Audit Report

ACQUISITION OF THE AMPHIBIOUS
LANDING TRANSPORT DOCK 17 CLASS OF SHIPS

Report Number 98-078 February 18, 1998

Office of the Inspector General
Department of Defense

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Acronyms

IPPD	Integrated Product and Process Development
LPD	Landing Transport Dock

February 18, 1998

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND TECHNOLOGY
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit Report on Acquisition of the Amphibious Landing Transport Dock 17 Class of Ships (Report No. 98-078)

We are providing this audit report for information and use. The Assistant Secretary of the Navy for Research, Development, and Acquisition concurred with the report's results.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Mr. Brian M. Flynn, Audit Program Director, at (703) 604-9051 (DSN 664-9051), email <bflynn@dodig.osd.mil>; or to Mr. David M. Wyte, Audit Project Manager, at (703) 604-9027 (DSN 664-9027), email <dwyte@dodig.osd.mil>. See Appendix D for the report distribution. The audit team members are listed inside the back cover.

David Steensma

David K. Steensma
Deputy Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 98-078 **February 18, 1998**
(Project No. 7AL-3009)

Acquisition of the Amphibious Landing Transport Dock 17 Class of Ships

Executive Summary

Introduction. This report discusses the Navy acquisition of the Amphibious Landing Transport Dock 17 class of ships (LPD 17). The Acquisition Category I Defense program for 12 vessels is expected to exceed $10 billion (then-year costs). The Navy is developing and constructing the LPD 17 class of ships in response to the Marine Corps "Operational Maneuver From the Sea" warfighting concept and its need to replace ships built in the 1960s and early 1970s. Milestone II approval for the ship class acquisition occurred in June 1996. Following a December 1996 competitive source selection, the Navy awarded a combination engineering, manufacturing and development, and low-rate initial production contract to Avondale Industries for $641 million.

Audit Objectives. The audit objective was to evaluate the overall management of the LPD 17 weapon system to determine whether the Navy is developing the acquisition cost-effectively in readiness for the production and deployment phases of the acquisition process. The audit also evaluated the effectiveness of the management control program as it applies to the audit objective.

Audit Results. The Navy developed an acquisition strategy for the LPD 17 weapon system that implements acquisition reform principles and reduces risk. Specifically, the strategy engages the warfighters in the weapon system acquisition, compresses schedules for the development and production phases, reduces cost of ownership, and should the need arise, provides flexibility for delivery deviations and less-than-desired performance. If the strategy is implemented as planned, the Navy should be able to deliver 12 LPD 17 class amphibious ships that meet requirements, are on time, and are within projected life-cycle costs. In addition, when compared with the LPD 17 Program Office Milestone II life-cycle cost estimate, the acquisition strategy will allow the Navy to retire 4 classes of ships and reduce operation and support costs for the LPD 17 ship class by $3.6 billion.

The management controls were effective in that we identified no material management control weakness. See Appendix A for details on the management control program.

Management Comments. The Assistant Secretary of the Navy (Research, Development, and Acquisition) concurred with the report's results. Part III contains the Navy comments.

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Part I - Audit Results

Audit Background

The Amphibious Landing Transport Dock 17 class of ships (LPD 17) is a Navy Acquisition Category I Defense weapon system acquisition. The ship class acquisition for 12 vessels is expected to exceed $10 billion (then-year costs). The Navy expects the twelfth ship to be delivered to the fleet in 2009. The Program Executive Office for the acquisition is the Carriers, Littoral Warfare, and Auxiliary Ships Management Directorate of the Navy. The program management office for the LPD 17 weapon system acquisition is Program Management Ships-317.

LPD 17 Acquisition. The LPD 17 class of ship weapon system acquisition entered its Milestone II acquisition phase in June 1996. Following a source selection in December 1996 between two competing contractor teams, the Navy awarded an engineering and manufacturing development, low-rate initial production contract. The target price for the lead LPD 17 ship is $641 million. As a result of the cost-plus-award-fee contract to Avondale Industries and its alliance team of Bath Iron Works, Hughes Aircraft Company, and Intergraph Corporation, the competing contractor filed a protest with the General Accounting Office, forcing the Navy to stop work on the lead ship until the protest was adjudicated. In April 1997, the General Accounting Office sustained the Navy award to Avondale Industries, allowing work to resume on the weapon system acquisition.

LPD 17 Requirements and Specifications. The Navy is developing and constructing the LPD 17 class of ships in response to the Marine Corps "Operational Maneuver From the Sea" warfighting concept and the need of the Navy to replace ships built in the 1960s and early 1970s. Marine Corps doctrine and tactics emphasize speed and maneuverability with sufficient vehicle, troop, and cargo lift capability for 2.5 Marine expeditionary brigades, helicopters, and landing craft air cushion vehicles. As members of three-ship amphibious ready groups, the LPD 17 class of ships will be capable of conducting over-the-horizon landing operations by deploying Marines on assault vehicles and landing craft, as well as on rotary and tilt-wing aircraft. Also, the Marine Corps AV-8 vertical-lift, fixed-wing aircraft will land and take off from LPD 17 flight decks. Further, the LPD 17 class of ships will be designed with reduced radar cross-section signatures and compartments configured for amphibious craft logistics support, aviation maintenance, and medical treatment of casualties.

The LPD 17's integrated combat system will support primary and secondary warfighting missions with cooperative engagement capability. Ship class design will accommodate advanced self-defense suites with highly integrated interior command, control, and communications systems. Fiber-optic local area networks will provide information conductivity and connectivity throughout the vessels. In addition, the LPD 17 will have state-of-the-art heating, ventilation, and air conditioning systems and will provide the latest quality-of-life standards for crew members and fleet Marines.

Audit Objectives

The audit objective was to evaluate the overall management of the LPD 17 weapon system acquisition to determine whether the Navy is developing the acquisition cost-effectively in readiness for the production and deployment phases of the acquisition process. We used the critical program management elements approach for the audit, and we tailored the approach to the engineering, manufacturing, and development phases of the acquisition process. We reviewed program definition, structure, and design; contracting; program assessments and decision reviews; periodic reporting; and management controls related to those objectives. The scope and methodology used to accomplish the objective, as well as the management controls, are discussed in Appendix A. Appendix B discusses prior audit coverage.

Delivering the Landing Transport Dock 17 Class of Amphibious Ships

The Navy developed an acquisition strategy for the LPD 17 weapon system that implements acquisition reform principles and should reduce risk. Specifically, the strategy engages the warfighters in weapon system acquisition, compresses schedules for the development and production phases, reduces cost of ownership, and provides flexibility for delivery deviations and less-than-desired performance should needs arise. If the strategy is implemented as planned, the Navy should be able to deliver 12 LPD 17 class amphibious ships that meet requirements, are on time, and are within projected life cycle-costs. In addition, when compared with the LPD 17 Program Office Milestone II life-cycle cost estimate, the acquisition strategy will allow the Navy to retire 4 classes of ships and reduce operation and support costs for the LPD 17 ship class by $3.6 billion.

Acquisition Reform Guidance

Planning and decisionmaking for the preliminary design and construction for the LPD 17 lead ship, *San Antonio*, began before DoD finalized acquisition reform guidance. In anticipation of the revised DoD Directive 5000.1, "Defense Acquisition," March 15, 1996, and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996, the Navy designed and implemented an acquisition strategy for the LPD 17 weapon system that addressed acquisition reform principles and reduced risks.

Acquisition Strategy

The Navy designed the acquisition strategy for the LPD 17 weapon system to concurrently accomplish three objectives. The LPD 17 acquisition strategy:

- supports the warfighter with vessels that perform mission requirements with ease of operation and support,

- expedites ship deliveries without decrementing quality by improving the acquisition business processes, and

- reduces life-cycle costs by introducing and installing "state of the practice" applications and products that will reverse "cradle to grave" cost growth.

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Supporting the Warfighter. The Navy designed the LPD 17 acquisition strategy to continually engage, the support of the warfighter. Before and after the *San Antonio's* preliminary ship design, the Navy actively solicited warfighters' ideas, comments, and recommendations. The Navy established the LPD 17 War Room, scheduled early operational assessments by the weapon system's testers, and placed on integrated product teams subject-matter experts on amphibious ship operations and Marine Corps warfighting doctrine and tactics for the LPD 17 weapon system acquisition.

LPD 17 War Room. The LPD 17 War Room serves as an engineering environment where warfighters, maintainers, and trainers can analyze problems and issues and generate potential solutions. Located at the Expeditionary Warfare Training Group Atlantic Headquarters Little Creek, Virginia, the LPD 17 War Room is also where key action officers meet to resolve mismatches between ship design and weapon system equipment with warfighting doctrine and tactics. The LPD 17 War Room:

- displays LPD 17 prints, diagrams, and artist's conceptions, and accommodates large screen computerized display capability for video, modeling simulations, and automated presentations;

- maintains documents and reference material in a library related to the LPD 17 weapon system; and

- sponsors conferences and workshops on topics addressing staffing; command, control, communications, computers, and information; maintenance; and women on the LPD 17.

The Navy conducted approximately 20 conferences, with each lasting for 2 days and averaging attendance of 35 members per conference session. In addition, the Navy posted workshop and conference reports and contents of the LPD 17 War Room library on the World Wide Web site.

Early Operational Assessments. The Navy scheduled early operational assessments by the Navy Operational Test and Evaluation Force and the Marine Corps Office of Test, Evaluation, and Analysis. The results of the early assessments on the preliminary designs of the *San Antonio* will improve the LPD 17 weapon system's operating and warfighting capabilities. Operational and suitability assessments made by subject-matter experts identified the following:

- potential illumination deficiencies in ship compartments,

- potential fueling difficulties,

- requirements for more testing to evaluate the interface effect of the MV-22 tilt wing weapon system,

- potential design deficiencies limiting mess deck seating and obstructing food service traffic flow,

- missing demineralized water station and inertial navigation cable to support AV-8 aircraft operations,

- a missing aviator storage locker for flight deck equipment,

- untested reliability of software for installed systems,

- a potential safety hazard because of a ladder placed near the port refueling stations, and

- an overstaffed bridge watchstanding team.

The Navy and Avondale Industries have recognized the deficiencies and issues and are addressing them in the detail design of the LPD 17 lead ship. Further, Navy and Marine Corps independent testers will make a follow-on assessment at the conclusion of the lead-ship detail design.

Integrated Product Teams. The Navy and Avondale Industries placed on integrated product teams subject-matter experts on amphibious ship operations and Marine Corps warfighting doctrine and tactics. The integrated product team members include other contractors who have developed, produced, and logistically supported types of systems similar to that being placed on the LPD 17s. The Navy program management office has a combined total of 774 years of amphibious shipboard experience, design, training, maintenance, and supply support experience. Avondale Industries has constructed a full range of Navy, Coast Guard, and merchant vessels, including the latest Dock Landing Ship number 52.

Improving the Acquisition Business Processes. The Navy LPD 17 acquisition strategy will implement new acquisition reform business processes. As Avondale Industries considers all elements of the product life cycle from conception through disposal to include quality, cost, schedule, and user requirements, the Navy believes that it will:

- advance LPD 17 ship deliveries by compressing planning and production cycles;

- simplify operation and support tasks by eliminating or replacing subsystems and components that are complicated, unique, and manpower intensive; and

- minimize operating disruptions by designing allowances and reserve capacity for future replacements and technical improvements into the LPD 17 class of ships.

The improved business processes and expected benefits that the Navy and Avondale Industries believe will result from the LPD 17 weapon system acquisition are as follows.

Integrated Product and Process Development Concept. The Navy and Avondale Industries are designing, producing, and planning to logistically support the LPD 17 weapon system acquisition following the integrated product and process development (IPPD) concept. They jointly formed multi-disciplinary product and cross-product teams to design, construct, and integrate the lead ship acquisition. Product teams exist for machinery, hull, accommodations, topside, distributed systems, integrated ship electronics, and mission. Cross-product teams exist for program management, total ship engineering, ownership, cost engineering, combined test, and integrated product data environment.

The IPPD concept will expedite weapon system deliveries by using concurrent engineering during development and production to streamline the process, minimize rework, and eliminate poor concepts. For example, the National Shipbuilding Research Program users' guide, "Concurrent Engineering - Primer and User's Guide for Shipbuilding," January 1995, states that development time can be reduced by as much as 70 percent, engineering changes by as much as 90 percent, and time to market by as much as 90 percent in some industries when they implement the IPPD concepts. Further, because the Navy actively participates in the process, contractor time and resources formerly dedicated to preparing and presenting program reviews and contract data requirements can be reduced or eliminated.

People Empowerment. The Navy and Avondale Industries IPPD concept empowered the LPD 17 product and cross-product teams to make decisions. Product and cross-product team charters make participating members responsible for all aspects of their products. The Navy and Avondale Industries accomplished the decisionmaking shift with formal training, IPPD facilitators, and appropriate guidance. Further, collocating Navy and Avondale Industries' team members in the same work area will save time by resolving issues on the spot without elevating them through their respective functional chains of command for resolution and approval. Savings can range from a few days to weeks depending on the substance of unresolved issues.

Integrated Product Data Environment. Avondale Industries is maintaining all data relevant to the LPD 17 weapon system in an integrated product data environment. The integrated product data environment architecture integrates a central 3-D ship product model with associated data products for designs, production milestones and schedules, technical manuals, configuration management documents, and life-cycle logistics support for electronic retrieval by interested users. The integrated product data environment database includes vendors' drawings and other technical information related to weapon system acquisition and its support. Should modifications occur as data are placed in the system, links within the system make changes to other stored data. The linkage capability avoids false starts and maintains communication and continuity throughout the acquisition process for all the affected acquisition IPPD teams. The integrated product data environment architecture for the product data management system uses commercially available components and allows flexibility for data use with evolved software applications. Further, the Navy uses a similar product data management system for its own applications.

Integrated Management Plan and Master Integrated Resource and Work Schedule. The Integrated Management Plan prepared by Avondale Industries defines how Avondale Industries will manage concurrent and interactive efforts affecting the LPD 17 lead-ship detail design and its system integration, construction, testing, and logistics and life-cycle support. As a component of the Integrated Management Plan, the Master Integrated Resource and Work Schedule identifies key events to support contract milestones and identifies critical paths to achieve exit criteria. As a management tool, the Integrated Management Plan and the Master Integrated Resource and Work Schedule combined with the cost/schedule control system criteria provide the Navy with baselines to measure and evaluate Avondale Industries' development and production progress and efficiency for the LPD 17 lead ship, *San* Antonio.

Incentives. The Navy LPD 17 lead-ship contract will encourage and reward Avondale Industries for superior effort. By placing options and award fees in the contract, the Navy hopes to establish and maintain a long-term relationship with Avondale Industries as its full-service contractor for the LPD 17 class of ships.

Options. To become the full-service contractor of the Navy for the LPD 17 class of ships, Avondale Industries must demonstrate that it can deliver ships on time and within estimated costs, and within or below estimated life-cycle costs. By using the modeling and metrics in the integrated product data environment and Integrated Management Plan to measure its effectiveness, Avondale Industries will demonstrate to the Navy that it can obtain planned schedule and life-cycle-cost objectives. By driving down production labor and material costs and operating and support costs for the LPD 17 weapon system, Avondale Industries expects to reduce life-cycle costs by more than 25 percent.

Award Fees. Avondale Industries can earn up to $64 million in award fees for its performance on the LPD 17 lead-ship contract. To earn the total of all award fees, Avondale Industries has to demonstrate exceptional management performance, technical performance, construction performance, cost performance, and cost-of-ownership-reduction performance. Further, all unearned award fees for evaluation periods will be carried over to a final award fee pool. However, to earn the final award fee, Avondale Industries has to demonstrate to the Navy within 2 years after the guaranty period ends that the first LPD 17 ship performs within required mission effectiveness operating parameters and predicted life-cycle operation and support costs. The final fee could amount to as much $10 million per ship.

Eliminating Military Specifications and Standards. The Navy request for proposal for the LPD 17 lead ship eliminated 569 military standard and specification requirements. By substituting performance specifications for standard design and production requirements, the Navy reduced more than 60 percent of the requirements in the initial LPD 17 request for proposal. In addition, the Navy has minimized contract data requirement deliverables. Requested data will be in the integrated product data environment and can be formatted without placing undue administrative burdens on Avondale Industries. In addition, submitted data will be provided in digital format rather than on paper, so the Navy expects to eliminate more than 600 paper documents.

Commercial Applications. The Navy modified the performance requirements for the LPD 17 lead-ship contract to reasonably accommodate nondevelopmental and commercial applications, including off-the-shelf items, components, specifications, standards, processes, and technology to include open-system architecture for the LPD 17 shipboard wide area network proposed by Avondale Industries. With open-system architecture, the Navy and Avondale Industries can capitalize on market-driven technology advancements as well as benefit from many sources of supply.

The "Smart Ship" shipboard systems demonstrated aboard the *USS Yorktown* will also be considered by Avondale Industries for the LPD 17 class of ships. In addition, the Navy plans to reduce the number of Government-furnished equipment items provided to Avondale Industries for the LPD 17 weapon system acquisition. The shift in responsibility for items such as engines, drive shafts, propellers, distillation plants, pumps, navigation sensors, ship control, and internal ship communications will allow Avondale Industries to negotiate favorable commercial prices with suppliers. Further, the shift to contractor-furnished equipment will reduce the number of DoD and Navy organizations that have to become involved with the LPD 17 weapon system acquisition throughout its life cycle.

Equipment Standardization. The Navy request for proposal for the LPD 17 lead ship emphasized equipment standardization. Trying to reduce life-cycle operation and support costs for the LPD 17 class of ships, the Navy requested examples where commonality can be applied. In its proposal submission, Avondale Industries combined requirements for three pumps into one pump as a beneficial example of reducing life-cycle operations and maintenance costs. Reducing the number of items for the same requirements will reduce LPD 17 weapon system life-cycle costs through economies of scale and will limit the number of line items requiring logistics support.

Testing. The Navy plans to use computer-aided design modeling and virtual reality simulation for the LPD 17 lead ship to unobtrusively test Avondale Industries' detail designs for form, fit, and function. Unobtrusive testing prevents defects before they appear by reviewing process controls instead of inspecting finished products. Further, unobtrusive testing reduces rework and the additional time required to redo the failed systems, items, or components. Besides testing for detail design form, fit, and function, the Navy will make early operational assessments and conduct live-fire testing, evaluations, and vulnerability assessments.

Maintainability. Avondale Industries is exploring condition, sensor, and infrared imaging systems for extending the reliability, availability, and maintainability of the LPD 17 class of ships. Although those integrated condition assessment systems may initially increase ship class costs, cost-as-an-independent-variable investment decisions for built-in diagnostic and condition-based monitoring for diesel engines, diesel generators, machinery control systems, air compressors, air conditioning plants, and reverse osmosis desalination plants will beneficially reduce ship-class ownership costs.

In addition, the LPD 17 weapon system will use low-maintenance titanium instead of copper nickel piping for fire mains and auxiliary sea water cooling, coatings for ballast tanks, all-electric auxiliaries instead of steam auxiliaries, anti-foul hull coatings, deck coverings, and fiber optic lighting. The Navy expects to reduce operation and support costs for each LPD 17 class of ship by $500,000 per year with those monitoring systems and equipment enhancements.

Training. The Navy brought the training community into the LPD 17 lead-ship design process early on to become familiar with ship operations and defense systems. As a result, it can concurrently influence designs to make the LPD 17 class of ships user friendly to crew members, embarked Marines, and maintainers, and it can start developing training programs before ship construction is completed.

The Navy will reduce training time and costs for the LPD 17 weapon system wherever possible by using interactive electronic training applications. Combined with integrated condition assessment systems, the training applications will reduce the number of courses taught and the number of training days dedicated to each training course. The Navy believes that integrated condition assessment systems and interactive electronic training applications can reduce ship-class staffing by 10 people.

Reducing Weapon System Life-Cycle Costs. The Navy built the LPD 17 acquisition strategy following the "Design for Ownership" concept. To be effective, the Navy and Avondale Industries consider the life-cycle cost impact of each decision before completing the weapon system's detailed design. The decisions determine the best value and application of "state of the practice" products, ownership cost-reduction goals, and subsequent logistics support over the weapon system's life cycle. Specifically, Avondale Industries will:

- leverage existing research and development and monitor other relevant research and development for innovative technology to reduce the LPD 17 weapon system life-cycle costs,
- reduce life-cycle training costs through an on-board, embedded training system that employs advanced instructional technology,
- stretch the interval between docking,
- reduce time allocated for intermediate and shipyard maintenance,
- propose manpower doctrine changes and manpower reducing technology,
- reduce interim supply support by tailoring inventory procedures,
- craft a single mechanism for configuration management,

- support the primary amphibious warfare mission by ensuring that embarked landing forces, support equipment, and vehicles can move rapidly from any LPD 17 class of ship to its military objective on the shore, and

- avoid adverse environmental effects and personnel hazards by screening all materials, choosing alternatives to hazardous materials, and using problem materials only when substitutions are not available.

In its request for proposal submission, Avondale Industries identified more than 40 cost-reduction strategies to reduce life-cycle costs. Appendix C lists 24 of those strategies.

Management Flexibility

The Navy does not plan to use multi-year funding for the LPD 17 weapon system acquisition. As a result, budget decisions to accommodate other priorities may delay ship deliveries and may later increase weapon system costs. In addition, the LPD 17 class of ships will be designed with fiber-optic shipboard wide area networks to link almost every bit of data on the vessels. Integrating information from self-defense systems; bridge functions; machinery controls and administrative functions; and command, control, communications, and intelligence systems will be a software challenge for Avondale Industries. Although the Navy has identified software integration as a moderate risk, underestimating the extent of the software integration challenge could result in ships not meeting desired performance requirements. As a result, software revision and block enhancements may be required by the Navy to mature the delivered LPD 17 weapon system software. However, the Shipbuilding and Conversion Navy appropriation reprogramming procedures and the acquisition strategy provide the LPD 17 acquisition management team with the flexibility to recover from delivery deviations and less-than-desired performance should the need arise. By including a warship developer and a command, control, communications, computer, and information integrator in the IPPD teaming process, and by complying with DoD budgetary guidance, the Navy hopes to abate the risk of delayed deliveries and increased life-cycle costs for the LPD 17 weapon system acquisition.

Deliveries. The Navy plans to construct the LPD 17 class of ships at two shipyards to maintain scheduled delivery dates. Eight ships will be constructed at Avondale Industries, and four ships will be constructed at Bath Iron Works. Although the decision will affect ship construction costs because of labor and overhead rate differentials and learning reduction, the availability of the shipyards does minimize delivery disruptions by providing the additional capacity for constructing vessels when scheduled start dates deviate from planned baselines. Further, maintaining on-time deliveries of 12 ships allows the Navy to retire 4 classes of ships and to avoid penalties for operating and supporting vessels beyond their planned lives.

Life-Cycle Costs. The Navy determined life-cycle costs for the LPD 17 weapon system by using comparative actual costs and parametric measurements. For the software development, integration, and testing functions, the Navy applied parametric measurements to derive cost estimates. Further, the DoD Cost Analysis Improvement Group found the estimates to be realistic. Avondale Industries also abated risks for software development, integration, and testing when they allied themselves with Hughes Aircraft Company for the command, control, communications, computer, and information segments of the LPD 17 acquisition.

In addition, the Navy believes that it can manage development and production and operation and support costs for the LPD 17 weapon system acquisition more efficiently by applying electronic and computer enhancements. The Navy estimates that by extending reliability, availability, and maintainability performance parameters and implementing improved life-cycle support processes for the LPD 17 class of ships over their 40-year planned lives, it will reduce operation and support costs by $3.6 billion when compared with the Milestone II life-cycle cost estimate prepared by the LPD 17 Program Office.

Management Comments

The Assistant Secretary of the Navy (Research, Development, and Acquisition) concurred with the report's results. We made editorial and clarification changes based on suggestions he provided, which did not change the audit results. Therefore, the full text of his comments are not included in the final report. Part III contains his memorandum.

Part II - Additional Information

Appendix A. Audit Process

Scope

We conducted this program results audit from June through November 1997 in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. We reviewed acquisition documents, dating from June 1992 through October 1997, covering program definition, program design, contracting, program assessments and decision reviews, and periodic reporting. We interviewed and obtained program documentation from officials in the Office of the Secretary of Defense and the Navy who were involved with the LPD 17 weapon system acquisition program. We also included tests of management controls as considered necessary.

Methodology

The audit was performed in accordance with Inspector General, DoD, critical program management elements approach. We reviewed program definition, program structure, program design, contracting, program assessments and decision reviews, periodic reporting, and management controls related to those objectives. We did not rely on computer-processed data or statistical sampling procedures to develop conclusions on this audit.

At the beginning of the audit, the LPD 17 weapon system acquisition was early in the engineering and manufacturing development phase. The Navy Program Office and Avondale Industries were solidifying the IPPD teams for the detailed design and subsequent construction of the LPD 17 lead-ship. The Navy acquisition strategy for the weapon system supports the warfighter, improves acquisition business processes, and reduces life-cycle costs, which are major acquisition reform issues.

Because the program had no key developments or engineering and manufacturing accomplishments at the time of the review, we were unable to determine whether the Navy acquisition of the LPD 17 weapon system will be cost-effectively developed for production and deployment in accordance with its planned acquisition strategy.

Contacts During the Audit. We visited or contacted individuals and organizations within the DoD and Avondale Industries, New Orleans, Louisiana. Further details are available on request.

Management Control Program

Requirement for Management Control Review. DoD Directive 50 10.3 8, "Management Control (MC) Program," August 26, 1996, requires DoD managers to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the controls.

Scope of Review of the Management Control Program. In accordance with DoD Directive 5000.1, "Defense Acquisition, " March 15, 1996, and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs, " March 15, 1996, acquisition managers are to use program cost, schedule, and performance parameters as control objectives to implement the DoD Directive 5010.38 requirements. Accordingly, we limited our review to management controls directly related to the critical program management elements of the acquisition programs reviewed.

Adequacy of Management Controls. Management controls were adequate in that we did not identify any systemic management control weakness applicable to our primary audit objective.

Appendix B. Summary of Prior Coverage

During the last 5 years, the General Accounting Office; the Office of the Inspector General, DoD; and the Naval Audit Service have issued four reports covering issues related to this audit.

General Accounting Office

Report No. GAO/NSIAD-97-195R (OSD [Office of the Secretary of Defense] Case No. 1431), "Ship Self-Defense: Program Priorities Are Questionable," August 15, 1997, reports that Congress may be relying on inaccurate information when it evaluates the Ship Self-Defense Program's progress and when it formulates future financial investments in shipboard antiwar warfare defense capabilities. Additionally, because the Program Executive Office for Theater Air Defense has reported inaccurate information and provided inadequate financial data, it may not be exercising the oversight necessary to accomplish established program objectives and priorities. The report made no recommendations; however, the report asked the Secretary of Defense to respond to the question, "How do current naval threat priorities relate to decisions on which ships will receive the Ship Self-Defense System Mark 1/ Quick Reaction Combat Capability?" The Office of the Under Secretary Defense for Acquisition and Technology responded by stating that mission profile and operational scenario priorities determined when ship self-defense systems would be installed. Because amphibious ships are employed where immediate conflicts are not expected or after carrier battle groups have established dominance, the Navy decided that ship self-defense systems would be installed on combatant ships before they were installed on amphibious ships.

Report No. GAO/NSIAD-96-47 (OSD Case No. 1053), "Marine Corps: Improving Amphibious Capability Would Require Larger Share of Budget Than Previously Provided, " February 13, 1996, reports on the current status of the Navy and Marine Corps capability to conduct amphibious assaults; planned improvements being made to the capability; costs of planned improvements; and their effect on future years' budgets. The General Accounting Office concludes that a funding shortfall of $16 billion will occur from FY 2002 through FY 2005 as a result of planned improvements. The report made no recommendations.

Inspector General, DoD

Inspector General, DoD, Report No. 97-005, "Acquisition of Ship Self-Defense Systems," October 15, 1996, reports that the Navy:

- calculated excessive requirements for ship self-defense system missiles;
- made a questionable determination of cost-effectiveness for the Mark-l Ship Self-Defense System;
- did not realistically justify the need for the Mark-l Ship Self-Defense System on amphibious class ships, based on past war-fighting scenarios;
- may duplicate the combined capabilities of existing combat systems with its surface mode improvement to the Block I Phalanx close-in weapon system; and
- duplicated the capabilities of the Block I Rolling Airframe Missile with its planned upgrade for the Evolved Sea Sparrow RIM-7P missiles.

The Inspector General recommended that the Navy:

- cancel the Sea Sparrow RIM-7R Missile program and the Block 1 Phalanx close-in weapon system upgrades, and
- adjust the requirements and acquisition objectives for the Evolved Sea Sparrow and Rolling Airframe Missiles and replace the Mark-l Ship Self-Defense System with an alerted passive overlay system.

The Navy nonconcurred with the report recommendations. However, during the audit mediation process, the Navy eliminated funding for the Evolved Sea Sparrow RIM-7R Missile program and the Block 1 Phalanx close-in weapon system upgrades as well as reduced funding for the Evolved Sea Sparrow and Rolling Airframe Missiles and the Mark-l Ship Self-Defense System.

Naval Audit Service

Naval Audit Service Report No. 071-95, "Navy Amphibious Fleet Requirements," September 29, 1995, reports that because of fiscal constraints, the possible Navy amphibious fleet of 35 ships may not be the best mix for the forward presence and crisis response missions. The report recommended that the Navy:

- reduce LPD 17 requirements from 12 ships to 10 ships and direct funds towards the purchase of Large Amphibious/Helicopter Carrier number 7;
- cancel contracts for excessive landing craft air cushion craft, or, if not possible, deactivate them instead of placing them in reduced operational status;

- reduce the number of landing craft air cushion craft crews dedicated to training; and
- reduce the number of landing craft air cushion craft in operational status because the construction of amphibious ships has not kept pace with landing craft air cushion craft acquisitions.

The Navy concurred with the recommendations addressing landing craft air cushion craft. The Navy nonconcurred with the recommendation for funding the Large Amphibious/Helicopter Carrier number 7 by reducing the LPD 17 from 12 ships to 10 ships. Congress subsequently funded the Large Amphibious/Helicopter Carrier number 7 with the FY 1996 Defense Appropriation Act.

Appendix C. Cost-Reduction Strategies

The following table describes the cost-reduction strategies that Avondale Industries plans to apply when it develops and produces the LPD 17 weapon system.

Program Activity	Strategy
Detail design	Use virtual prototyping.
	Identify Government-furnished equipment that does not meet open system architecture standards as candidates for commercial-off-the-shelf or nondevelopmental product options.
	Exploit technology as a cost-reduction enabler.
Total ship system integration	Use simulation software to validate shipboard wide area network maintenance engineering analysis results.
Hardware and software development for contractor-furnished equipment	Use open architecture, commercial-off-the-shelf-based solutions.
Integration of contractor-furnished equipment and Government-furnished equipment	Incorporate associate contractor agreements into integrated process teams to reduce hardware and software incompatibility risks.
Contractor-furnished equipment	Make supportability considerations the primary selection criteria.
	Enlist suppliers in life-cycle reduction effort.
Construction	Use the IPPD concept and the integrated product development environment to reduce costs.
	Review construction practices to support life-cycle goals.
	Review virtual prototyping to support critical design walk-through applications.
Contractor-furnished equipment installation	Review virtual prototyping to establish a design and installation approach to reduce life-cycle costs.
	Apply maximum standard modular installation modules for ease of upgrade.

Program Activity	Strategy
Test and evaluation	Use virtual prototyping to perform system test and evaluation validation and verify design performance before shipboard tests.
	Validate requirements early, structure validations of rigorous requirements to be traceable.
	Tailor test program to facilitate technology insertion.
Integrated logistics support	Accomplish integrated logistics support concurrently with design and construction.
	Define supportability as key program attribute.
	Evaluate innovative support concepts along with design alternatives for life-cycle cost reduction.
	Investigate just-in-time support for commercial off-the-shelf and nondevelopmental items and with associate contractor agreements for Government-furnished equipment.
Life-Cycle support planning	Emphasize flexibility, responsiveness to changing environment.
	Maintain continuous, condition-based maintenance to increase dry-docking intervals.
	Maintain continuity of team from early design on common work areas.
	Investigate interfacing LPD 17 integrated product data environment with Navy maintenance systems and shipyard industrial management programs.

Appendix D. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
  Director, Defense Logistics Studies Information Exchange
Under Secretary of Defense (Comptroller)
  Deputy Chief Financial Officer
  Deputy Comptroller (Program/Budget)
Assistant Secretary of Defense (Public Affairs)

Department of the Army

Auditor General, Department of the Army

Department of the Navy

Assistant Secretary of the Navy (Financial Management and Comptroller)
Assistant Secretary of the Navy (Research, Development, and Acquisition)
Auditor General, Department of the Navy
Program Executive Officer, Carriers, Littoral Warfare and Auxiliary Ships
Program Manager, LPD 17 Amphibious Transport Dock Ship Program Office

Department of the Air Force

Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Department of the Air Force

Other Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, National Security Agency
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Non-Defense Organizations

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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 National Security, Committee on Appropriations
House Committee on Government Reform and Oversight
House Subcommittee on Government Management, Information, and Technology, Committee on Government Reform and Oversight
House Subcommittee on National Security, International Affairs, and Criminal Justice, Committee on Government Reform and Oversight
House Committee on National Security

Part III - Management Comments

Assistant Secretary of the Navy (Research, Development, and Acquisition) Comments

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FEB 4 - 1998

MEMORANDUM FOR DEPARTMENT OF DEFENSE INSPECTOR GENERAL
(OAIG/AUD/AM)

SUBJECT: Audit Report On Acquisition of the Amphibious Landing Transport Dock 17 Class of Ships (Project No. 7AL-3009) - ACTION MEMORANDUM

The Navy appreciates the opportunity to review the draft audit report forwarded on December 29, 1997, and concurs with it. Specific comments to the report were provided under separate cover.

In addition, I would like to commend the members of the audit team for their willingness to accommodate schedules with the Program Executive Officer for Carriers, Littoral Warfare and Auxiliary Ships throughout the conduct of this audit.

M. P. Sullivan
RADM, SC, USN
Principal Deputy

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