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Status of the Trident Submarine and Missile Programs. PSAD-77-34; B-163058. March 8, 1977. 19 pp.

Report to the Congress; by Robert F. Keller, Acting Comptroller General.

Issue Area: Federal Procurement of Goods and Services: Notifying the Congress of Status of Important Procurement Programs (1905); Science and Technology: Management and Oversight of Programs (2004).
Contact: Procurement and Systems Acquisition Div.
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Organization Concerned: Department of the Navy.
Congressional Relevance: House Committee on Armed Services; Senate Committee on Armed Services; Congress.

A review of the Trident Submarine and Missile program's cost, schedule and technical performance was conducted. A particular concern was to determine whether the submarine and missile will be operational in September 1979, as planned. Navy and contractor officials were interviewed, and records provided by the officials were reviewed. The Trident submarine will be the successor to the Polaris/Poseidon ballistic missile fleet. Findings/Conclusions: At the time of GAO's review, the Navy was reporting an estimated cost of $18.8 billion for an 11-ship program. As of December 31, 1976, the Navy reported a 13-ship program at a cost of $21.4 billion. The planning documents called for 16 Trident submarines. Costs estimated to be about $12 billion are not included in the total program costs. This includes the costs for five ships beyond the 11 included in the Selected Acquisition Report, backfit of the Poseidon submarines, propulsion plant and warhead, construction, and other items which, if included, could bring the total program costs to over $30 billion. The Trident deployment date has been postponed 5 months because of delays in submarine construction. The missile developmental flight test program is on a very tight schedule with little margin to absorb any additional delays. Should any new problems or further delays develop, it could affect the entire test program. Recommendations: A best estimate of the number of Trident submarines and missiles needed and the cost for this force should be determined because the merits of this program and others can only be evaluated when the total commitment being undertaken is known. (Author/SC)

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Status Of The Trident Submarine And Missile Programs

Department of the Navy

The TRIDENT submarine will be the successor to the POLARIS/POSEIDON ballistic missile fleet. The Navy stated that the ultimate size of the TRIDENT program will be determined when issues relating primarily to strategic policies, objectives, and arms limitations negotiations are resolved.

At the time of GAO's review the Navy was reporting an estimated cost of $18.8 billion for an 11-ship program. As of December 31, 1976, the Navy reported a 13-ship program at a cost of $21.4 billion. GAO found that 16 TRIDENT submarines were included in planning documents. A fleet of this size could total over $30 billion.

GAO recommends that a best estimate of the number of TRIDENT submarines and missiles needed and the cost for this force be determined because the merits of this, and other programs, can only be evaluated when the total commitment being undertaken is known.

PSAD-77-34

MARCH 8, 1977

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

B-163058

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

This report presents our views on the major issues of the TRIDENT Submarine and Missile Programs which will require attention. For the past several years we have annually reported to the Congress on the status of selected major weapons systems. This report is one of a series of 29 reports that we are furnishing this year to the Congress for its use in reviewing fiscal year 1978 requests for funds.

A draft of this report was reviewed by agency officials associated with the management of the program, and their comments have been incorporated as appropriate.

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

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Defense.

ACTING Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

STATUS OF THE TRIDENT
SUBMARINE AND MISSILE
PROGRAMS
Department of the Navy

D I G E S T

The TRIDENT is a sea-based weapons system designed to deter nuclear attack. It will be a follow-on to the POLARIS/POSEIDON ballistic missile fleet.

The objectives of this program include

--deployment of a nuclear propelled TRIDENT submarine which can carry 24 missiles;

--deployment of a TRIDENT I missile with a full payload range of 4,000 miles capable of being launched from TRIDENT and some modified POSEIDON submarines;

--development of a west coast personnel training and support facility for the TRIDENT system at Bangor, Washington; and

--conducting advance development of the Mark 500 Evader maneuvering re-entry vehicle. (See p. 1.)

Current planning now calls for funding 16 ships by fiscal year 1984 in a continuing shipbuilding program at a rate of 3 ships every 2 years. According to the Chief of Naval Operations, the ultimate size of the program will be determined after several issues are resolved, such as:

--Strategic arms limitation negotiations.

--Evolving national strategic objectives.

--The role of the TRIDENT in the national strategic policy.

--The retirement dates of the POLARIS and POSEIDON submarines. (See pp. 17 and 18.)

Since the June 30, 1975, Department of Defense Selected Acquisition Report, which reported a TRIDENT program consisting of 10 submarines, 370 TRIDENT I missiles and the support facility, SUBASE Bangor, the program cost has increased by $2,549.9 million as of September 30, 1976, to $18,877.6 million for 11 submarines, 406 TRIDENT I missiles, and 1 support facility. (See pp. 3 and 4.)

Costs estimated to be about $12 billion are not included in total program costs. This includes costs for 5 ships beyond the 11 included in the Selected Acquisition Report, backfit of the POSEIDON submarines, propulsion plant and warhead, construction, and other items, which if included in the program costs, could bring the total to over $30 billion. (See pp. 3 and 4.)

The December 31, 1976, Selected Acquisition Report was issued while this GAO report was being processed. It shows a 13-ship program and an estimated cost of $21,426.5 million. (See p. 3.)

The TRIDENT deployment date has been postponed 5 months to September 1979 because of delays in submarine construction. (See p. 5.)

Several factors currently are jeopardizing delivery of the first submarine in December 1978. If improvements are not made in the design effort, availability of skilled labor and shipyard productivity, and receipt of contractor-furnished material, delivery of the first submarine will be later than expected. (See pp. 9 and 12.)

The TRIDENT I missile program has experienced a series of rocket motor test failures. Investigations by the Navy and Lockheed have not pinpointed the cause of the failures but a redesigned nozzle has been successfully tested twice in a full-scale static test and was substituted in the missile for the initial flight test. (See p. 15.)

Until recently, a flight termination system was only planned for test missiles. After analyzing test data, the Navy expressed concern to Lockheed about the potential hazards to submarines and crews caused by missile detonation. To overcome this problem, the Navy required Lockheed to modify its design by installing a flight termination system on all missiles. The contractor estimated the associated costs to be $23 million, which included $2.6 million for production of the first 52 missiles. The Navy has not yet made an independent production estimate for the flight termination device for the remaining 618 missiles. (See p. 15.)

The missile developmental flight test program is on a very tight schedule with little margin to absorb any additional delays. Should any new problems or further delays surface, the entire flight test program could be affected. Problems to be resolved if a safe and reliable missile is to be produced and delivered on schedule include:

--Acceptability of the missile's flight termination system. (See p. 13.)

--Successful completion of the initial missile development test flights. (See p. 14.)

A Department of Defense review of the missile program held in December 1976, determined that no major problems existed in the program which would prevent production. However, the officials noted that flight test data is needed to confirm the adequacy of the production design. On January 17, 1977, the TRIDENT I missile was authorized for production, and funding is being released to cover production requirements through May 1977. The release of the balance of fiscal year 1977 funding will be deferred pending review in May 1977 of early flight test results. (See p. 16.)

The first flight of the TRIDENT I missile occurred on January 18, 1977, and the Navy reported that the flight was successful. (See p. 13.)

Construction of several buildings at SUBASE Bangor is currently behind schedule. (See p. 18.)

The Navy has a requirement for an east coast strategic submarine facility which could support the POSEIDON squadron to be relocated from Rota, Spain; the TRIDENT I backfit POSEIDON submarines; and, possibly, TRIDENT submarines at some future time. Numerous sites were considered and on November 30, 1976, the Secretary of the Navy announced that Kings Bay, Georgia, had been selected as the preferred alternative for further study but no decision has been made. An environmental impact statement must be completed before such a decision can be made. (See p. 18.)

CONCLUSION AND RECOMMENDATION

GAO believes that an acquisition program with stated quantities and related cost estimates is essential to an effective framework for managing and controlling all acquisition programs, and provides a basis for comparisons to other programs. The merits of the TRIDENT program can best be evaluated when the total commitment being undertaken is known.

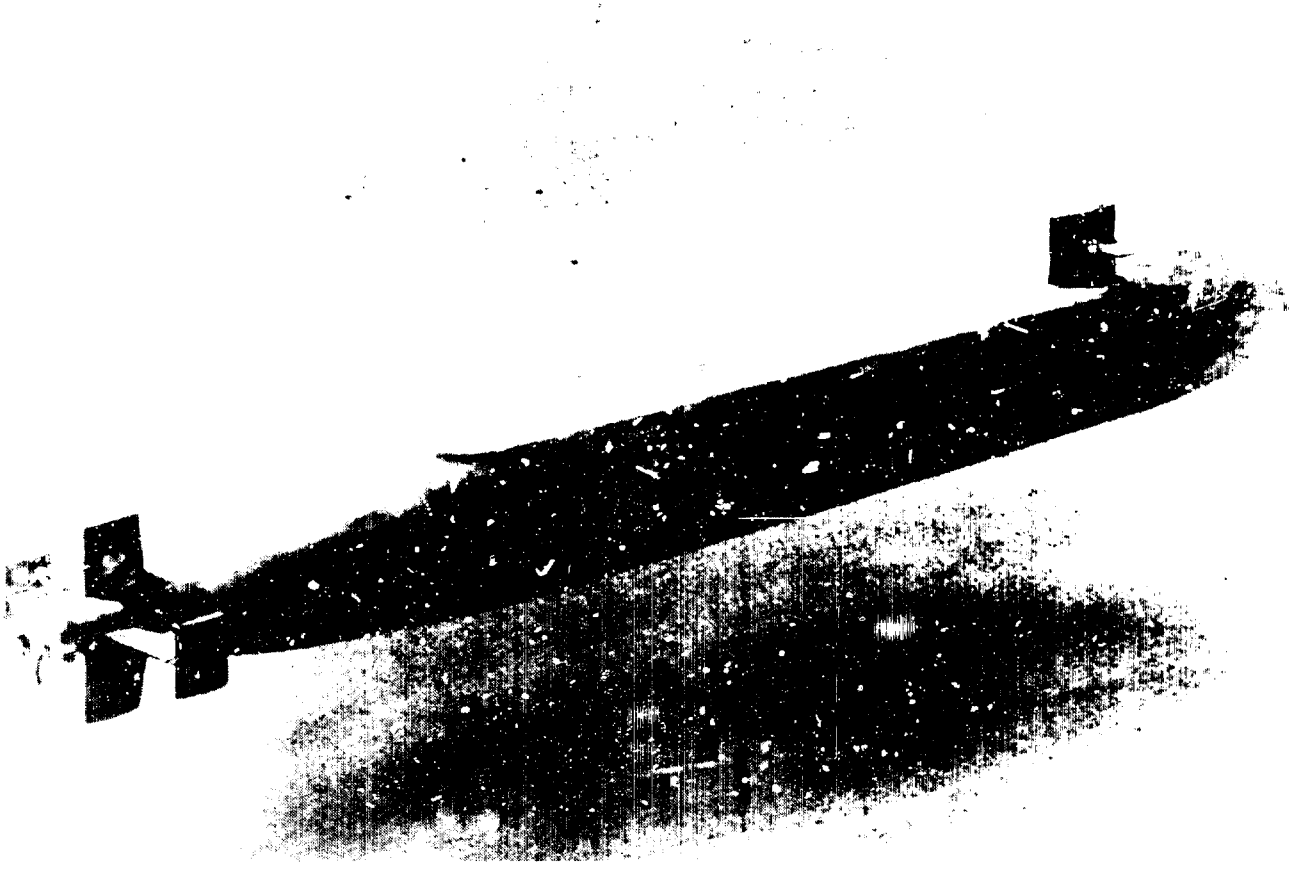
GAO recommends that the Secretary of Defense provide the Congress with a best estimate of the number of TRIDENT submarines and missiles needed and the estimated total cost of this force.

A draft of this report was reviewed by agency officials associated with the management of the program and their comments have been incorporated as appropriate.

Contents

ABBREVIATIONS

DSARC	Defense System Acquisition Review Council
FYDP	Five Year Defense Program
GAO	General Accounting Office
O&MN	Operations and Maintenance, Navy
OPN	Other Procurement, Navy
SAR	Selected Acquisition Report



TRIDENT SUBMARINE

(PHOTO COURTESY OF U.S. NAVY)

CHAPTER 1

INTRODUCTION

The United States' strategic nuclear weapons can be launched from either bombers, fixed silos, or submarines. The Department of Defense views submarines at sea as the least vulnerable of the three. TRIDENT is a follow-on to the present POLARIS/POSEIDON systems.

The principal objectives of the TRIDENT program are to

--deploy a faster, quieter, and more capable ballistic missile submarine which can carry 24 missiles;

--deploy a ballistic missile (TRIDENT I) with a full payload range of 4,000 nautical miles capable of launch from the TRIDENT and some modified POSEIDON submarines;

--construct a west coast personnel training and support facility for the TRIDENT system at Bangor, Washington, called SUBASE Bangor; and

--conduct advanced development of the Mark 500 Evader maneuvering re-entry vehicle which is compatible with the TRIDENT I missile.

The Navy also plans to develop a TRIDENT II missile which will be larger and more capable than TRIDENT I, but this is not included in the current program.

The Electric Boat Division of the General Dynamics Corporation was awarded the construction contract for the first submarine in July 1974, and the Navy exercised its option for three more submarines. The next contract, for the fifth submarine with options for up to four more, is planned to be awarded in early 1977.

The Lockheed Missiles and Space Company was awarded the major prime contract for full-scale development and production of the first 52 TRIDENT I missiles in August 1974. On January 17, 1977, the missile was approved for production through May 1977. If initial flight tests are successful, further production will be authorized.

SCOPE OF REVIEW

The major objectives of our review were to examine the program's cost, schedule, and technical performance and to determine if the submarine and missile will be operational in September 1979, as planned.

The information presented in this report is based on interviews with Navy and contractor officials and reviews of records provided by those officials. A draft of this report was reviewed by agency officials associated with management of the program and their comments have been incorporated as appropriate.

CHAPTER 2

WEAPON SYSTEM STATUS

This chapter highlights the cost, schedule, and performance of the TRIDENT program through September 30, 1976, as shown in the Selected Acquisition Report (SAR) and related documents. 1/

COST

The September 30, 1976, SAR reported the estimated cost for the TRIDENT program at $18,877.6 million for 11 submarines, 406 TRIDENT I missiles (including 30 developmental), and SUBASE Bangor, the west coast support facility. Since June 30, 1975, this estimate has increased $2,549.9 million as follows:

	6-30-75	9-30-76	Net change
	----------(millions)----------		
Development:			
Submarine	$ 701.6	$ 719.4	$ 17.8
Missile	3,395.9	3,578.7	182.8
Procurement:			
Submarine	8,271.3	9,845.0	1,573.7
Missile	3,250.2	4,007.5	757.3
TRIDENT support construction	708.7	a/727.0	18.3
Total	$16,327.7	$18,877.6	$2,549.9
Quantity:			
Submarines	10	11	1
Missiles	370	406	36

a/SUBASE Bangor is still being constructed for a 10-submarine program.

The $2,549.9 million cost increase is attributed by the Navy to these changes.

1/The December 31, 1976, SAR (issued while this GAO report was being processed) shows a 13-ship program and an estimated cost of $21,426.5 million.

Change	Cost (millions)
Addition of the 11th submarine	$1,195.0
Secretary of Defense decision to delay building of the 6th through 10th submarines by 4 months each and corresponding effect on missile production	635.8
Redesign of the missile flight termination system and associated development program delays ($140.0 million), and consequent delay for restructure of the missile procurement production schedule ($240.5 million)	380.5
Additional allowance for economic escalation	392.0
Addition of 36 missiles to support the 11th submarine and follow-on test program	144.5
Cost growth on submarine design contract and prior year ships	109.6
Second stage rocket motor detonation problems	35.0
Additions and rescheduling of support facilities at SUBASE Bangor	32.9
Other estimating changes	-375.4
Total	$2,549.9

Cost not included in program acquisition costs

On August 20, 1975, the Secretary of Defense approved Navy plans to build more than 10 TRIDENT submarines at a rate of three every 2 years, resulting in a shipbulding schedule of 16 ships by 1984, and continuing thereafter. The Navy advised us that they had not developed complete estimated costs for the 12th through 16th ship (see p. 17).

Costs related to the TRIDENT system estimated to be in excess of $12 billion are not included in the total program acqusition costs of $18.9 billion. This includes costs for 5 ships beyond the 11 included in the Selected Acquisition Report, backfit of the POSEIDON submarines, propulsion plant and warhead, construction, and other items which, if included in the program costs, could bring the total to over $30 billion.

Status of funds

A total of $9,308.5 million was appropriated through fiscal year 1977 for the TRIDENT program. As of September 30,

1976, $5,736 million has been obligated--$2,969.5 million for research and development, $2,504 million for procurement, and $262.5 million for military construction.

SCHEDULE

Missile development problems and submarine material problems have caused a delay in several of the TRIDENT program milestone dates. Changes to the submarine and missile dates are discussed below.

Submarine

Since June 30, 1975, the system initial operational capability date has been postponed an additional 5 months to September 1979. This postponement resulted from a 4-month delay in the estimated delivery date of the first submarine from August 1978 to December 1978, and a 1-month extension in the predeployment period. The late delivery of missile tube insert castings, a shift to a different main seawater valve design, and late delivery of other equipment caused the 4-month delay.

Missile

Several of the TRIDENT I missile milestone dates were delayed from 3 to 6 months, due primarily to redesign of the flight termination system.

Milestone	Approved program	Current estimate (9-30-76)
First missile flight development test with ballistic re-entry vehicle	7-76	a/1-77
Production approval--Defense System Acquisition Review Council (DSARC III)	8-76	a/12-76
Missile production go ahead	8-76	a/1-77
First performance evaluation missile flight test from a ballistic missile submarine	6-78	11-78
First demonstration and shakedown operation	2-79	6-79
Operational availability date with ballistic re-entry vehicle	4-79	9-79
Backfit TRIDENT I (C-4) missile into POSEIDON ballistic missile submarine	FY 79	FY 80

a/Actual.

In addition to the above changes, the completion date for the Mark 500 Evader advance development program was delayed from September 1977 to September 1979 because of funding constraints. This will not have any effect on the TRIDENT I missile because the Navy does not have any plans at this time to produce the Mark 500 Evader re-entry vehicle.

Support facilities

Because of the 5-month delay in the system initial operational capability date, the estimated date for SUBASE Bangor to support the first TRIDENT submarine was changed from the second quarter of fiscal year 1979 to the fourth quarter of fiscal year 1979.

Performance

There have been no major changes in the operational and technical performance characteristics of the TRIDENT submarine and missile reported in SAR.

CHAPTER 3

DELIVERY OF THE FIRST TRIDENT SUBMARINE

The TRIDENT submarine contract established an April 1979 delivery date for the first submarine and also required the contractor to use his best efforts to deliver the submarine as early as December 1977. In February 1975, Electric Boat notified the Navy that it could not meet the December 1977 date and rescheduled its best efforts delivery date to August 31, 1978.

In April 1976 the contractor again notified the Navy that its revised delivery date could not be met and the best efforts delivery date was extended an additional 4 months to December 31, 1978. The delay occurred because of problems with the design of the main seawater valves, late delivery of missile tube insert castings and torpedo tubes, and late completion of the reactor compartment shield tank. These problems were resolved and neither the Navy nor Electric Boat expect them to cause any further delays.

The latest revision of the best efforts delivery date and those factors that we believe jeopardize the December 1978 delivery date are discussed below.

DELAY FROM AUGUST TO DECEMBER 1978

The most recent delay in the best efforts delivery date occurred because of problems with the following critical items.

Main seawater valves

Originally, the Navy specified that the design of the 688 class attack submarine main seawater valves be used for the TRIDENT. After manufacture of the TRIDENT valves had begun it was discovered that these valves corroded more rapidly than expected and would require earlier replacement than the TRIDENT overhaul cycle allowed. Therefore, on December 30, 1975, the Navy authorized Electric Boat to procure material for a different valve.

Electric Boat estimated the change would delay delivery of the first ship by 8 months unless part of an existing facility could be used solely to manufacture these valves. To keep the delay to 4 months, Electric Boat invested about $291,000 in the facility and the Navy provided nine items of equipment valued at about $500,000. The Navy also awarded

a $450,000 contract to Electric Boat to purchase 19 items of auxiliary and accessory equipment.

Navy officials said that the valve design change would not have been authorized at that time if there were not other factors contributing to the submarine delivery delay. Navy officials stated that the main seawater valve will not cause any delivery delays.

Missile tube insert castings

In February 1976 Electric Boat officials told the Navy that the delivery of missile tube insert castings was 2 months late due principally to difficulties in making weld repairs of the steel castings. Deliveries of the castings were later delayed another 2 months. The vendors have since improved their ability to weld repairs to the castings and all of the castings for the first submarine have now been received at the missile tube manufacturer's plant. Electric Boat officials no longer consider the missile tube insert castings a critical item.

Late delivery of torpedo tubes

In February 1976 delivery of torpedo tubes for the first TRIDENT was 3 months late for the August 1978 ship delivery schedule. The delay was due to late placement of a purchase order for fabrication of the tubes and late delivery of design drawings, castings, and other materials to be furnished by Electric Boat. As of September 1976 Electric Boat had not provided all of the necessary castings from its foundry, and the estimated delivery of the torpedo tubes was 1 month behind the December 1978 ship delivery schedule. However, Electric Boat does not believe that this delay will prevent delivery of the submarine in December 1978.

Late completion of reactor compartment shield tank

In February 1976 the fabrication of the reactor compartment shield tank was 5-1/2 months delinquent to the August 1978 ship delivery schedule. The delay was caused by a vendor's refusal to comply with the provisions of the Cost Accounting Standards Board. At Electric Boat's request, the Navy authorized use of an alternative construction method which eliminated the need for the vendor's items. The tank was installed in October 1976 and is no longer considered a threat to the December 1978 delivery schedule.

FACTORS JEOPARDIZING DECEMBER 1978 DELIVERY

We have identified several factors which may further delay delivery of the first submarine beyond December 1978. These are discussed below.

Late completion of design drawings

As of September 25, 1976, Electric Boat was behind the December 31, 1978, ship delivery schedule on a number of design drawings. By that date, 6,999 drawings were scheduled to be issued; however, only 6,591 were issued.

Electric Boat officials gave the following reasons for drawing delays:

--The full scope of the TRIDENT design work was underestimated by the contractor and the Navy at the time that the contract bid package was prepared and evaluated. Previous submarine contracts required that approximately 30 percent of the drawings be for new design items while the remaining 70 percent were modifications to existing designs. However, for TRIDENT, approximately 80 percent of the drawings are for entirely new design, while only 20 percent are revisions to existing designs.

--TRIDENT design specifications have imposed new requirements for interchangeability, standardization, and more stringent dimensioning detail, which has resulted in more time and effort than anticipated.

--Progress on verifying the numerous design changes using the TRIDENT mockup has fallen behind, primarily because of the rework caused by these changes and unavailability of contractor- and Government-furnished equipment design data.

--There has been a shortage of skilled draftsmen to perform the more complex design and unanticipated new design efforts.

Availability of skilled labor

In our March 1976 staff study, we reported that Electric Boat had forecasted its current submarine contracts workload would require a peak employee strength of 23,600 by mid-1978. Of the 12,400 shipyard direct labor employees included in the

forecast, it was estimated 60 percent would be skilled and 40 percent unskilled. On October 5, 1976, Electric Boat revised its hiring plan and increased the forecasted employee strength to 31,000. This forecast includes 16,300 direct labor employees and projects that the skill mix ratio will be 55 percent skilled and 45 percent unskilled.

In July 1976, the Supervisor of Shipbuilding and Conversion at Groton doubted that Electric Boat could hire and accommodate an employee strength of 23,600 needed for the new construction. During our review, Electric Boat had increased its total number of employees from 19,244 to 21,792, but the skill mix ratio decreased from 61 percent to 56 percent. Since then the Navy advised us that Electric Boat reached an employee strength of 23,600; however, the desired skill mix ratio has not been achieved. Whether a labor force of 31,000 with an adequate skill mix ratio can be hired and accommodated is subject to question.

Low productivity

During 1976 the Navy and Electric Boat's parent corporation, General Dynamics, expressed concern about the shipyard's labor productivity. In March, Electric Boat began reporting monthly data on direct labor productivity for each submarine under construction. As of June 26, 1976, Electric Boat had expended about 1.59 million hours of direct labor constructing the first ship, although the actual work accomplished was estimated by its Industrial Engineering Department to require only about 1.17 million hours. Reasons given by the contractor for the low productivity are:

--In 1973 shipyard labor was organized along program lines with several different trades working under a single supervisor and responsible for a specific project. This was a relatively inflexible way of assigning production workers. To improve production, Eletric Boat announced a major reorganization in August 1976, wherein all workers in a particular trade would be pooled under a single supervisor.

--The percentage of skilled workers at Groton shipyard has decreased. This was caused by the recent hiring of more unskilled workers than skilled workers and by the withdrawal of skilled workers from the work force to supervise the new workers.

--Electric Boat's Quonset Point manufacturing facility became operational in January 1974 with a work force

composed primarily of unskilled labor. This resulted in slow manufacturing rates of the early hull cylinders, frames, and other steel fabrication.

Late receipt of contractor-furnished material

In June 1974 a Defense Contract Audit Agency report cited material purchasing problems dating back to 1971. Electric Boat was not ordering materials early enough to have the items delivered when required. In response, Electric Boat developed a material ordering guide for the 688 class attack submarines and TRIDENT submarines to improve material ordering.

In November 1975 Electric Boat reported that it expected 18 major contractor furnished items would be received from 2 to 20 months late. Even though submarine delivery has been delayed 4 months, the material ordering and receipt problem has worsened. In September 1976, 35 major items were expected to be received 2 to 20 months late.

An Electric Boat official said that work-around plans have been developed for 34 of the 35 items. These plans are alternative construction or installation methods intended to compensate for late material deliveries. Some examples include:

--Installing some major components after launch of the submarine.

--Shock and endurance testing of the second diesel generator rather than the first, so that the first unit can be installed to support the schedule.

Although work-around plans help to complete the submarine on time, they (1) are disruptive to the orderly, planned construction of the ship, (2) could result in additional construction costs, and (3) may even further delay the delivery schedule.

No work-around plans have been adopted to compensate for late delivery of the missile tubes, a critical item for delivering the submarine on time. The vendor has promised to deliver 6 of the 24 tubes by December 23, 1976, and to deliver 1 tube every 10 days thereafter. Electric Boat officials believe that it is essential that the planned installation rate of 3 tubes every 2 weeks be maintained to deliver the submarine in December 1978. Several work-around plans have been identified and are being studied for

feasibility if any further delays in delivery of the missile tubes occur.

CONCLUSION

Several factors are currently jeopardizing delivery of the first submarine in December 1978. We believe that if improvements are not made in the design effort, availability of skilled labor and shipyard productivity, and in receipt of contractor-furnished material, delivery of the first submarine will be later than expected.

CHAPTER 4

DELIVERY OF THE TRIDENT I MISSILE

The contract for full scale development of the TRIDENT I missile was awarded in August 1974, and the Navy now believes it is ready for developmental flight tests. An extensive series of 30 test flights is scheduled before missile deployment.

The first flight of the missile occurred on January 18, 1977, and we were advised by the Navy that the flight was successful.

The first flight, although scheduled for July 1976, was delayed to January 1977 because of a major redesign of the flight termination system and resolution of test range safety. This also postponed deployment of the TRIDENT I missile to September 1979. These delays and other related problems are currently affecting the missile program.

FLIGHT TERMINATION SYSTEM

In May 1976 a first stage rocket motor ground test was conducted to test the operation of the flight termination system, a device used to abort safely the flight of errant missiles. The rocket motor ignited properly, but after the flight termination system was activated an unexpected motor detonation occurred. Lockheed and the Navy attribute the detonation to the ground test environment, but they also recognize that a similar detonation could occur in a test flight environment.

Since an effective flight termination device is required for conducting missile flight tests, the device was redesigned, causing a 5-month delay in the program. The Navy estimated the cost of the additional missile development effort, delays for this redesign and restructure of the missile procurement production schedule at $380.5 million.

Safety of missile flight tests

The Air Force Commander for the Eastern Test Range is responsible for safe test operations at the Cape Canaveral test range and must approve each TRIDENT flight test. Flight test missiles are required to have termination devices which can be activated to abort the flight of errant missiles. The May 1976 detonation raised serious concern about the adequacy of the flight termination system planned for the TRIDENT I

missile. The Air Force was also concerned about the residual thrust (continued burning of the propellant for a period after the flight termination device is activated) carrying the missile dangerously close to civilian areas. The Air Force believes that a missile detonation caused by activation of the flight termination system or by missile impact with the ground could endanger the civilian population.

The Navy originally planned to use Launch Complex 25 for flight testing of the TRIDENT I missile. However, due to the Air Force's concern and in order not to delay the flight test program, the Navy proposed relocating the test to Launch Complex 37. The Navy estimates modification of Launch Complex 37 to accommodate the TRIDENT I missile will cost $7 million and require 13 months to complete. The Navy's plans were based on obtaining congressional reprograming approval for the relocation in early September 1976. However, action was postponed until the Congress convenes in January 1977.

In the interim, the Navy plans to conduct flight tests from Launch Complex 25 under imposed environmental and trajectory restrictions. To lessen the hazard to the Cape Canaveral Community should a TRIDENT I missile detonate during launch, the flight path of the missile was changed to shift the risk from the civilian areas to the test site. However, accommodating this flight path will reduce the amount of test data collected on reentry. Should the testing prove successful, the Navy will be able to change the trajectory to the preferred flight path.

Delays in developmental flight test program

An extensive series of 30 developmental test flights is scheduled before deploying the TRIDENT I missile. The most recent delay of the first flight test was caused by the May 1976 flight termination problem. Subsequent rocket motor nozzle failures (see p. 15) and concerns over range safety compounded this problem postponing the first flight test to January 1977.

Any further major delays in developmental flight test could affect the whole program. The schedule of subsequent flights is already compact with the first 20 flights scheduled at a rate of about 1 per month and the final 10 flights at 2 per month.

According to Lockheed, a critical date has not been established when the missile deployment date will need to be further delayed. As of the end of September 1976, the contractor stated there was about 6 months slack in the program, of which 3 months is in the early stages of the developmental flight test program.

Flight termination devices on deployed missiles

Until recently, flight termination capability was not planned for deployed TRIDENT I missiles, only for test missiles. However, after analyzing the test data from the May 1976 first stage motor detonation, the Navy expressed concern to Lockheed about potential hazards to the submarine and crew should a similar detonation occur during normal operations.

On July 7, 1976, the Navy told Lockheed that the TRIDENT I missile design is to provide for automatic pressure relief in the event of structural failure and missile breakup. The contractor was further told that such a system is within its current contract responsibility to design a safe and operable missile. Lockheed disagreed with the Navy and said the design change required a revision in weapon system specifications. Lockheed estimated $19.4 million would be required for development of the automatic pressure relief system, $2.6 million for production of these systems for the first 52 missiles, and $1 million for production support. The Navy has not yet made an independent estimate of the production cost for the flight termination device for the remaining 618 missiles.

ROCKET MOTOR TEST FAILURES

The TRIDENT I missile program has experienced a series of developmental rocket motor test failures. In March 1976 we reported on the second stage rocket motor detonations, which occurred during ground tests in May 1974 and June 1975. Lockheed is confident the problems associated with these two detonations have been solved by modifying the propellant. There have been three additional rocket motor test failures, including the May 1976 test failure previously discussed. The other two failures occurred on first stage rocket motors tested September 16, 1976, and October 21, 1976. Although neither test resulted in a detonation, both rocket motors suffered similar nozzle failures shortly after the motor was fired. Investigations by the Navy and Lockheed have not pinpointed the cause of the failures. Subsequent to these failures, the Navy advised us that a redesigned nozzle has been successfully tested twice in a full-scale

static test and was substituted in the missile before the initial flight test.

PRODUCTION DECISION

The TRIDENT I missile production approval date is a major program milestone. Prior to missile production go ahead DSARC III is scheduled. DSARC III is high level review of program progress and suitability to enter substantial production and deployment. One of the considerations is whether all previously identified technical uncertainties have been resolved and operational suitability determined by test and evaluation.

DSARC III was held on December 23, 1976. The DSARC concluded that while no major problems exist in this program which would preclude proceeding with production, flight test data is needed to confirm the adequacy of the current production design. On January 17, 1977, the missile program was authorized to proceed with production and $180 million of the fiscal year 1977 funding is being released to cover production requirements through May 1977. Release of the remaining funds will be deferred pending a successful program review of early flight test results in May 1977. The results of the initial missile test flights should have a considerable bearing on any decision to continue production and subsequent deployment.

SUMMARY

Several problems need to be resolved if a safe and reliable missile is to be produced and delivered on schedule. The major ones are the acceptability of the missile's flight termination system, and successful completion of the initial missile development test flights through May 1977.

The missile developmental flight test program is on a very tight schedule with little margin to absorb any additional delays. Should any new problems or further delays surface, the entire flight test program may be affected. Results from the test program need to be thoroughly analyzed for potential effects on production and delivery of the missile.

CHAPTER 5

OTHER TRIDENT RELATED MATTERS

Several other issues are currently affecting the TRIDENT program. They are the increasing TRIDENT force levels, the basing of TRIDENT submarines beyond the first 10, and construction delays at SUBASE Bangor.

INCREASED TRIDENT FORCE LEVELS

The Navy plans to continue building TRIDENT submarines beyond the original 10 ships to preclude the decrease in sea-based missile launchers, which will occur when POSEIDON submarines are retired in the late 1980s and early 1990s.

On August 20, 1975, the Secretary of Defense approved a continuing shipbuilding schedule of three ships every 2 years, resulting in a shipbuilding schedule of 16 ships by 1984, and continuing thereafter as shown in the following table.

Submarine Building Rate by Fiscal Year

Prior year ships			FYDP 1976								
1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	continuing
11 ship program reported in current SAR											
1	2	1	1	2	1	2	1	2	1	2	

The Navy does not report or develop cost estimates for those ships which are planned beyond the current FYDP. The 11th submarine was not reported in SAR until 1975, after the annual update of FYDP. The 12th and 13th submarines planned in 1982 should be reported in the December 1976 SAR when FYDP is again updated 1/. The number of TRIDENT submarines will continue to increase until a final force level is established.

According to the Chief of Naval Operations, the final force level cannot be established because of several unresolved issues, such as:

--Strategic arms limitation negotiations.

--The role of the TRIDENT in the national strategic policy.

1/These submarines were reported in the December 31, 1976, SAR.

--The retirement dates of the POLARIS and POSEIDON submarines.

--Evolving national strategic objectives.

EAST COAST BASING OF TRIDENT SUBMARINES

The expanding shipbuilding program will require additional facilities because the submarine base at Bangor, Washington, is being constructed to accommodate a fleet of only 10 TRIDENT submarines. While no decision has been made on where additional TRIDENT submarines will be based, the Navy has conducted a study of alternative east coast locations for a ballistic missile submarine refit site and possible TRIDENT basing.

Each site considered by the Navy study was evaluated for its capability to support (1) the POSEIDON squadron to be relocated from Rota, Spain, (2) the TRIDENT I backfit POSEIDON submarines, and (3) TRIDENT submarines at some future time. The study was completed in September 1976, and the Secretary of the Navy announced King's Bay, Georgia, as the preferred alternative location on November 30, 1976. However, a Navy decision on whether or not this site will be used has not been made. An environmental impact statement must be completed before such a decision can be made.

SUBMARINE SUPPORT FACILITIES

The submarine base under construction at Bangor, Washington, includes facilities for submarine maintenance, missile assembly and checkout, and personnel training and housing. The base is scheduled to be operational in the fourth quarter of fiscal year 1979.

Construction of 14 facilities at the base is currently 1 to 15 months behind schedule. Two examples of delinquent facilities are:

--Nondestructive Test and Inspection Building. This building must be modified to provide support of TRIDENT I motor processing, including radiographic inspection and testing (3 months delinquent). In addition, a new facility, the Radiographic Inspection Building, has recently been added. This building will contain a new state-of-the-art radiographic inspection system (9 months delinquent).

--Missile Assembly Building No. 1. This facility is necessary to support assembly, disassembly, and checkout of TRIDENT I deployed missiles (5 months delinquent).

An additional factor which may contribute to construction delays was a strike by plumbers and pipefitters from June to September 1976. Program officials are currently assessing the effect of this strike on the construction schedule.

Despite these delays, TRIDENT program officials said that work-around plans were availble so that construction delays would not prevent operation of the base in September 1979, or loading the missile in the lead submarine.

CONCLUSION

The Navy plans to continue acquiring TRIDENT submarines and missiles beyond the current approved program in the SAR. The final force level will be determined when certain issues relating to strategic policy, strategic objectives and strategic arms limitation negotiations are resolved. However, we believe that an acquisition program with stated quantities and related cost estimates are essential to an effective framework for managing and controlling all acquisition programs and provides a basis for comparisons to other programs. In our opinion, the merits of a program can best be evaluated when the total commitment being undertaken is known.

RECOMMENDATION

We recommend that the Secretary of Defense provide the Congress with a best estimate of the number of TRIDENT submarines and missiles needed and the estimated total cost of this force.