Audit Report

OFFICE OF THE INSPECTOR GENERAL

MILESTONE REVIEW PROCESS FOR THE CONSOLIDATED AUTOMATED SUPPORT SYSTEM

Report No. 94-116 June 2, 1994

Department of Defense

Additional Copies

Copies of the report can be obtained from the Secondary Reports Distribution Unit, Audit Planning and Technical Support Directorate (703) 614-6303 (DSN 224-6303) or FAX (703) 614-8542.

Suggestions for Future Audits

To suggest ideas for or to request future audits, contact the Planning and Coordination Branch, Audit Planning and Technical Support Directorate, at (703) 614-1868 (DSN 224-2868) or FAX (703) 614-8542. Ideas and requests can also be mailed to:

Inspector General, Department of Defense
OAIG-AUD (ATTN: APTS Audit Suggestions)
400 Army Navy Drive (Room 801)
Arlington, Virginia 22202-2884

DoD Hotline

To report fraud, waste, or abuse, call the DoD Hotline at (800) 424-9098 (DSN 223-5080) or write to the DoD Hotline, The Pentagon, Washington, D.C. 20301-1900. The identity of writers and callers is fully protected.

Acronyms

ACAT	Acquisition Category
ATE	Automatic Test Equipment
CASS	Consolidated Automated Support System
CNI	Communications/Navigation/Identification
COEA	Cost and Operational Effectiveness Analysis
DT	Developmental Testing
FCA	Functional Configuration Audit
LRIP	Low-Rate Initial Production
NPDM	Navy Program Decision Meeting
OSD	Office of the Secretary of Defense
OT	Operational Testing
PCA	Physical Configuration Audit
PFG	Pneumatic Function Generator

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-2884

June 2, 1994

MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT)
DIRECTOR, OPERATIONAL TEST AND EVALUATION

SUBJECT: Milestone Review Process for the Consolidated Automated Support System (Report No. 94-116)

We are providing this report for your review and comments. This report is the first in a series of reports resulting from our audit of the milestone review process for Component-managed acquisition programs. We requested comments on a draft of this report. Formal comments were not received; however, the report incorporates informal comments and feedback related to the March 1994 Navy Program Decision Meeting.

As required under DoD Directive 7650.3, "Followup on General Accounting Office, DoD Inspector General, and Internal Audit Reports," September 5, 1989, all audit recommendations must be resolved promptly. Therefore, you must provide final comments on the recommendations by August 1, 1994. The recommendations are subject to resolution in accordance with DoD Directive 7650.3 in the event of nonconcurrence or failure to comment. We also ask that your comments indicate concurrence or nonconcurrence with the material internal control weakness highlighted in Part I.

We appreciate the courtesies extended to the audit staff. If you have any questions on this report, please contact Mr. Jack D. Snider, Project Manager, at (703) 693-0402 (DSN 223-0402). Appendix E lists the distribution of this report. Audit team members are listed inside back cover.

Robert J. Lieberman
Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 94-116 **June 2, 1994**
(Project No. 3AE-0061.00)

MILESTONE REVIEW PROCESS FOR THE CONSOLIDATED AUTOMATED SUPPORT SYSTEM

EXECUTIVE SUMMARY

Introduction. The Navy's Consolidated Automated Support System (CASS) includes standardized automatic test equipment with computer-assisted, multi-function capabilities with potential multi-Service application to support testing of aircraft subsystems and missiles. The Navy Acquisition Executive approved low-rate initial production for 55, 60, and 68 CASS stations,* in September 1990, July 1992, and June 1993, respectively. A Navy program decision meeting for a Milestone III, Production Approval, decision was scheduled for December 1993; however, the decision was deferred until March 1994. On March 25, the program decision meeting was held, approving entry into the production and deployment phase of the acquisition process.

Objective. The audit objective was to evaluate the effectiveness of the milestone review process for Component-managed acquisition programs. The audit also assessed the adequacy of the information provided to DoD Component milestone decision authorities in support of major milestone and program reviews and evaluated internal controls related to the objective. The CASS Program was one program reviewed in our ongoing audit of the Milestone Review Process for Component-Managed Acquisition Programs.

Audit Results. The overall CASS Program was not ready to proceed into the production and deployment phase of the acquisition process. Successful completion of additional operational test and evaluation and verified correction of testing and configuration audit deficiencies were required. As a result, the CASS Program could potentially have passed a key acquisition milestone without plans for adequate closure of action items or correction of deficiencies. The Navy initiated timely corrective action on the deficiencies identified in this audit concerning the CASS Program and deferred the Navy program decision meeting until March 1994. The corrective action should be completed before the FY 1995 production buy.

Internal Controls. The audit identified a material internal control weakness in that Navy policy on performance of cost and operational effectiveness analyses conflicted with DoD acquisition regulations. This internal control weakness is summarized in Part I and fully discussed in Part II of this report.

Potential Benefits of Audit. Potential monetary benefits are not quantifiable. Implementation of the recommendations will ensure that decisionmakers have all available information to make fully informed decisions concerning whether the CASS Program is ready to proceed into production and whether proposed program plans for the subsequent acquisition stage is consistent with sound acquisition management practices (Appendix C).

---

*A CASS station is a collection of multi-function automatic test equipment structured around a common core with four testing configurations.

Summary of Recommendations. We recommended conducting a Milestone III review of the CASS Program limited to the Lot IV and V buys and the configuration units that have completed testing, deferring the award of the Lot VI buy until successful completion of additional operational test and evaluation and a Navy program decision meeting on the overall program, completing the Operational Testing-III phase as part of the evaluation of operational effectiveness and suitability of the CASS Program, correcting the deficiencies identified during functional and physical configuration audits of the CASS Program before the Lot V buy, reviewing CASS Program cost and benefit analyses to determine whether the documents contain the elements of a cost and operational effectiveness analysis needed to support the Milestone III decision, and issuing policy requiring that cost and operational effectiveness analyses be conducted for future Milestone III decisions. We also recommended that the Director, Operational Test and Evaluation, designate the CASS Program for oversight and decide on the operational effectiveness and suitability of the CASS Program.

Management Comments. We requested comments on a draft of this report from the Assistant Secretary of the Navy (Research, Development and Acquisition) and the Director, Operational Test and Evaluation; however, comments were not received. As a result, we require comments on this final report by August 1, 1994.

Table of Contents

Executive Summary i

Part I - Introduction 1

Background 2
Objective 3
Scope and Methodology 4
Internal Controls 4
Prior Audits and Other Reviews 5
Other Matters of Interest 5

Part II - Finding and Recommendations 7

Readiness for Acquisition Milestone III, Production Approval 8

Part III - Additional Information 29

Appendix A. Consolidated Automated Support System Station Configurations 30
Appendix B. Changes in Consolidated Automated Support System Test Characteristics 31
Appendix C. Summary of Potential Benefits Resulting From Audit 32
Appendix D. Organizations Visited or Contacted 33
Appendix E. Report Distribution 34

The Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD, prepared this report.

Part I - Introduction

Background

This report discusses the adequacy of the information, including operational test and evaluation, provided to the Navy milestone decision authorities in support of a Navy program decision meeting (NPDM) for a Milestone III, Production Approval, decision for the Navy's Consolidated Automated Support System (CASS) Program.

Navy Program Decision Meeting. The NPDM is the Navy's forum for acquisition program milestone decisions[1] and reviews within the Navy. The conclusions of the milestone decisions and reviews are promulgated in an acquisition decision memorandum. The Assistant Secretary of the Navy (Research, Development and Acquisition) is the decision authority for all acquisition category[2] (ACAT) IC, II, and III programs. The Assistant Secretary chairs all ACAT IC, II, and III NPDMs, unless otherwise delegated. The program executive officers, direct reporting program managers, and system commanders are delegated the decision authority for all ACAT IV programs.

Role of Milestone Decision Authority. At each decision point, the milestone decision authority assesses the status of the program relative to the user's needs, the established program baseline and acquisition strategy, and approved financial plans. The milestone decision authority also evaluates the updated acquisition strategy and the plans for conducting the next phase and managing risk; makes cost-performance-schedule trade-offs; assesses the affordability of what is being proposed; and determines whether the program should be terminated, redirected, or allowed to continue into the next phase. All operational requirements, testing, funding, and the majority of other issues should be resolved or adequately addressed before the NPDM.

Operational Test and Evaluation. The DoD Instruction 5000.2, "Defense Acquisition Policies and Procedures," February 23, 1991, requires that acquisition programs successfully complete a dedicated phase of operational test and evaluation before Milestone III, Production Approval. The dedicated phase of operational test and evaluation must demonstrate the operational effectiveness and suitability of production or production-representative units under realistic combat conditions to determine whether operational performance requirements are satisfied. The Director, Operational Test and Evaluation, Office of the Secretary of Defense (OSD), must approve all operational test plans for ACAT ID and IC Programs. The Director must also issue a beyond low-rate initial production report before entry into full-rate production on ACAT I and

[1]The point when a recommendation is made and approval sought regarding starting or continuing (proceeding to next phase) an acquisition program. Milestones are: 0 (Concept Studies Approval), I (Concept Demonstration), II (Development Approval), III (Production Approval), and IV (Major Modification Approval).

[2]An acquisition category is a classification established to facilitate decentralized decisionmaking and execution and compliance with statutorily imposed requirements. The categories determine the level of review, decision authority, and applicable procedures.

other designated programs on the adequacy of testing conducted by the respective independent operational test and evaluation organization and whether the test results confirm operational effectiveness and suitability.

Consolidated Automated Support System. The Navy's CASS Program is an ACAT II Program composed of standardized automatic test equipment (ATE) with computer-assisted, multi-function capabilities to support testing of aircraft subsystems and missiles. The CASS Program features fleet-wide standardization of hardware and software elements and is designed to enhance electronic test capability over existing ATE. The CASS Program's system hardware is also designed to provide the Navy intermediate and depot-level maintenance with better electronic testing capability. The CASS Program is composed of functional interfaces allowing the testing of a variety of hardware. The interfaces are evolving to meet Air Force as well as Navy requirements. To minimize unique types of automatic test systems, the Under Secretary of Defense for Acquisition and Technology has established policy to require DoD Components to satisfy all acquisition needs for ATE hardware and software by using designated automatic test systems. The CASS Program is one of those designated systems. The Naval Air Systems Command is assigned lead systems command responsibility for the CASS Program with participation from the Naval Sea Systems Command and the Space and Naval Warfare Systems Command. The Navy Acquisition Executive approved low-rate initial production[3] (LRIP) for 55, 60, and 68 CASS stations,[4] in September 1990, July 1992, and June 1993, respectively. NPDMs for Milestone III, Production Approval, decisions for a Lot IV buy of 63 CASS stations was made in March 1994; Lot V and Lot VI buys of 60 and 82 CASS stations are scheduled for March 1995 and FY 1996, respectively. The Navy plans to procure a total of 720 CASS stations. As of November 1993, the total cost of the CASS Program was estimated at about $1.8 billion in FY 1990 constant dollars of which $1.5 billion and $298.1 million was for procurement, and research and development, respectively.

Objective

The overall audit objective was to evaluate the effectiveness of the milestone review process for Component-managed acquisition programs. The audit also assessed the adequacy of the information provided to Military Department milestone decision authorities in support of major milestone and program reviews and evaluated internal controls related to the objective. The CASS Program was one program reviewed during the audit. During the audit survey,

[3]Low-rate initial production is the production of a system in limited quantity to provide articles for operational test and evaluation, to establish an initial production base, and to permit an orderly increase in the production rate sufficient to lead to full-rate production upon successful completion of operational testing.

[4]A CASS station is a collection of multi-function ATE structured around a common core with four testing configurations (Appendix A).

we determined that the CASS Program was scheduled to have a Milestone III, Production Approval, decision before the completion of our overall audit work. Therefore, we are reporting this issue separately because action is needed on the identified issues before the conclusion of our overall audit.

Scope and Methodology

We conducted this program audit from May 1993 through February 1994 and reviewed data dated from February 1976 through February 1994. To accomplish the objective, we:

o discussed issues relating to the effectiveness of the milestone review process for the CASS Program with OSD and Navy personnel;

o determined the adequacy of the information that the Navy provided to the decision authorities in support of major milestone and program reviews;

o evaluated the effectiveness of the milestone review and program review processes for the CASS Program; and

o reviewed CASS Program decision documents as well as selected acquisition reports, Defense acquisition executive summary reports, and various contract cost management reports.

The audit was made in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD, and accordingly included such tests of internal controls as were deemed necessary. We did not rely on computer-processed data to support our finding and recommendations. Appendix D lists the organizations visited or contacted.

Internal Controls

Internal Controls Evaluated. We evaluated internal controls related to the effectiveness of the milestone review process and the adequacy of the information provided to the milestone decision authorities in support of major milestone and program reviews for the CASS Program. The DoD Instruction 5000.2, "Defense Acquisition Policies and Procedures," February 23, 1991, and DoD Manual 5000.2-M, "Defense Acquisition Management Documentation and Reports," February 23, 1991, specify those controls and procedures. We also assessed implementation of the requirements of DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987, including performance of vulnerability assessments and management control reviews.

Internal Control Weakness Identified. We identified a material internal control weakness as defined by Office of Management and Budget Circular A-123, "Internal Control Systems," August 4, 1986, and DoD Directive 5010.38. Internal controls to conduct milestone reviews existed; however, those controls were not fully effective. Specifically, the Navy had issued policy in a March 30, 1992, memorandum stating that cost and operational effectiveness analyses (COEAs) were not required to support Milestone III, Production Approval, decisions. This policy was contrary to DoD Instruction 5000.2 and contributed to the lack of a formal COEA on the CASS Program. The weakness was not reported in the Naval Air Systems Command Internal Management Control Program because no management control reviews were performed on the CASS Program. Our summary report will address the overall implementation of the DoD Internal Management Control Program for the Milestone Review Process.

Internal Control Weakness Correction. Recommendation 1.f. in this report, if implemented, will correct the internal control weakness. Monetary benefits associated with the implementation of our recommendation to require COEAs in support of Navy Milestone III decisions are not quantifiable because benefits will depend on future actions by the Navy. A copy of the final report will be provided to the senior official responsible for internal controls in the Department of the Navy.

Prior Audits and Other Reviews

Since 1988, the General Accounting Office and the Office of the Inspector General, DoD, have issued one and five reports, respectively, that included the CASS Program. However, we did not follow up on the prior audit reports because they did not contain findings or recommendations related to our objective.

Other Matters of Interest

On December 17, 1993, the Deputy Inspector General, DoD, sent a memorandum to the Navy stating concerns about the readiness of the CASS Program for production and deployment. Although our audit was not complete, we had cause to be concerned that a full-rate production decision might be approved prematurely. We worked with Navy management to address those concerns and, as a result, the Navy deferred an NPDM until March 1994 and clarified program documentation on the CASS Program's acquisition strategy and test program. The Navy actions are reflected in this report.

On March 25, 1994, the Navy held an NPDM concerning a Milestone III, Production Approval, decision for the CASS Program. The NPDM addressed the recommendations in our draft report on the CASS Program. The Navy

concurred with Recommendations 1.a. through 1.f. that were addressed to it and indicated that Recommendations 2.a. and 2.b., addressed to the Director, Operational Test and Evaluation, were acceptable. However, neither the Assistant Secretary of the Navy (Research, Development and Acquisition) nor the Director, Operational Test and Evaluation, provided formal comments to our draft report.

Part II - Finding and Recommendations

Readiness for Acquisition Milestone III, Production Approval

The overall CASS Program was not ready to proceed into the Production and Deployment phase of the acquisition process. The CASS Program management had not successfully completed all required operational test and evaluations and verified correction of deficiencies identified in testing and configuration audits. These conditions existed because:

o the CASS Program was considered to be low-risk,

o completion of testing was deferred until the life-cycle test phase,

o design review minutes were not contract deliverables,

o reporting design review results and documenting configuration changes were not considered a priority, and

o a life-cycle cost estimate was considered sufficient cost and operational justification.

As a result, the Navy cannot be assured that the CASS Program has all deficiencies corrected, will not experience excessive rework and retrofit, and will not require additional funding.

Background

Test and Evaluation Guidance. The DoD Instruction 5000.2, part 8, requires that test and evaluation verify that systems have attained technical performance specifications and are operationally effective and suitable for the intended use. The DoD requires both developmental and operational testing to provide essential information to support decisionmaking. Developmental testing verifies that the system meets technical performance specifications and that it is ready for operational testing. Operational testing, conducted under realistic conditions, verifies that the system is operationally effective and suitable for the mission intended and is the primary method of predicting system performance.

Configuration Management Guidance. The DoD Instruction 5000.2, part 9, section A, states that an effective configuration management program will be established to implement the decisions made in the systems engineering process by:

o documenting and verifying the functional and physical characteristics of a configuration item,

o controlling changes to an item and its documentation,

o recording the configuration of actual items, and

- o auditing the configuration item and its configuration identification.

The DoD Instruction 5000.2, part 6, section O, attachment 1, indicates that design change activity should be stabilized by demonstrating, in part, that a system configuration audit has been accomplished and discrepancies resolved.

Cost and Operational Effectiveness Analysis Guidance. The DoD Instruction 5000.2, part 4, and DoD Manual 5000.2-M, part 8, provide procedures and guidelines for COEAs. The COEA evaluates the costs and benefits, including operational effectiveness or military utility, of alternative actions to meet recognized Defense needs. The COEA aids decisionmaking, facilitates communications, and documents acquisition decisions by highlighting the advantages and disadvantages of the alternatives being considered and showing the sensitivity of each alternative to possible changes in key assumptions, such as variables, including selected performance capabilities. Further, the COEA provides early identification and discussion of reasonable alternatives among decisionmakers and staffs at all levels. A COEA is required to be prepared and considered at milestone decision reviews of ACAT I[5] programs beginning with Milestone I, Concept Demonstration Approval. At Milestone II, Development Approval, the COEA establishes performance floor and cost ceiling objectives or acceptable bands for possible combinations of cost and performance; shows the trade-offs used to arrive at the objectives for Phase II, Engineering and Manufacturing Development; and examines the impact of program termination. At Milestone III, Production Approval, the COEA may update the previous COEA required at Milestone II; however, if the program has experienced major performance or cost changes during Phase II, a new COEA may be required. The elements of the updated COEA for a Milestone III review will be specified by the milestone decision authority as part of the pre-milestone planning process. At Milestone IV, Major Modification Approval, the milestone decision authority may require a COEA and specify what elements to include in the COEA. The DoD Component responsible for the mission area in which a deficiency or opportunity is identified normally prepares the COEA. The DoD Component head or a designee determines the independent analysis organization to prepare the COEA.

Preparation for Milestone III

Prior to the Milestone III, Production Approval, decision in March 1994, the CASS stations had not demonstrated through developmental and operational testing that they met all minimum acceptable performance requirements and contract specifications. Deficiencies identified by the testing that could not be corrected were deferred to future life-cycle testing. The Navy is changing the CASS stations to correct the deficiencies and is producing CASS stations and subsystems containing most of the improvements. However, until those CASS stations are operationally tested, decisionmakers will not know whether the

[5]The underlying principles and analytical concepts of a COEA are tailored and implemented in support of ACAT II, III, and IV programs as considered appropriate by the respective DoD Component acquisition executive.

changes have resolved the identified problems. The Navy plans to conduct a follow-on operational test and evaluation on CASS stations to verify that the previously identified problems have been resolved; however, this follow-on operational test is scheduled to be conducted after a full-rate production decision. The Navy has contracted for 183 CASS stations. Before the planned follow-on operational tests, the Navy will have contracted for approximately 306 CASS stations, which is about 43 percent of the total production of 720 stations.

Technical Evaluation. From February 5, 1992, through May 5, 1992, the Commander, Operational Test Evaluation Force, conducted an operational evaluation, Operational Testing (OT)-IIB, of the four CASS configurations, including hybrid,[6] radio frequency,[7] communication/navigation/identification (CNI),[8] and electro-optical.[9] The evaluation was to determine the operational effectiveness and operational suitability of the CASS Program and its readiness for fleet introduction; however, the test did not expose CASS stations to the rigors of shipboard operations, one of the intended operating environments. Five test stations, including two hybrids, one with a pneumatic function generator (PFG);[10] radio frequency; CNI; and electro-optical; logged 7,938 operating hours in the 3-month test period. A total of 156 faults were inserted to test the CASS station's capability to detect and isolate system faults within itself and in test program sets that the CASS stations interface with.

On May 5, 1992, Commander, Operational Test Evaluation Force, concluded OT-IIB and recommended in Chief of Naval Operations Report No. 3960-12, "Operational Evaluation of CASS Automatic Test Equipment," July 27, 1992, that fleet introduction of the CASS Program be delayed until 12 specific

[6]The hybrid station is referred to as the "core" of the total CASS test system and as the "basic CASS tester." When the hybrid station is combined with additional instrumentation and control software, three additional station configurations result. Those stations are the radio frequency, CNI, and the electro-optical (Appendix A).

[7]The radio frequency station has semiautomatic capabilities to test avionic units whose technology encompasses, but is not limited to, radar, low and high-frequency stimulus, measurement, and digital functions.

[8]The CNI station has semiautomatic capabilities to test avionic units whose technology encompasses, but is not limited to, communications, navigation, identification, low-frequency stimulus or measurement, and digital functions.

[9]The electro-optical station provides for electro-optical performance tests, fault isolation, and functional testing.

[10]The PFG, which is an important piece of ancillary equipment, is a pressure/vacuum measurement and control system used to measure, control, and display pressure and rates of change of altitude and airspeed associated with CASS stations. During OT-IIB, the PFG proved to be immature and unreliable because so many PFG-specific problems were identified by the test team that the PFG had to be excluded in order to proceed with further testing. These PFG-specific problems do not allow for the repair of the PFG, therefore, reducing the maintainability of the CASS stations. The Navy is redesigning the PFG and is confident about the PFG's future performance; however, the PFG has not yet been tested by the user in its expected operational environment.

problem areas are corrected and the corrections are verified in another phase of operational test and evaluation. Accordingly, the Naval Air System Command tasked the Flight Test and Engineering Group, Naval Air Warfare Center Aircraft Division, Patuxent River, Maryland (the Flight Test and Engineering Group), to perform a technical evaluation, Developmental Testing (DT)-IIC-3, on production versions of the CASS stations. The Naval Air Systems Command limited the scope of DT-IIC-3 to the 12 specific problem areas and deferred the following testing to a CASS Life-Cycle Test Program:[11]

o regression testing for measuring contract compliance with electronic signals at the input/output,

o regression testing for measuring contract compliance for station control software, and

o deficiencies identified during contractor demonstration testing.

Also deferred to the Life-Cycle Test Program were 32 deficiencies identified during DT-IIC-2 testing in February 1992. As of September 23, 1993, 14 of the 32 deficiencies have been fully or partially closed. The following OT-IIB deficiencies were also deferred to the Life-Cycle Test Program:

o The PFG was in redesign and not available during DT-IIC-3 testing.

o Streamlining the maintenance documentation system would avoid duplication of effort.[12]

On September 30, 1992, DT-IIC-3 began with more than 12,000 hours of testing performed on three configurations of CASS stations, including a hybrid, radio frequency, and electro-optical stations with a full-scale engineering development electro-optical console. The CNI and the hybrid with the PFG configurations that were tested in OT-IIB were not tested in DT-IIC-3 because the spread spectrum assets that make up the CNI were not available and the PFG proved to be immature and unreliable, requiring redesign. The technical

[11]The CASS Life-Cycle Test Program is a recent innovation for supporting the Naval Air Systems Command policy on program management responsibility for aviation systems. The CASS Program Manager is responsible for maintaining readiness and performance of the system and continuous improvement throughout the product life cycle. Those responsibilities are supported through an on-going test and measurement process to monitor station performance in the field, anticipate problems, determine technical solutions, and drive continuous product improvement. The CASS Life-Cycle Test Program began in FY 1992 and continues throughout the life cycle of the program.

[12]The Maintenance Documentation System was ineffective and time-consuming. The procedure was designed to collect maintenance data for possible future interface with the Naval Aviation Logistics Command Management Information System, Phase II; the intermediate maintenance activity; and the Supply Support Center automated maintenance and material control system. Since the user would have to enter information in both the CASS stations and again in the Naval Aviation Logistics Command Management Information System, Phase II, the maintenance documentation system tested was a duplication of effort. However, duplication of maintenance documentation in the CASS Program is now selectable rather than mandatory, eliminating redundancy.

and operational characteristics and thresholds for each test event applied to the DT-IIC-3 CASS test stations were not as stringent as those applied to the OT-IIB CASS test stations. Comparison of the test and evaluation master plans for OT-IIB and DT-IIC-3 showed that DT-IIC-3 had a significant reduction in test parameters (Appendix B) and eliminated the requirement to successfully complete OT-IIIA before full fleet introduction of the CASS Program. The present phase of OT-III, which replaced OT-IIIA in the test plan, is less stringent. Specifically, the OT-IIIA test plan required that "Successful accomplishment of OT-IIIA will support a recommendation for full fleet introduction." This statement was not in the OT-II test plan. The purpose of OT-III is to determine the operational effectiveness and operational suitability of the CASS stations to accurately detect and isolate faults within units under test when executing maintenance and production weapons systems test program sets, to verify correction of deficiencies identified in OT-IIC, and to complete deferred or incomplete operational test and evaluation. Therefore, based on the current acquisition strategy, operational test and evaluation of the test program sets to detect and isolate faults in weapon replaceable assemblies will not be accomplished until after Milestone III.

During the DT-IIC-3, 30 deficiency reports that coincide with the 12 problem areas from the OT-IIB were written. Of the 30 deficiency reports written, 21 were closed, 8 were moved to the Life-Cycle Test Program, and 1 was combined with another deficiency report that was moved to the Life-Cycle Test Program. Additionally, 198 quality-problem reports were issued to the contractor of which 167 were corrected. The remaining 31 quality-problem areas were considered technically low risk[13] and moved to the Life-Cycle Test Program. In the Life-Cycle Test Program, 25 of the 31 quality problem areas were closed. Of the remaining 6 problems areas, 2 are undergoing verification by the Flight Test and Engineering Group to validate correction of the problems, 1 was submitted to the CASS Technical Working Group for approval to proceed with deficiency correction, and 3 are test program set issues that need future life-cycle testing.

On May 14, 1993, the Flight Test and Engineering Group concluded that the 3 configurations of CASS stations used in the DT-IIC-3 and all associated software were technically low risk and could proceed to OT-IIC. However, the Flight Test and Engineering Group recommended further testing during the Life-Cycle Test Program to validate the following items that were deferred to the Life-Cycle Test Program:

- o two OT-IIB deficiencies noted above,
- o deficiencies identified during DT-IIC-2 testing,
- o regression testing for measuring contract compliance with electronic signals at the input/output,

[13]Low risk means that the program has a high probability of meeting all performance objectives; ordinary risk associated with doing business; and no special management action or planning required to verify compliance with cost, schedule, or performance requirements.

o regression testing for measuring contract compliance for station control software, and

o deficiencies identified during contractor demonstration testing.

Operational Evaluation. The Navy conducted the OT-IIC at the CASS Test Facility, Naval Air Station, Patuxent River, Maryland, and aboard the USS Carl Vinson. The purpose of the test was to determine the operational effectiveness and operational suitability of the CASS Program and its readiness for fleet introduction. The 12 major deficiencies from OT-IIB were to be corrected and the corrections verified before fleet introduction of the CASS Program. Those deficiencies were to be examined during the OT-IIC testing. However, the deficiencies associated with the PFG could not be examined because the PFG was undergoing re-engineering to correct the deficiencies experienced in OT-IIB and was not available for OT-IIC testing.

From May 31 through July 9, 1993, OT-IIC logged 2,287 operating hours on 3 configurations of CASS stations, including a hybrid, radio frequency, and electro-optical, at the CASS Test Facility. The technical and operational characteristics and thresholds for tests applied to the OT-IIC CASS test stations were not as stringent as those applied to the OT-IIB CASS test stations (Appendix B). From June 22 through 30, 1993, a CNI-configured CASS station was tested aboard the USS Carl Vinson. While the stations at the CASS Test Facility were configured with production-representative software and associated firmware, the station aboard the ship was configured with non-production-representative software to run a test program set in support of the Joint Tactical Information Distribution System developmental testing. As a result, reliability data was not collected on the shipboard CNI station because of the difference in software and firmware from that at the shore stations.

On September 29, 1993, the Commander, Operational Test and Evaluation Force, reported the results of the OT-IIC. The report did not specifically address whether the 12 major OT-IIB deficiencies were satisfactorily corrected; however, it did state that production CASS stations are operationally effective, operationally suitable in the shore environment, and potentially operationally suitable in the afloat environment. The report recommended fleet introduction to ashore facilities and supported shipboard installations when the following deficiencies were corrected to the Chief of Naval Operations' satisfaction:

o full evaluation of the impact of shipboard Electromagnetic Interference and vibrations on CASS station operations and

o redesign the unit under test holding fixture to conform with shipboard space limitations.

The report also noted that, when shipboard CASS station installations become fully operational, shipboard interoperability of the CASS Program will need to

be evaluated in later test phases. The need for further evaluation occurred because CASS station interoperability[14] was tested in the ashore operating environment only.

On November 4, 1993, the Director, Air Warfare, Office of the Chief of Naval Operations, issued a memorandum addressing the OT-IIC report. The memorandum stated that, based on assessments by engineers from the Flight Test Engineering Group, the issues concerning the impact of shipboard electromagnetic interference, vibrations on CASS station operations, and unit under test holding fixture were resolved; therefore, the CASS Program has demonstrated its readiness for full fleet introduction. The assessments indicated that the engineers tested the impact of shipboard electromagnetic interference and vibrations on CASS station operations, found those concerns to be low risk, and recommended closure. However, for the unit under test holding fixture deficiency, the engineers did not do any operational testing to determine whether the discrepancy was corrected. The engineers based their recommended closure of the discrepancy on corrections being incorporated into the system and assumed that the corrections would be effective without doing additional testing to verify that the deficiency was corrected.

Scheduling Milestone Decision. Based on the results of OT-IIC and the approval by the Office of the Chief of Naval Operations, the CASS Program was scheduled for a Milestone III, Production Approval, decision in March 1994. After we issued our December 17, 1993, memorandum, the Navy clarified that the Milestone III decision was only on 3 configurations of CASS stations, including the hybrid, radio frequency, and CNI. Another Milestone III decision for the electro-optical station configuration is not scheduled until March 1995 after the completion of additional testing. We found no reference to a second Milestone III decision on the electro-optical station configuration until the CASS Program Manager issued a memorandum February 16, 1994, that revised the Integrated Program Summary, stating the recommendation to the Assistant Secretary of the Navy (Research, Development and Acquisition) as:

> Approve Milestone III for the CASS Hybrid, RF [Radio Frequency] and CNI configurations. The first production unit (LRIP II) Electro-optic (EO) configuration is undergoing Physical Configuration Audit (PCA) now. It is scheduled for delivery in November 1994 after completion of First Article and Production Acceptance testing. A Milestone III decision for the EO configuration will be requested in 2QTR [second quarter] FY 1995.

Based on uncertainties as to whether the 12 major OT-IIB deficiencies and the holding fixture deficiency were satisfactorily corrected and the need for further evaluation concerning the electro-optical and shipboard interoperability of CASS stations, decisionmakers cannot be fully assured that the overall CASS Program is operationally ready for fleet introduction and for full-scale production. However, we consider the Navy decision to hold a second Milestone III review

[14]Interoperability is the ability to adequately interface with other specific ancillary equipment and other systems in its intended operating environment.

on the electro-optical configuration to be reasonable so that the tested hybrid, radio frequency, and CNI configurations can proceed as scheduled into production.

Field Reliability Report. The Naval Air Warfare Center, Aircraft Division, Lakehurst, New Jersey (the Aircraft Division), conducts reliability analyses of LRIP CASS stations installed in the field. A report on the analyses is updated monthly and distributed to the CASS Program Office. The report is critical to the CASS Program's development and production and the Navy ATE program and is an excellent management tool. The report:

- o provides a profile of system performance,
- o identifies reliability problem areas,
- o provides direction for reliability improvement,
- o assists the Navy in reassessing its acquisition strategy for the best products,
- o provides maintainability and maintenance information for the CASS Program's logistics planning, and
- o provides Navy ATE program information.

The January 26, 1994, report indicated that

> Over the past few months, the Digital Test Unit (DTU) Channel Cards have been the most troublesome CASS asset. This fact is reflected in the last two reports. Based on this anomaly, the CASS Technical Working Group (TWG) has concluded that an improvement in the manufacturing process, especially in the Environmental Stress Screening (ESS), could significantly improve the reliability of the DTU Channel Cards. While the vendor of the DTU Channel Cards has in the past overlooked the ESS process due to "cost" and "schedule" consideration, it is being realized that an appropriate ESS process is relatively cost effective. A redesign of the DTU Channel Cards is also an option offered by the vendor. Furthermore, we [the Aircraft Division] recommend that the Navy look seriously into the rescreening process and determine if a more stringent rescreening process is also cost effective for the CASS's life cycle.

The report stated that digital test unit failures continue to dominate test results; however, proper attention was given to the digital test unit problem during the CASS Reliability and Maintainability Quarterly Review in December 1993 and during the CASS Technical Working Group Meeting in January 1994. The Navy should continue close scrutiny of field reliability reports to identify and correct deficiencies.

Design Review and Functional and Physical Configuration Audit[15] Deficiencies

The Navy did not verify that design review deficiencies were documented and that discrepancies identified during the functional and physical configuration audits were resolved before the scheduled Milestone III decision.

Design Reviews. The CASS Program Office conducted the Critical Design Review[16] and the Final Design Review[17] in 1986 and 1987, respectively. However, design deficiencies were not documented and tracked to validate that configuration control was maintained throughout the life cycle of the program. Further, without documented deficiencies, the Navy could not verify during the PCA and FCA that deficiencies were resolved and incorporated in the design.

Critical Design Review. The Critical Design Review was used to conduct source selection rather than to perform an in-depth technical assessment of design maturity or to document deficiencies and establish an audit trail to substantiate changes. During the Critical Design Review, the CASS Program Office evaluated the proposals of General Electric, Aerospace Division, and Grumman Aerospace Corporation to select one contractor, which was General Electric, Aerospace Division.

---

[15]Military Standard 973, "Configuration Management," April 17, 1992, defines a functional configuration audit (FCA) as the formal examination of functional characteristics of a configuration item, before acceptance, to verify that the item has achieved the requirements specified in its functional and allocated configuration documentation. A physical configuration audit (PCA) is the formal examination of the as-built configuration of an item against its design documentation. The PCA for a configuration item shall not be started unless the FCA for the configuration item has already been accomplished or is being accomplished concurrent with the PCA. The PCA includes a detailed audit of engineering drawings; specifications; technical data; tests used in production of configuration items; and design documentation, listings, and operation and support documents for computer software configuration items. Preliminary and critical design review minutes shall be examined to verify that all findings have been incorporated and completed.

[16]Military Standard 1521, "Technical Review and Audits for Systems, Equipments, and Computer Software," June 1985, states that a critical design review is conducted for each configuration item when detail design is essentially complete. The purpose of the review is to determine that the detail design of the configuration item under review satisfies the performance and engineering specialty requirements of the hardware configuration item development specifications; establish detail design compatibility among the configuration item and other items of equipment, facilities, computer software, and personnel; assess configuration item risk areas and the results of the producibility analyses conducted on system hardware; and review the preliminary hardware product specifications. For computer software configuration items, the review focuses on the determination of the acceptability of the detailed design, performance, and test characteristics of the design solution and on the adequacy of the operation and support documents.

[17]The Final Design Review reviewed changes made to the system specifications baseline since the Critical Design Review in 1986.

Final Design Review. The Final Design Review included a presentation of the design by General Electric; however, deficiencies and appropriate action items were not prepared and tracked through closure. CASS Program Office officials stated that no deficiencies were documented since the contractor's design met or exceeded all design and performance requirements. However, significant redesign work was performed on CASS stations to change them to a ducted air conditioning cooling system. Also, additional redesign work remains on the under unit test holding fixture, test program set holding fixture, and other CASS assets. The CASS Program Office questioned the contractor about air conditioning cooling, station shut down, cable routing, and other deficiencies at the Final Design Review; however, the Program Office did not prepare action items to correct the deficiencies. Those deficiencies caused failures that were documented as deficiencies during developmental testing. Further, the problems were also identified as deficiencies during the PCA. Therefore, the Navy should have documented and tracked deficiencies at the Final Design Review to correct deficiencies during the early phase of development.

Functional Configuration Audit Results. The FCA for the CASS electronic warfare, radar, CNI, electro-optical, and display test system end items was conducted incrementally beginning in March 1990. The audit documented 259 discrepancies of which 12 remained open as of February 4, 1994. Examples of the discrepancies include functions related to the electro-optical configuration that were not demonstrated such as the ability to measure divergence of the laser, minimum and maximum energy of the laser, and amplitude and pulse stability. The electro-optical configuration is scheduled for a Milestone III decision in March 1995. The Navy had planned to procure 6 LRIP units in the electro-optical configuration as part of the Lot V buy to occur in FY 1995, but changed plans as a result of our audit to delay this procurement until the Lot VI buy in FY 1996.

Physical Configuration Audit Results. The PCA was performed incrementally, beginning January 12, 1992. Each increment of the PCA resulted in a separate listing of deficiencies. General Electric, Aerospace Division, which was acquired by Martin Marietta, did not respond to the discrepancies until May 26, 1992, after the fifth PCA. The incremental PCAs included hardware and software audits. The PCA on the electro-optical configuration was not completed, but is scheduled to be completed leading to completion of first article and production acceptance testing in November 1994.

Hardware Audit. The Naval Air Technical Services Facility Detachment, Washington, District of Columbia (the Facility Detachment), that performed the hardware PCA, documented 675 hardware deficiencies. Deficiencies identified during the hardware PCA included incorrect part markings, components installed on the hardware that did not correspond with the drawing, drawing discrepancies, drawings that did not correctly represent the hardware configuration, quantity differences on the parts list as compared to the hardware, components missing from the hardware, and no part marking. On November 15, 1993, the Facility Detachment stated that for 474 of the 675 deficiencies, it agreed with the solutions proposed by Martin Marietta. For the remaining 201 deficiencies, the Facility Detachment disagreed with the solutions for 32, required additional information for 161, requested solutions for

2, and requested resubmission of the solution for 6. On February 4, 1994, the Facility Detachment stated that it agreed with the solutions for 74 deficiencies and requested resubmission of the solutions for 6 deficiencies. However, the Facility Detachment did not address the status of the remaining 121 open deficiencies.[18] On February 7, 1994, in a point paper, the CASS Program Office indicated that only 7 deficiencies remained open.

Software Audit. The Naval Air Warfare Center, Aircraft Division, Lakehurst, New Jersey (the Aircraft Division), that performed the software PCA, documented 1,144 software deficiencies. As of November 30, 1993, the Aircraft Division considered 1,058 of the 1,144 deficiencies to be closed, 62 deficiencies were in review, and 24 deficiencies relating to hardware specifications were awaiting a response from Martin Marietta. As of January 28, 1994, the Aircraft Division stated that all problems generated during the software PCA have been successfully resolved and closed. Some problems identified during the PCA included no documentation for the firmware, no delivery of software programmer's manuals for commercial off-the-shelf software, and no delivery of other software documentation, which is needed to validate proper support of the equipment. The PCA deficiencies resulted, in part, from a lack of CASS Program software licenses, a software license issue to rebuild all computer software configuration items with Martin Marietta software, and a compiler license for the Spread Spectrum Modulator/Demodulator firmware.

Navy Cost and Operational Effectiveness Analysis

The Navy did not prepare a COEA in support of Milestones IIA-2 and IIA-3, Development Approval for the CASS Program's LRIP Lots II and III milestone decisions in July 1992 and June 1993, respectively, and the Milestone III, Production Approval, decision scheduled for March 1994. Instead, for Milestones IIA-2 and IIA-3, updated program life-cycle cost estimates approved April 3, 1992, and May 27, 1993, respectively, and a cost benefits analysis were substituted for COEAs. The life-cycle cost estimates provided the total cost to the Government of acquisition and ownership of the CASS Program over its useful life, including the cost of development, acquisition, and support. However, those cost estimates lacked comprehensive cost and operational analyses provided by a COEA. Prospective Computer Analysts, Incorporated, originally developed the cost benefits analysis in November 1986 to support the Milestone I decision for engineering development of the CASS Program. In August 1987 and May 1992, the analysis was updated to support the Milestone II and III decisions, respectively. The analysis extensively considered four alternatives and concluded that the CASS alternative was the most effective and cost efficient approach to developing and operating a system that meets the Navy's ATE mission and performance goals for the 1990s and beyond.

[18]The 121 open hardware deficiencies was calculated by subtracting the 74 agreed to solutions and 6 resubmission solutions from the remaining 201 deficiencies.

However, the cost benefit analysis report stated that, even though many elements of a COEA were in the cost benefit analysis, additional efforts were needed to provide a complete COEA. Those additional efforts included:

o sensitivity analysis of independent cost and technical variables;

o expansion and incorporation of mission need analyses;

o expansion and incorporation of threat and operational environment statements;

o expansion of the cost uncertainty analysis of the cost benefit analysis;

o definition of cost and technical thresholds;

o analysis of long-term life-cycle costs, especially operations and support costs for the CASS Program and the Augmentation of Family of Testers alternative; and

o reformatting of the cost benefit analysis results and additional analyses above into the format specified in DoD Manual 5000.2-M.

In view of the comments by Prospective Computer Analysts, Incorporated, in the May 1992 cost benefit analysis stating that additional efforts needed to be performed to provide a complete COEA, we believe that a review of the analyses should be conducted to verify that the analyses contain the elements of a COEA needed to support the Milestone III, Production Approval, decision.

Cause for Inadequate Accomplishment of Specific Exit Criteria

Preparation for the Milestone III decision was not fully adequate because the CASS Program was considered to be low-risk, completion of testing was deferred until the life-cycle test phase, design review minutes were not contract deliverables, reporting design review results and documenting configuration changes were not considered a priority, and a life-cycle cost estimate was considered sufficient cost and operational justification. The CASS Program management deferred essential Milestone III prerequisites until after the Milestone III decision because of concerns about awarding further LRIP contracts and possible breaks in production. However, the program risk associated with this approach should be clearly presented to the milestone decision authority.

Low-Risk Program. CASS stations were not tested because the CASS Program Office considered the system to be low risk and deferred testing until the life-cycle test phase that begins after Milestone III Review and because CASS stations, subsystems, and ancillary equipment were not available during operational testing and evaluation.

Configuration Audits and Design Review. Discrepancies identified during the functional and physical configuration audits were not fully resolved and critical design review deficiencies were not documented because CASS Program officials indicated that minutes from the Critical Design Review were not a deliverable under the contract and because the risk of proceeding to Milestone III with correction of the deficiencies identified but untested was considered low risk. Further, CASS Program officials did not consider reporting the results from the Final Design Review to management and documenting resolution and closure to be a high priority.

Life-Cycle Cost Estimate. A COEA was not prepared in support of the Milestone II and III decisions because life-cycle cost estimates were considered sufficient cost and operational justification to support acquisition of the CASS Program and DoD guidance was interpreted as not requiring a COEA.

Milestone II. Based on a March 30, 1992, memorandum by the Office of the Assistant Secretary of Navy (Research, Development and Acquisition), the Navy considered a life-cycle cost estimate to be sufficient instead of preparing a COEA to support the milestone review process. The memorandum stated that

> In lieu of a Cost and Operational Effectiveness Analysis (COEA), an updated program life cycle cost estimate will suffice for the scheduled intermediate milestone for the CASS low rate initial production (Lot II, Milestone IIA-2). The Navy Program Decision Meeting is scheduled for 30 April 1992.

The memorandum was also the basis for not preparing a COEA for the Milestone IIA-3 decision. The memorandum was based, in part, on:

o an updated cost benefit analysis prepared for Milestone IIA-1 in September 1990 showed that the CASS Program was more cost beneficial than upgrading the existing family of testers or peculiar test equipment alternatives,

o an updated life-cycle cost estimate had already been prepared to support the Milestone II-2A decision, and

o a COEA proposal for Milestone III had been prepared.

The COEA proposal prepared by the CASS Program Office stated, in part, that

> The CASS Program Manager anticipates requesting approval for a second Low Rate Initial Production (LRIP) buy in April 92. To support this Milestone an updated program Life Cycle Cost (LCC) Estimate is viewed as sufficient for meeting the milestone COEA requirement. As part of this COEA process, the LCC will be reviewed and its results and assumptions validated by the COEA Study Team prior to Milestone IIA-2.

Milestone III. For Milestone III, the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) determined that a COEA was not required based on a previous decision and interpretation of DoD

Instruction 5000.2 and DoD Manual 5000.2-M even though an undated COEA proposal by the CASS Program Office indicated that a COEA was required. The COEA proposal stated, in part, that

> In preparation for Milestone III, a complete COEA in accordance with the requirements of reference (a) [DoD Instruction 5000.2, part 4, section E, "Cost and Operational Effectiveness Analysis"] will be accomplished by the Study Team. The team will study and analyze three potential solutions to the Navy's Automatic Test Equipment requirement for the latter twentieth/early twenty-first century.

Documentation provided by the CASS Program Office indicated that the COEA proposal was not approved and that a COEA was not required for the Milestone III decision based on the March 30, 1992, memorandum by the Office of the Assistant Secretary of Navy (Research, Development and Acquisition), which, as discussed above, addressing only an LRIP decision and not the Milestone III decision. The documentation included another memorandum from the Office of the Assistant Secretary, dated October 9, 1991, and one from the Office of the Deputy Chief of Naval Operations, dated June 1, 1992, that also indicated that a COEA was not required for the Milestone III decision. Since a COEA was not approved for the Milestone III decision, the CASS Program Office requested studies of the CASS Program.

Office of the Assistant Secretary of the Navy (Research, Development and Acquisition). An October 9, 1991, memorandum by the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) indicated that a Milestone III does not normally require a COEA. Instead, the program office would provide updated life-cycle cost data, as appropriate. The memorandum indicated that the decision was based on DoD Manual 5000.2-M, part 8, concerning Milestone III guidance and stated that

> A cost and operational effectiveness analysis is not required unless conditions have changed sufficiently so that previous cost-effectiveness determinations are no longer valid. Because costs are more likely to have changed, Milestone III analyses often provide updated estimates of life cycle costs.

We disagree with the above position by the Assistant Secretary of the Navy (Research, Development and Acquisition). If costs change, the validity of a previous cost and operational effectiveness determination can only be assessed through an updated COEA, not updated life-cycle costs. Additionally, since a COEA was not prepared for the CASS Program at Milestone III, a COEA cannot be updated. Also, DoD policy states memoranda such as this by the Assistant Secretary expire if not formally implemented into policy within 90 days. A COEA should have been prepared for the CASS Program's Milestone III decision to determine whether the Program was cost-effective. Since a COEA had not been prepared for the previous milestones, decisionmakers could not validate previous COEA determinations and assess whether the CASS Program was the most cost-effective alternative. Further, DoD Manual 5000.2-M supplements guidance provided by DoD Instruction 5000.2. The Instruction states that

> At Milestone III, Production Approval, the COEA may be only an update of the Milestone II analysis. However, if there have been major performance or cost changes during Phase II, Engineering and Manufacturing Development, a new analysis may be required. The elements of the analysis to be updated for a Milestone III review will be specified by the milestone decision authority as part of the pre-milestone planning process.

Particularly since a COEA had not been prepared for the Milestone II decision, the Assistant Secretary of the Navy (Research, Development and Acquisition) should have considered requiring the preparation of a COEA as part of the pre-milestone planning process for the CASS Program's Milestone III decision to validate that the most cost and operationally effective program is being produced to meet recognized Defense needs.

Office of the Deputy Chief of Naval Operations. A June 1, 1992, memorandum by the Office of the Deputy Chief of Naval Operations for Navy Program Planning[19] interpreted DoD Instruction 5000.1, "Defense Acquisition," February 23, 1991, to state that, beyond Milestone II, a COEA was not required for programs. The memorandum stated that program managers and sponsors should be notified that a COEA was not required. The memorandum indicated that representatives from the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) and the Office of the Deputy Chief of Naval Operations made the determination. Such a determination is not in accordance with DoD Instruction 5000.2, as noted above. The Office of the Deputy Chief of Naval Operations should have recommended that an updated COEA be prepared for Milestone III decisions.

Studies. Since the preparation of a COEA was not approved for the Milestone III decision, the CASS Program Office requested studies by the Center for Naval Analyses and the Institute for Defense Analyses.

Center for Naval Analyses Study. In May 1993, the Center for Naval Analyses issued a study on the benefits of the CASS on an aircraft carrier. The study examined what impact the replacement of existing ATE with CASS stations would have on the aircraft intermediate maintenance department of an aircraft carrier. The study team visited the USS America; inventoried the ATE that was aboard; and talked with aircraft intermediate maintenance department officers, shop supervisors, and operators about tester usage rates. The study team determined the number and type of CASS stations that would be required to produce the same throughput of work as the existing ATE. The study concluded that by replacing existing ATE on the USS America with CASS stations, a reduction in the following would result:

- the number of operators and maintainers would drop from 98 to 68, saving about $1 million;

- associated annual training costs would decrease by a factor of five; and

[19]Name changed to Office of the Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessment, in 1992.

o the number of spare parts to support the test equipment would drop from 2,000 to 120 items, saving about $9 million.

Institute for Defense Analyses Study. In May 1993, the Institute for Defense Analyses issued a study that estimated the costs and benefits of Pre-Planned Product Improvements to the CASS Program. The study stated that the CASS was the most comprehensive general-purpose ATE in DoD. Congress, OSD, and the Navy have expressed interest in expanding the capability of the CASS Program to test new, emerging avionics systems and in applying CASS to Navy shipboard electronics and other electronics for the Army, the Air Force, and the Marine Corps. The study constructed and analyzed a list of potential candidate Pre-Planned Product Improvements and estimated the costs of the improvements by the expenses of procuring the equipment and supporting software, integrating the system into the CASS Program, and operating and supporting the new capability at operational sites. The benefits of the improvements were estimated by their ability to test the emerging avionics systems that are being designed for new Navy and Air Force aircraft such as the F/A-18E/F, F-22, and A/F-X. The study was not a cost-effectiveness analysis; however, it did recommend a list of Pre-Planned Product Improvements for immediate follow-on engineering study. The approach highlighted by the study has significant merit.

Effect of Milestone Decision and Test Equipment Review

If the CASS Program does not successfully complete additional operational test and evaluation and verify correction of deficiencies identified in testing and configuration audits, the Navy cannot be assured that the CASS Program has corrected all test deficiencies, will not experience excessive rework and retrofit, and will not require additional funding.

Test Deficiencies. By deferring many deficiencies identified during developmental and operational testing to the Life-Cycle Test Program, decisionmakers cannot be assured that the CASS Program is ready for entry into the Production and Deployment phase of the acquisition process. The Navy is making changes to the CASS Program to correct the deficiencies and is producing CASS stations and subsystems containing most improvements. Until these CASS stations are tested further, however, decisionmakers will not know whether the changes have resolved the previously identified problems. The Navy plans to conduct a follow-on operational test and evaluation in the third quarter of FY 1995 on CASS stations to verify that the previously identified problems have been resolved; however, this follow-on operational test is scheduled more than a year after the planned Milestone III, Production Approval, decision in March 1994. Before the planned follow-on operational tests, the Navy will have contracted for 306 CASS stations,[20] which is about

[20]The Navy approved production of 55, 60, and 68 CASS stations in September 1990, July 1992, and June 1993, respectively, and is planning to approve production of 63 and 60 stations in March 1994 and March 1995, respectively, for a total of 306 stations.

43 percent of the total production of 720 stations. In FY 1996, the Navy has scheduled a Lot VI production buy for 82 stations. However, before this buy, the Navy should complete the OT-III to verify that deferred CASS Program deficiencies have been corrected.

Rework and Retrofit. By not ensuring that operational performance requirements are met and functional and physical configuration audit deficiencies are corrected before establishing a production baseline, the Navy cannot be assured that CASS Program operational requirements are met and design deficiencies have been corrected before production that could result in excessive rework and retrofit. In addition, the program could experience increasing program costs and a lengthened procurement schedule as a result of not correcting deficiencies identified in the configuration audits.

Additional Funding. Using incomplete test results increases the risk of costly retrofits or fielding an ineffective system. Additionally, the Program may require additional funding for life-cycle testing associated with deferring the correction of test deficiencies.

Conclusion

Milestone Decision. A Milestone III, Production Approval, decision for the CASS Program limited to the Lots IV and V production buys should be conducted on the hybrid, radio frequency, and CNI approved configurations. Limiting the Milestone III decision to the Lots IV and V production buys and approved configurations would permit continued production. The Navy's second Milestone III decision on the electro-optical configuration could then review completion of operational testing of corrective actions for deficiencies identified in prior operational tests that have been deferred to the Life-Cycle Test Program. Equally important, OT-III test results will provide operational effectiveness and suitability assessment of the CASS Program to accurately detect and isolate faults in units undergoing test. However, before the Milestone III decision for the Lots IV and V production buys, the Assistant Secretary of the Navy (Research, Development and Acquisition) should review the CASS Program cost and benefit analyses to determine whether the analyses can be used in lieu of a COEA to support the Milestone III decision. The DoD Instruction 5000.2 allows the milestone decision authority to specify the elements of a COEA for the Milestone III decision. However, a COEA of the CASS Program may not be needed to support the Milestone III decision because of:

- the cost benefit analyses already prepared,
- the need to proceed with the Program, and
- our recommendations in a separate audit report to perform a COEA of the overall DoD automatic test system investment strategy.

The award of the Lot VI buy should be deferred until successful completion of operational test and evaluation and correction of the deficiencies identified during the functional and physical configuration audits. The OT-III phase of the CASS Program should include an evaluation of operational effectiveness and suitability of the CASS Program. For future Milestone III decisions on other Navy programs, policy should be issued requiring that COEAs be conducted.

Cost and Operational Effectiveness Analysis Policy. The October 9, 1991, position by the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) indicating that a Milestone III decision does not normally require a COEA does not comply with DoD Instruction 5000.2. The Assistant Secretary should issue clear policy requiring that COEAs be prepared for all future Milestone III decisions in accordance with DoD Instruction 5000.2.

Director, Operational Test and Evaluation. The Director, Operational Test and Evaluation, should designate the CASS Program for oversight and decide on the operational effectiveness and suitability of the CASS Program in support of the recommended Navy Program Decision Meeting before the Lot VI production buy. To verify that the CASS Program is operationally ready for production and deployment and suitable for fulfilling a variety of DoD ATE requirements, the CASS Program should be subject to test and evaluation oversight by the Director, Operational Test and Evaluation. Copies of the formal, detailed developmental and operational test and evaluation reports of the results, conclusions, and recommendations prepared at the end of each phase of developmental, operational test and evaluation, and field reliability reports should be provided to the Director, Operational Test and Evaluation, for an assessment of test adequacy and the Director's assessment of the CASS Program's operational effectiveness and suitability. This assessment is particularly important since the CASS Program may be considered as a standard ATE set for use by other Military Departments. The decision concerning the operational effectiveness and suitability of the CASS Program should be provided to the Assistant Secretary of the Navy (Research, Development and Acquisition) for consideration at the recommended Navy Program Decision Meeting.

Recommendations for Corrective Action

1. We recommend that the Assistant Secretary of the Navy (Research, Development and Acquisition):

a. Conduct a Milestone III, Production Approval, decision for the Consolidated Automated Support System Program limited to the Lots IV and V production buys and the hybrid, radio frequency, and Communications/ Navigation/Identification configurations.

b. Defer the award of the Lot VI production buy decision until the results of operational test and evaluation through the Operational

Testing-III phase are available and a Navy program decision meeting to review the overall Consolidated Automated Support System Program and, in particular, the electro-optical configuration is completed.

c. Require the Operational Testing-III phase include operational effectiveness and suitability of the Consolidated Automated Support System Program to accurately detect and isolate faults within Units Under Test when executing maintenance and production weapons systems test program sets, to verify correction of deficiencies identified in Operational Testing-IIC, and to complete deferred or incomplete operational test and evaluation.

d. Require correction of the deficiencies identified during functional and physical configuration audits of the Consolidated Automated Support System Program. Correction is defined as successful completion of a plan of action by the contractor with mutual agreement by the Navy on the corrective actions to be incorporated into production units before the Lot V production decision.

e. Decide whether the Consolidated Automated Support System Program cost and benefit analyses contain the elements of a cost and operational effectiveness analysis needed to support the Milestone III, Production Approval, decision.

f. Issue clear policy for future program decisions that require cost and operational effectiveness analyses be conducted for Milestone III, in accordance with DoD Instruction 5000.2, "Defense Acquisition Policies and Procedures," February 23, 1991, and DoD Manual 5000.2-M, "Defense Acquisition Management Documentation and Reports," February 23, 1991.

2. We recommend that the Director, Operational Test and Evaluation:

a. Designate the Consolidated Automated Support System Program for program oversight, including review of the test and evaluation master plan.

b. Render a decision concerning the operational effectiveness and suitability of the Consolidated Automated Support System Program based on the results of Operational Testing-III in support of the recommended Navy program decision meeting before the Lot VI production buy.

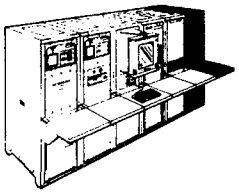
Management Comments and Audit Response

Management Comments. We did not receive formal comments from the Assistant Secretary of the Navy (Research, Development and Acquisition) and the Director, Operational Test and Evaluation, to a draft of this report issued March 17, 1994. The comments were required by May 16, 1994.

Audit Response. The DoD Directive 7650.3 requires that all audit recommendations be resolved promptly. Although we understand that the Navy has taken action to address the concerns raised in this report and to implement the recommendations, confirmation is needed, as well as estimated dates of completion for all actions. Therefore, we request that the Assistant Secretary and the Director provide comments on the final report.

Part III - Additional Information

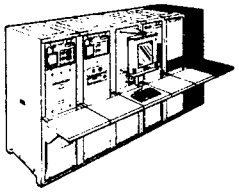
Appendix A. Consolidated Automated Support System Station Configurations



CNI Station

Basic Test Capability
plus:

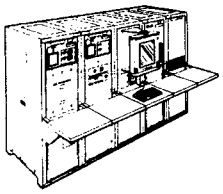
- Communications
- Navigation
- Spread Spectrum Systems



RF Station

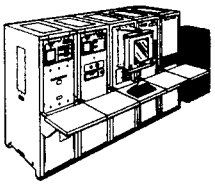
Basic Test Capability
plus:

- Electronic Counter-Measures
- Electronic Counter-Counter-Measures
- Electronic Warfare Support Measures
- Fire Control Radar
- Navigation Radar
- Tracking Radar
- Surveillance Radar
- Radar Altimeter



Hybrid Station
(Basic Test Station)

- General Purpose Electrical / Electronics
- Computers
- Instruments
- Flight Controls
- Plus Subsystems for
  - Pneumatic
  - Display
  - Inertial Navigation



EO Station

Basic Test Capability
plus·

- Forward Looking Infrared (FLIR)
- Lasers / Designators
- Laser Range Finders
- Visual TV Systems

Appendix B. Changes in Consolidated Automated Support System Test Characteristics

The CASS test characteristics in the Test and Evaluation Master Plans used for the OT-IIB and DT-IIC-3 were compared for differences in technical and operational characteristics and thresholds. The Test and Evaluation Master Plan No. 778, revision 1, change 1, January 3, 1992, approved by the Assistant Secretary of the Navy (Research, Development and Acquisition), was used to conduct OT-IIB testing. The Test and Evaluation Master Plan No. 778, revision 1, change 2, May 16, 1993, approved by the Acting Assistant Secretary of the Navy (Research, Development and Acquisition), was used to conduct DT-IIC-3 and OT-IIC testing.

Critical Technical Characteristics. The following critical technical characteristics were in change 1 but not in change 2:

- Mean-Time-To-Calibrate
- Maximum Annual Scheduled Maintenance
- Time Constraints for Fault Isolation

Technical Threshold. One technical threshold in change 1 was reduced in change 2: Test Program Set Transferability was reduced from 100 percent to 90 percent.

Operational Characteristic Threshold. One operational characteristic threshold in change 1 was excluded in change 2: the time constraints for Fault Isolation.

Suitability Parameter. The following suitability parameters in change 1 were excluded in change 2:

- Mean-Time-To-Calibrate
- Maximum Annual Scheduled Maintenance
- Maximum Corrective Maintenance Time

Appendix C. Summary of Potential Benefits Resulting From Audit

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
1.a.	Program Results. Will validate the production of the CASS Program limited to the Lots IV and V production buys.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
1.b.	Program Results. Will verify the deferral of the Lot VI production buy decision until operational test and evaluation is successfully completed.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
1.c.	Program Results. Will verify that the Operational Testing-III phase includes operational effectiveness and suitability.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
1.d.	Program Results. Will verify correction of the deficiencies identified during functional and physical configuration audits of the CASS Program.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
1.e.	Program Results. Will verify that CASS Program cost and benefit analyses contain the elements of a cost and operational effectiveness analysis.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
1.f.	Program Results and Internal Controls. Will validate that cost and operational effectiveness analyses are prepared for future Milestone III decisions.	Benefits not quantifiable because the benefits will depend on future actions by the Navy.
2.	Program Results. Will provide an independent decision as to the operational effectiveness and suitability of the CASS Program.	Benefits not quantifiable because the benefits will depend on future actions by OSD.

Appendix D. Organizations Visited or Contacted

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology, Washington, DC
- Assistant Secretary of Defense (Economic Security), Washington, DC
- Director, Acquisition Program Integration, Washington, DC
- Director, Tactical Systems, Washington, DC

Comptroller of the Department of Defense, Washington, DC
Director, Operational Test and Evaluation, Washington, DC

Department of the Navy

Assistant Secretary of the Navy (Research, Development and Acquisition), Washington, DC
Naval Air Systems Command, Arlington, VA
- Consolidated Automated Support System Program Office, Arlington, VA
- Naval Air Technical Services Facility, Washington, DC
- Naval Air Warfare Center, Aircraft Division, Lakehurst, NJ
- Naval Air Warfare Center, Aircraft Division, Patuxent River, MD

Naval Sea Systems Command, Arlington, VA
Space and Naval Warfare Systems Command, Arlington, VA
Commander, Operational Test and Evaluation Force, Norfolk, VA

Department of the Air Force

Assistant Secretary of the Air Force (Acquisition), Washington, DC
- Deputy Assistant Secretary (Communications, Computer and Support Systems), Washington, DC

Defense Agencies

Defense Contract Audit Agency, Alexandria, VA
Defense Logistics Agency, Alexandria, VA
- Defense Contract Management Command, Alexandria, VA
  - Defense Contract Management Area Office, Orlando, FL

Contractor

Martin Marietta, Daytona Beach, FL

Department of the Air Force

Secretary of the Air Force
Assistant Secretary of the Air Force (Acquisition)
Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Air Force Audit Agency

Defense Agencies

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
  Commander, Defense Contract Management Command
    Defense Contract Management Area Office, Orlando, FL
Inspector General, Defense Intelligence Agency
Inspector General, National Security Agency
Director, Defense Logistics Studies Information Exchange

Non-Defense Organizations

Office of Management and Budget
U.S. General Accounting Office, National Security and International Affairs Division, Technical Information Center

Chairman and Ranking Minority Member of the Following Congressional Committees and Subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Government Operations
House Subcommittee on Legislation and National Security, Committee on Government Operations

Audit Team Members

Donald E. Reed	Director, Acquisition Management Directorate
Russell A. Rau	Audit Program Director, Systems Acquisition Division
Jack D. Snider	Audit Project Manager
Cordelia Grace-Scott	Senior Auditor
Debbie A. Calhoun	Auditor
Mary Ann Hourclé	Editor
Teresa D. Bone	Administrative Support