	Jan. 1972	Feb. 1972
David Packard	Jan. 1969	Dec. 1971
Paul H. Nitze	July 1967	Jan. 1969
DEPARTMENT OF THE NAVY		
SECRETARY OF THE NAVY:		
John W. Warner	Apr. 1972	Present
John H. Chafee	Jan. 1969	Apr. 1972
Paul R. Ignatius	Sept. 1967	Jan. 1969
CHIEF OF NAVAL OPERATIONS:		
Adm. Elmo R. Zumwalt, Jr.	July 1970	Present
Adm. Thomas H. Moorer	Aug. 1967	June 1970
CHIEF OF NAVAL MATERIAL:		
Adm. Isaac C. Kidd, Jr.	Dec. 1971	Present
Adm. Jackson D. Arnold	July 1970	Dec. 1971
Adm. Ignatius J. Gallantin	May 1965	June 1970

APPENDIX III

	Tenure of office	
	From	To
DEPARTMENT OF THE NAVY (continued)		
COMMANDER, NAVAL AIR SYSTEMS COMMAND:		
Vice Adm. Kent L. Lee	Aug. 1973	Present
Rear Adm. Thomas R. McClellan	Apr. 1971	Aug. 1973
Rear Adm. Thomas J. Walker	Feb. 1969	Apr. 1971
Rear Adm. Robert L. Townsend	May 1966	Feb. 1969
COMMANDER, NAVAL AIR DEVELOPMENT CENTER:		
Capt. Henry B. McCaulley	July 1971	Present
Capt. Frank W. Edwald	Oct. 1968	July 1971
Capt. Barney L. Towle	Aug. 1966	Oct. 1968

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