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

March 11, 1992

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (PROGRAM ANALYSIS AND EVALUATION)

SUBJECT: Audit Report on Cost Estimates for the SSN-21 Class Attack Submarine Program (Report No. 92-060)

Introduction

We are providing this report for your information and use. This audit was performed as a result of a request from the Office of the Assistant Secretary of Defense (Program Analysis and Evaluation), who was concerned that research and development (R&D) costs on the lead ship may not have been consistently reported in the past, and not all R&D costs may be included in the SSN-21 Class Attack Submarine (SSN-21) Program. We included the separately managed AN/BSY-2 Submarine Combat System (Combat System) Program because the two programs were consolidated for reporting purposes. This report is a result of our audit to determine if R&D costs applicable to the SSN-21 and the Combat System programs (Submarine program) were identified with the programs' costs. We will issue a separate audit report, Project No. 1AL-5014.01, "Audit Report on the Budget Submission for the SSN-21 Class Attack Submarine Program," that addresses the SSN-21 program's budget submission for FYs 1992 through 1997 and discusses the identification of contingency funds in the program's budget, as well as the lack of supporting budget documentation.

Scope of Audit

This program audit included an examination of R&D program elements; independent research and development projects; and efforts funded with Shipbuilding and Construction, Navy, and Other Procurement, Navy, appropriations.

R&D program elements. We reviewed the FY 1992 and FY 1993 Navy and Defense Agencies R&D Descriptive Summaries to identify program elements related to the Submarine program. A program element is a description of a research effort, including its purpose and associated costs and may consist of multiple projects. We examined 27 program element (a total of 32 projects) justifications, program plans, and funding documentation for determining their application to the Submarine program. We also discussed the 27 program elements

with responsible program officials. For program elements that appeared to be related to the Submarine program, we also reviewed applicable contractual actions and statements of work for FY 1990 and FY 1991 contracts that were issued by the Naval Sea Systems Command (NAVSEA). Enclosure 1 lists the 27 program elements reviewed.

Independent research and development. We examined 77 FY 1991 and FY 1992 independent research and development (IR&D) projects for 7 of the Submarine program's prime contractors and major subcontractors. We analyzed the IR&D project summaries and held discussions with responsible officials to determine the projects' applicability to the Submarine program.

Shipbuilding and Construction, Navy, and Other Procurement, Navy. We reviewed FY 1990 and FY 1991 Shipbuilding and Construction, Navy, and Other Procurement, Navy, funding documentation and associated statements of work for the SSN-21 to determine whether the funds were expended for SSN-21 R&D efforts.

This program audit was made from June through December 1991 and included a review of transactions for FYs 1984 through 1991. 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. A list of activities visited and contacted is in Enclosure 3.

Internal Controls

We did not assess internal controls because our audit objectives did not provide for a review of the program element manager's controls. Also, there were no policies or procedures that required that related program element costs be associated with the Submarine program.

Background

The SSN-21 is the Navy's newest nuclear-powered attack submarine. Its missions include antisubmarine and antisurface warfare, strike warfare, ocean surveillance, and electronic and mine warfare. The SSN-21 will have an advanced Combat System, which will detect, classify, and track targets and enhance the Submarine's command and control operations.

As of December 1990, the total program acquisition cost was $33.6 billion (then-year dollars) for 12 submarines. That cost consisted of four program elements: SSN-21 development, AN/BSY-2 development, S6W nuclear propulsion plant development, and ship

contract design. The total R&D budget for these program elements was $5 billion. During the audit, because of the reduction in threat, the Secretary of Defense recommended limiting production of the SSN-21 to one submarine and terminating the program. The SSN-21 Program Office will continue R&D efforts to ensure the one SSN-21 will be fully operational.

Prior Audit

The General Accounting Office (GAO) issued Report No. GAO/IMTEC-90-21 (OSD Case No. 8280), "SUBMARINE TECHNOLOGY: Transition Plans Needed to Realize Gains from DoD Advanced Research," to Congress on February 14, 1990. GAO concluded that the Navy had not developed a strategy for effectively transitioning Advanced Submarine Technology Program (ASTP) research from the Defense Advanced Research Projects Agency (DARPA). GAO recommended that the Secretary of the Navy develop criteria, plans, and procedures to ensure that ASTP technologies are adequately considered for transition to the Navy and those technologies that are promising be transferred. The Navy concurred with the recommendation and formalized procedures for transitioning technology. These procedures require that projects transition to the Advanced Submarine Research and Development Office within NAVSEA for further development and possible subsequent incorporation into a vessel.

GAO also concluded that the Navy did not consider the ASTP research in designing the SSN-21 and did not plan the submarine design with features that would facilitate implementation of new technologies. GAO recommended that the Navy analyze ASTP technologies being researched or developed to determine which could be cost-effectively provided for in the SSN-21 design to facilitate later incorporation. The Navy concurred with the recommendation. The Navy's Advanced Submarine Research and Technology Office considers each maturing submarine technology for possible incorporation into current and future submarine designs.

Discussion

R&D Program Elements

The FY 1992 and FY 1993 Navy and Defense Agencies R&D Descriptive Summaries reported 27 program element descriptions that appeared to relate to the Submarine program. Our review of the 27 program elements disclosed that 11 program elements (15 projects) were related but were not being associated with the Submarine program. (We determined that the remaining 16 program

elements were not related to the Submarine program.) Our review of the 15 projects showed that the R&D efforts had either a direct or an indirect association with the Submarine program. As a result, we classified the 15 R&D projects into 2 categories: Category 1--those benefiting the Submarine program, and Category 2--those benefiting the Submarine program, as well as surface ship and other submarine programs. A list of these projects is in Enclosure 2.

Category 1. Category 1 consists of four projects totaling $159.4 million. Electronic support measures equipment (AN/WLQ-4(V)1 product improvements), nonacoustic silencing, and HY-130 steel will benefit the SSN-21. Submarine sonar improvements will benefit the Combat System. A discussion of these efforts follows.

AN/WLQ-4(V)1. The AN/WLQ-4(V)1 monitors radio frequency signals. The Navy began modifying the equipment in FY 1986. In FY 1990, Congress directed the Submarine Combat Weapons System Office to improve existing electronic support measures equipment for application to the SSN-21. The equipment was planned for installation on a later SSN-21 because of scheduling difficulties. R&D costs for FYs 1986 through 1991 were $38.4 million, and the system was being tested.

Nonacoustic silencing. Nonacoustic silencing is directed toward quieting the Submarine's operation and involves efforts from various activities outside and within the Navy. These efforts included research performed by the Office of Naval Technology (a Navy research office), DARPA (a DoD activity responsible for advanced research), and NAVSEA's Advanced Submarine R&D Office. R&D costs totaled $32.7 million (FYs 1987 through 1991 totaled $5.3 million, and FYs 1992 through 1997 totaled $27.4 million). NAVSEA's program plan documentation for the efforts showed that the nonacoustic silencing project was directly applicable to the SSN-21. SSN-21 program officials confirmed that this project directly benefits the submarine.

HY-130. HY-130 is the development of advanced steel that will be used as the hull material for the SSN-21. Research on the steel has consisted of efforts by DARPA and NAVSEA's Advanced Submarine R&D Office. The SSN-21 Program Office was continuing the development effort. Before transitioning to the SSN-21 Program Office, R&D costs for FYs 1988 through 1990 totaled $21 million.

Sonar. Submarine sonar improvements is an advanced R&D program consisting of 17 R&D projects. Two projects (Hull Array Improvement and Transducer) that apply to the Combat System were

identified in the FY 1992 Sponsor Program Proposal as potential near-term upgrades. Also, the Submarine improvement program acquisition documentation related the Hull Array Improvement project to the SSN-21. R&D costs associated with these two projects totaled $67.3 million (FYs 1986 through 1991 totaled $13.3 million, and FYs 1992 through 1997 totaled $54 million).

The research efforts were not associated because the efforts were managed under organizations other than the Submarine program offices. Although the research effort documentation identified the efforts as being developed for the Submarine program, the efforts were not associated with the program because they had not reached developmental maturity for their incorporation. The Submarine program did not recognize research costs until the research effort had been approved for its incorporation; and after approval, only research costs expended directly by the program were recognized.

Category 2. Category 2 consists of 11 projects totaling $1.9 billion that will benefit the SSN-21, as well as other surface ships or submarines. Four examples of this category are nuclear technology development, nuclear propulsion technology, MK48 (Advanced Capability), and submarine sonar improvements. A discussion of these projects follows.

Nuclear technology development. Nuclear technology development is a program under the responsibility of NAVSEA's Nuclear Propulsion Directorate, which designs and develops components and systems for use in all types of Naval nuclear propulsion plants. This includes efforts for the development of advanced instrumentation and control equipment, evaluation of components and plant configuration to ensure system compatibility, and evaluation and development of better means of data transmission. The research efforts may be used on existing submarines, the SSN-21, and future submarines. R&D costs for this project totaled $457.9 million (FYs 1984 through 1991 totaled $270.1 million, and FYs 1992 through 1994 totaled $187.8 million).

Nuclear propulsion technology. Nuclear propulsion technology, also under NAVSEA, is a program whose efforts include developing stronger, lighter, and more corrosion-resistant materials needed to ensure nuclear propulsion plant resiliency, reliability, and safety. This program is not specific to the SSN-21, but results of the program will be applicable to the SSN-21. R&D costs for this project totaled $343.4 million (FYs 1984 through 1991 totaled $295.6 million, and FYs 1992 through 1994 totaled $47.8 million). The nuclear propulsion technology costs do not include efforts associated with the

SSN-21 nuclear reactor development. An agreement between the Department of Energy and the Navy established that the development of the nuclear reactor will be done by the Department of Energy. The audit showed that the Department of Energy spent $625 million of its funds on the nuclear reactor development, and this reactor cost was not directly associated with the SSN-21.

MK48. The MK48 Advanced Capability (ADCAP) torpedo program is an upgrade for the MK48 torpedo. The MK48 ADCAP will have upgraded software, additional fuel capacity, and an improved propulsion system. The MK48 ADCAP benefits the SSN-21 and other submarines through improved submarine operations. R&D costs for the MK48 ADCAP program totaled $277.7 million (FYs 1989 through 1991 totaled $119.8 million, and FYs 1992 through 1997 totaled $157.9 million).

Sonar. Submarine sonar improvements consist of 15 projects having an estimated cost of $221.5 million. These projects are for advanced development and testing of improvements to existing and future sonar and combat systems. Two of the fifteen projects were Target Motion Analysis Improvements Tasks and Advanced Targeting and Weapon Management System. Objectives of the Target Motion Analysis project were to process sparse, poor quality acoustic data from multiple sensors/trackers to determine position and motion of moving target(s). R&D costs associated with this project totaled $8.1 million (FYs 1986 through 1991 totaled $2.1 million, and FYs 1992 through 1997 totaled $6 million). The objective of the Advanced Targeting and Weapon Management project was to develop a targeting prototype system to demonstrate improved combat effectiveness in laboratory and at-sea environments. R&D costs associated with this project totaled $16.2 million (FYs 1986 through 1991 totaled $2.4 million, and FYs 1992 through 1997 totaled $13.8 million).

These costs were not associated with specific programs because research efforts had not sufficiently matured for submarine or surface ship application. If the research efforts continue to develop into a system or system improvement, the submarines or surface ships will benefit from the efforts. Also, when research efforts mature and can be applied to multiple programs, difficulty would exist in developing a share ratio of the costs among the benefiting programs. DoD policy did not require that these costs be allocated among the benefiting programs.

IR&D and Appropriation Funding

Our review of the IR&D projects did not reveal any unreported research costs for the Submarine program. Also, our review of Shipbuilding and Construction, Navy, and Other Procurement, Navy, appropriation funding documentation did not identify research efforts supported with these appropriations.

Request for Comments

Since this report contains no findings or recommendations, written comments are not required. If you choose to comment, please do so by April 13, 1992.

The courtesies extended to the audit staff are appreciated. If you have any questions on this audit, please contact Mr. Rayburn H. Stricklin, Program Director, at (703) 614-3965 (DSN 224-3965) or Mr. Roger H. Florence, Project Manager, at (703) 693-0489 (DSN 223-0489). Enclosure 4 identifies the audit team members. The planned distribution of this report is listed in Enclosure 5.

Robert J. Lieberman
Assistant Inspector General
for Auditing

Enclosure

cc:
Secretary of the Navy

LIST OF THE 27 FY 1992/1993 PROGRAM ELEMENTS REVIEWED*
(NAVY & DEFENSE ADVANCE RESEARCH PROJECT AGENCY)

Program Element	Project Number	Project Title
0101226N	S1265	Submarine Acoustic Warfare Development
0204229N	W0545	Tomahawk
0204313N	X0758	SURTASS
0602314N	N/A	Antisubmarine Warfare Technology
0602323N	N/A	Submarine Technology
0602324N	N/A	Nuclear Propulsion
0603504N	S0223	Submarine Sonar Improvements
0603522N	S0770	Advanced Submarine Surveillance Support Program
0603561N	S2033	Advanced Submarine Systems Development
0603561N	S2034	Research and Development Submarine
0603562N	S1739	Submarine Arctic Warfare
0603570N	S1258	Nuclear Technology Development
0603601N	1556	Advanced Sea Mine 2000
0603601N	S1917	Remote Control of Mines
0603601N	S2024	Mine MK60 (CAPTOR) Improvement/Advanced Antisubmarine Warfare Mine (SUBSTRIKE)
0603691N	S0366	MK48 Advanced Capability
0603708N	X0821	Anti-Submarine Warfare Signal Processing
0604502N	S0742	Submarine Integrated Antenna System
0604502N	S1411	Attack Submarine Integrated Communications
0604503N	S0219	Submarine Sonar System
0604515N	S0775	Submarine Surveillance Support Program
0604559N	S2094	Unmanned Underwater Vehicle
0604562N	S0236	Attack Submarine Combat System Improvement Program
0604567N	S0857	Ship Subsystem Development/Land Based Test Sites
0604601N	S0267	Mine Improvements
0604601N	S0272	Quickstrike
0602702E	TT-03	Tactical Technology (Antisubmarine Warfare)
0602708E	IC-01 & IC-02	Integrated Command and Control
0603226E	EE-36 & EE-38	Experimental Evaluation of Major Innovative Technology
0603569E	AS-01	Advanced Submarine Technology Program
0603756E	CS-02	Consolidated DoD Software Initiative
0604507N	S1440	Enhanced Modular Signal Processor

* Four projects were not subject to a detailed examination because they were recognized as associated with the Submarine program. These projects are:

Program Element	Project Number	Project Title
0603570	S1914	S6W Nuclear Propulsion Plant
0604524	S1941	AN/BSY-2 Development
0604561	S1946	SSN-21 Development
0604567	S1803	Ship Contract Design

ENCLOSURE 1

RESEARCH AND DEVELOPMENT COSTS THAT BENEFIT THE SSN-21 CLASS SUBMARINE AND THE COMBAT SYSTEM

($ in Millions for Prior Year and Future Years)

Category 1

R&D efforts that benefit the SSN-21 class submarine and the Combat System (new technology or system upgrades).

Submarine Sonar Improvements	$ 67.3
Electronic Support Measures (AN/WLQ-4(V)1)	38.4
Nonacoustic Silencing	32.7
HY-130 Steel	21.0
Total	$159.4

Category 2

R&D efforts that may benefit the SSN-21 class submarine and the Combat System, as well as surface ships and other submarines (new technology or system upgrades).

Nuclear Technology Development	$ 457.9
Nuclear Propulsion Technology	343.4
MK48 (Advanced Capability)	277.7
Submarine Sonar Improvements	221.5
Tomahawk	157.2
Acoustic Silencing	132.5
CAPTOR/SUBSTRIKE*	108.9
Submarine Sonar Systems	105.6
Submarine Arctic Warfare	70.8
Submarine Antenna Communications	62.0
Propulsors	25.3
Total	$1,962.8

* Mine MK60 (CAPTOR) Improvement/ Advanced Antisubmarine Warfare Mine (SUBSTRIKE).

ACTIVITIES VISITED OR CONTACTED

Office of the Secretary of Defense

Office of the Under Secretary of Defense for Acquisition, Washington, DC
Assistant Secretary of Defense (Program Analysis and Evaluation), Washington, DC
Office of the Comptroller of the Department of Defense, Washington, DC

Department of the Navy

Office of the Navy Comptroller, Investment and Development Division (Other Investment and Development Branch), Washington, DC
Headquarters, Naval Sea Systems Command, Washington, DC
Space and Naval Warfare Command, Washington, DC
Office of the Chief of Naval Research (Office of Naval Technology), Arlington, VA
Naval Undersea Warfare Center, Newport, RI
David Taylor Research Center, Bethesda, MD
Naval Center for Cost Analysis, Washington, DC

Defense Agency

Defense Advanced Research Projects Agency, Arlington, VA

Non-DoD Agency

U.S. General Accounting Office, Washington, DC

AUDIT TEAM MEMBERS

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