BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Two Contracts For Nuclear Attack Submarines Modified Under Authority Of Public Law 85-804--Status As Of December 22, 1979

The Defense Appropriation Authorization Act of 1979 requires the Comptroller General to audit and review two specific contracts for SSN-688 class nuclear attack submarines.

The purpose of the audit is to insure that funds authorized for payments under contract modifications made in the interest of national defense are being used only on the two contracts and that the contractor is not realizing any total combined profit on these contracts.

GAO's review disclosed that the funds are being spent as intended and the contractor is not realizing a combined profit on the contracts.

GAO further found that a problem identified in December 1979 has the potential for significant cost growth.

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

B-197665

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

This is our second report on the status of two contracts for SSN-688 class attack submarines modified under the authority of Public Law 85-804. This report covers the year ended December 22, 1979.

Our review was made pursuant to section 821 of the 1979 Defense Appropriation Authorization Act which requires the Comptroller General to report annually the results of audits and reviews of contracts N00024-71-C-0268 (-0268) and N00024-74-C-0206 (-0206), which the Navy awarded to General Dynamics Corporation. The purpose of these audits and reviews is to insure that funds authorized to provide relief under Public Law 85-804 are used only in connection with the contracts and that the prime contractor does not realize any total combined profit on the contracts.

We found that as of the company's fiscal year ending in December 1979:

--Funds provided are still being used only on the specified contracts.

--Electric Boat (the division of General Dynamics constructing the submarines) continues to project an overall loss on the contracts and will have to experience a significant underrun on the remaining estimated costs to become profitable.

--The chances of its achieving such an underrun appear to be remote.

--An unresolved weld problem identified in December 1979 has the potential for significant cost growth.

HSE 820500
SL N00500

MGC 00001
DLG 02938

--Another problem concerning use of nonconforming steel caused delays in ship construction and increased costs but has been resolved.

These observations are discussed in the following sections.

USE OF AUTHORIZED FUNDS

Through December 22, 1979, Electric Boat had incurred $78 million of costs in excess of the absorbed loss and amounts billed the Government as shown below.

	Contract -0268	Contract -0206	Total
	(millions)		
Incurred costs	$1,009.2	$867.0	$1,876.2
Less absorbed loss	-126.3	-85.6	-211.9
Adjusted costs	882.9	781.4	1,664.3
Less: Progress payments billed	-865.7	-704.6	-1,570.3
Extraordinary escalation billed (note a)	-3.4	-12.6	-16.0
Unreimbursed costs	$ 13.8	$ 64.2	$ 78.0

a/Extraordinary escalation is additional costs attributable solely to inflation above that included in the $2,668 million estimated cost at completion as of the time of the settlement.

The incurred costs have not been reduced by costs which the Defense Contract Audit Agency considers unallowable under the Defense Acquisition Regulation. The Defense Contract Audit Agency has questioned $49.6 million. Of this amount, we were informed that $24.1 million is subject to negotiation and $25.5 million is subject to litigation before the Armed Services Board of Contract Appeals. Even if the entire $49.6 million is disallowed, there would still be a balance of $28.4 million in unreimbursed costs. Therefore, since the amount expended on the contracts is greater than the reimbursement, the funds made available under Public Law 85-804 are not being used on business other than the two contracts.

COMBINED PROFIT/LOSS POSITION

As shown below, the contractor's estimated loss at completion on December 22, 1979, is $361 million, which is an increase (overrun) of $2 million over the $359 million estimated loss after the financial settlement. The terms of the settlement provide that cost underruns be shared by the contractor and the Government on a 50/50 basis. Cost overruns are to be shared in the same proportion up to a maximum overrun of $100 million. To determine the estimated cost at completion for sharing purposes, the total estimated cost is reduced by the costs for contract modifications and extraordinary escalation from January 1978 to December 1979. The reduction is made solely for the purpose of converting the total estimated cost to a basis consistent with the estimated cost at completion prepared at the time of the settlement.

	Contract		
	-0268	-0206	Total
	(millions)		
Estimated cost at completion on December 22, 1979 (note a)	$1,023	$1,709	$2,732
Less: Contract modifications	-7	-13	-20
Extraordinary escalation forecast	-4	-37	-41
Estimated cost for sharing purposes	1,012	1,659	2,671
Estimated cost at completion as of time of settlement	1,009	1,659	2,668
Cost overrun	3	0	3
Amount of overrun to be absorbed by contractor per settlement terms (50%) (note b)	2	0	2
Estimated loss at completion as of time of settlement	136	223	359
Estimated loss at completion on December 22, 1979	$ 138	$ 223	$ 361

a/See app. I for analysis by hull number.

b/Figures rounded.

The December 22, 1979, estimated cost at completion of $2,732 million includes the $49.6 million of costs questioned by the Defense Contract Audit Agency and a management reserve of $47.3 million established by Electric Boat for contract -0206. Electric Boat officials said this reserve represents costs which may not be incurred based on current labor trends, but it is not firm enough to warrant reducing the total estimated cost. However, Navy officials said that they do not believe the savings will be realized.

As summarized below, the expected combined loss could be between $312 million and $361 million, depending on the amount of questioned costs disallowed and labor savings realized.

	Contract		
	-0268	-0206	Total
	(millions)		
Loss before adjustments	$138	$223	$361
Loss if only labor savings are realized	138	199	337
Loss if only questioned costs are sustained	117	218	335
Loss if both labor savings are realized and questioned costs are sustained	117	195	312

PROSPECTS FOR AN OVERALL PROFIT ON THE COMBINED CONTRACTS

Because cost underruns are shared by the contractor and the Government on a 50/50 basis, the contractor would have to underrun the total estimated cost by $722 million to break even on the maximum estimated loss of $361 million or by $624 million to break even on the minimum estimated loss of $312 million. It should be noted that the minimum estimated loss already anticipates labor savings of $47 million; therefore, the total minimum underrun needed would be $671 million ($624 million plus $47 million).

There is little chance that the contractor will underrun by these amounts. Through December 22, 1979, the contractor had already incurred costs of $1,876 million, leaving $856 million of the total cost estimate of $2,732 million to be incurred. To break even, the contractor would have to underrun the $856 million by either $722 million or $671 million, depending on the assumptions used.

The total loss is also affected by change orders since the contractor is allowed to earn a profit on change orders, as long as there is no overall profit on the two contracts. Adjudicated change orders in relation to total estimated construction costs, however, have not been material, amounting to only $7.1 million on December 31, 1979. As of the same date, unadjudicated changes and requests for proposal totaled only $7.4 million.

PROBLEMS AFFECTING COST GROWTH

Inadequate welding and inspection

A problem regarding inadequate welding and inspection of submarine structure welds was discovered in early December 1979. By June 28, 1980, Electric Boat had incurred costs of $14.7 million on contracts -0268 and -0206 and more than $2.6 million on the Trident program because of this problem. Additional costs are anticipated, but the magnitude of the problem had not been determined at the time of our review. Accordingly, the amount of additional costs could not be reasonably estimated.

In December 1979, representatives of the Supervisor of Shipbuilding, Conversion and Repair (SUPSHIP), U.S. Navy, Groton, Connecticut, noted incomplete welding in the SSN-698. The welds had previously been inspected and accepted by Electric Boat. Subsequently, additional incomplete welding was identified by SUPSHIP on SSNs-698, -699, and -702. SUPSHIP also identified additional deficiencies in the hull structural and deck support areas of the SSN-698.

Because of these disclosures, Electric Boat checked into the adequacy of structural welding requiring magnetic particle inspection 1/ and the quality assurance means of demonstrating such adequacy for ships under construction. The general manager of Electric Boat initially reported to SUPSHIP that the trades people and the inspectors did not do what was required of them, and that the quality control system was not sufficient to detect these failures. He also said that an Electric Boat review of 80 plans involving

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1/Magnetic particle inspection is a nondestructive test method used for locating surface and subsurface discontinuities in ferromagnetic welds or materials.

structural welding disclosed another problem. Some of the plans which showed welds requiring magnetic particle inspection had no record showing that required inspection had been performed. The general manager also said that there is no published Navy list identifying certain type welds for which magnetic particle inspection is required. He concluded by saying that Electric Boat's inquiry to date indicates that the shortcomings found have occurred in relatively limited areas and are not representative of the quality of Electric Boat's total work in the structural area.

In a subsequent report to the Navy, Electric Boat stated that the welding problem was limited to the three areas of (1) the work of four suspect inspectors, (2) contour grinding of hull penetrations, and (3) miscellaneous structure, including deck support systems. Upon completion of the inspection program on the SSN-698, Electric Boat believed that the structural steel welds would be satisfactory and the ship would be ready for fast cruise and sea trials. The report made no specific mentions of inspecting other SSN-688 class submarines.

SUPSHIP did not consider the report complete or satisfactory because of the limited information presented by Electric Boat. In the meantime, because of concern for the weld problem and questionable inspections, the Navy drydocked the already delivered SSN-694 to inspect the hull and other structural welds. The Navy also recommended operating restrictions for four other SSN-688 class submarines delivered by Electric Boat on these contracts until the condition of the welds on the SSN-694 could be verified.

Navy inspection teams subsequently completed an evaluation of previously delivered submarines SSNs-690, -692 and -694. These audits revealed the same type of defects found on the submarines under construction.

Action has been taken by the Navy to correct those defects associated with the hull safety of SSNs-690, -692, and -694, and the precautionary operating restrictions for those ships have been removed. Similar corrective action will be taken on the other two delivered SSNs--SSNs-696 and -697.

Defects not associated with the hull safety have been reviewed, and a determination was made that correcting these defects is not critical to continued operation of the ships at design test depth. These defects are primarily associated with deck stanchions, pipe hangers, and

structural support foundations. Corrective action on deficient welds not associated with the hull safety will be undertaken by the Navy during regularly scheduled maintenance periods.

Correspondence between the Navy and Electric Boat shows disagreement as to the magnitude of the problem on the undelivered ships. Electric Boat alleges that the scope of the problem has been determined. SUPSHIP alleges that Electric Boat has only taken that action necessary to correct specific reported incidents without delving deeper to determine the full scope of the problem and its underlying causes. Because of the welding and other quality problems, on April 2, 1980, SUPSHIP requested Electric Boat to conduct an indepth review and evaluation of the adequacy of the quality program and to report the results together with corrective action taken and planned within 45 days.

SUPSHIP did not agree with Electric Boat's response of May 23, 1980, that its quality program fully complied with MIL-Q-9858A because it was not considered to be an indepth review and evaluation of the quality program as requested. In connection with fiscal years 1980-81 procurements, the Navy planned to conduct a preaward audit of the quality program in June.

Since the magnitude of the problem had not been established at the time of our review, the expected amount of cost growth due to the welding problem cannot be reasonably estimated. A SUPSHIP official stated that cost overruns on undelivered ships will be subject to the 50/50 cost sharing clause of the settlement. Also, costs associated with the reinspection and correction of welds on the delivered ships, whose guaranteed periods are past, may have to be borne initially by the Navy because the ships have been accepted. However, we have been advised that the Navy's General Counsel is determining whether any legal options exist for recovering from the contractor any of the incurred costs associated with Navy repair of the delivered ships.

Nonconforming steel

During an audit of material in November 1978, Electric Boat discovered that material certifications supplied by vendors for some carbon steel stock (QQ-S-741D) were not in accordance with purchase order requirements. Electric Boat receiving personnel failed to compare the accompanying test

certificates with the purchase order requirements--a required inspection procedure. The nonconforming steel is used in pressure-containing systems; piping; structural support foundations; hangers; plugs; and manufactured, machined, and formed parts. Electric Boat determined that, of the QQ-S-741D steel received from 1970 to July 1979, about 12 percent did not conform to purchase order requirements.

The shipbuilder's proposed course of action to resolve the problem consisted of (1) identifying and removing raw material and machined parts involving the nonconforming steel from the inventory system, (2) identifying all shipboard usage, and (3) performing an engineering analysis to determine where nonconforming steel may require replacement.

The Navy considered the problem resolved in November 1979, with the exception of specific waivers to be submitted on an independent boat basis. A SUPSHIP official stated the impact of the steel problem along with other concurrent problems in 1979 caused delays of from 3 to 5 months on SSNs-697 and -699. Because of this problem, through June 28, 1980, Electric Boat had incurred costs of $2.7 million relating to the SSN-688 and Trident class programs, of which $1.8 million applies to the SSN-688 contracts.

SUPSHIP's position is that Electric Boat is solely responsible for the problem but that the overrun costs related to the problem will be subject to the 50/50 cost sharing provision of the settlement. While Electric Boat is seeking recovery from its steel distributors, it requested that costs associated with the problem be considered insurance risks under the insurance provision clause of the contract and that SUPSHIP issue an insurance field change order. SUPSHIP denied the request because, on the informal information provided, it could determine no basis for a claim under the insurance provision or other provisions of the contracts.

ELECTRIC BOAT AND NAVY COMMENTS

Electric Boat

In past reviews, Electric Boat would discuss the contents of our drafts with our representatives onsite but did not do so in this case. Instead, the shipbuilder submitted its comments after completion of the site work.

Electric Boat stated in general terms that the section, "Problems Affecting Cost Growth," was an inaccurate assessment of the situation and requested its deletion. However, its response provided no specific comments on the alleged inaccuracies therein. We believe the section presents a fair, accurate, and updated description of the problems. In this regard, the Navy SUPSHIP reviewed and agreed with the report's contents as written. Electric Boat comments are included as appendix II.

Electric Boat said it had difficulty in attempting to comment on the report because

--the chronology of the events had been reversed,

--we incorrectly matched Electric Boat reports and the related Navy responses,

--factual errors existed in our report as to what was said in the Electric Boat correspondence, and

--in extracting a sentence here or a sentence there from the correspondence, the context was lost as well as the significance of the matters involved.

In response to the above, the report does not attempt to present a detailed chronology of events but simply to present the general nature, significance, and status of the problems with respect to cost growth. Also, our purpose was not to report a point/counterpoint exchange of responses but merely to summarily identify the problems and their potential cost impact on the SSN-688 contracts. Although Electric Boat alleged factual errors as to what was said in its correspondence, it did not provide any specific references to a paragraph, sentence, or work in its response. We do not agree that our reporting of the supporting documentation was out of context or detracted from its significance. As previously mentioned, our rationale for reporting the problems is to point out the potential impact for cost growth under the terms of the Public Law 85-804 settlement.

The remainder of Electric Boat's response is a detailed expansion of its position on these problems.

We believe the report fairly presents the positions of Electric Boat and the Navy in their actions relating to the problems. In several brief pages, the report gives credence to actions taken or being taken by Electric Boat as well as

the Navy's concerns on such actions. However, contrary to Electric Boat's request to delete the problems section because of the complex, technical matters involved, we believe it is our responsibility to report these issues because of their significance and the potential for cost growth.

Navy

The Navy submitted informal comments that suggested revising the report along two lines.

On the one hand, the Navy recommended that the discussion in the section, "Problems Affecting Cost Growth," be substantially limited. The Navy believes that

--the details of the steel and welding problems can be more appropriately addressed in other forums (such as the congressional budget process),

--there has already been considerable discussion with the Congress on this matter,

--the Congress will continue to be informed on the progress in correcting the deficiencies and the impact on the planned program as details become available, and

--it appears somewhat incongruous to devote a substantial portion of the report to matters which merely buttress the already supported conclusion that a profit is unlikely to be realized.

On the other hand, the Navy reiterated its position that change orders after the settlement provisions are separate from the reformed contracts. Therefore, section 821 of Public Law 95-485 only applies to the contract as it existed at the time of reformation. Hence, the contractor is allowed to earn profit on change orders after the reformed contract settlement. Theoretically, this could yield an overall profit on the contracts after the work has been completed.

While section 821 requires that certain review objectives be accomplished in connection with specified contracts, we believe our audit authority and responsibilities clearly extend to reporting on significant developments affecting these contracts. In this particular instance, the occurrence and subsequent resolution of the steel and

welding problems will have an undetermined future cost impact. We believe that this situation meets the above criteria and warrants reporting under our statutory authority.

As stated in prior reports, our position on change order profit, which is based on the legislative history of section 821, remains that total final profit or loss on these contracts will be affected by all change orders regardless of when they were executed.

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Copies of this report are being sent to the chairmen, Senate and House Armed Services Committees; Senator William Proxmire; and the chairman, General Dynamics Corporation.

Comptroller General
of the United States

APPENDIX I

ESTIMATED COST AT COMPLETION

DECEMBER 22, 1979

Contract and hull no.	Incurred	Estimate to complete	Estimate at completion
	----------(millions)----------		
-0268:			
690	$ 178	$ 1	$ 179
692	136	1	137
694	135	1	136
696	144	1	145
697	140	1	141
698	139	3	142
699	137	6	143
Total	1,009	14	1,023
-0206:			
700	174	6	180
701	120	28	148
702	109	38	147
703	94	55	149
704	81	69	150
705	69	82	151
706	61	90	151
707	51	103	154
708	43	114	157
709	35	125	160
710	30	132	162
Total	867	842	1,709
Total	$1,876	$856	$2,732

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GENERAL DYNAMICS
Electric Boat Division
Eastern Point Road, Groton, Connecticut 06340 • 203 446-5960

June 26, 1980

Enclosure: (1) General Dynamics, Electric Boat Division Letter to SUPSHIP, Subject: General Dynamics Corporation, Electric Boat Division, Quality Program, dated May 23, 1980.
(2) Quality Assurance Management Plan Presentation dated June 9, 1980

Mr. Fred D. Layton
United States General Accounting Office
Regional Office
Suite 1907, 100 Summer Street
Boston, Massachusetts 02110

Dear Mr. Layton:

Electric Boat Division has received and reviewed your draft audit report entitled "Two Contracts for Nuclear Attack Submarines Modified by Public Law 85-804 ... Status As of December 22, 1979". As we understand it the purpose of the audit which is stated on the cover sheet is:

> "The purpose of the audit is to ensure that funds authorized for payments under contract modifications made in the interest of national defense are being used only on the two contracts and that the contractor is not realizing any total combined profit on these contracts."

Our comments are directed first to that section of the audit dealing with this purpose and then to the peripheral matters addressed in it.

I. Comments on Contract Funds Status

1. On the first page of the draft audit you stated:

> "--Electric Boat (the division of General Dynamics constructing the submarines) continues to project an overall loss on the contracts and will have to experience a significant underrun on the remaining estimated costs to become profitable."
>
> "--The chances of its achieving such efficiencies appear to be remote."

To imply that anyone could perform $850 million dollars of work for $132 million by "achieving such efficiencies" is misleading. We request that you delete the sentence "The chances of ... to be remote."

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2. In the section entitled "Use of Funds Authorized" you present a table of figures and conclude that since there are $78 million of unabsorbed cost that none of the funds are being used for purposes other than performance of the contracts. While the conclusion is correct the calculation used to support this finding excludes approximately $210 million of absorbed loss. We think it is incorrect to do so. Before any funds would be available for some purpose other than performance of the two contracts the entire $290 million would of necessity have to be recovered. We request that the table be revised as follows:

	CONTRACT		
	-0268	-0206	Total
Incurred Costs	$1,009.2	$867.0	$1,876.2
Loss: Progress Payments Billed	-865.7	-704.6	-1,570.3
Extraordinary Escalation Billed	-3.4	-12.6	-16.0
Unreimbursed Costs	$ 140.1	$149.8	$ 289.9

II. Recent Events at Electric Boat

Your report then proceeds to a discussion of two recent events at the shipyard concerning welding and "non-conforming steel". It is evident that your draft audit of the activities surrounding these events is an effort to summarize an extremely complex technical matter. Since these two portions of your report were never discussed with the Shipbuilder this is the first opportunity we have had to address the matter.

The GAO summary causes considerable difficulty for one attempting to comment on the audit because:

- the chronology of the events has been reversed.
- you have incorrectly matched EB reports and the Navy responses they relate to.
- there are factual errors in your report with respect to what was said in the EB correspondence.
- in extracting a sentence here or a sentence there from the correspondence, the context is lost as well as the significance of the matters involved.

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Since the time of the writing of the draft report, additional information has been obtained and further reviews made by the Company and the Government which are pertinent to the subject matter of the two areas you have addressed. The following comments therefore are not an attempt to comment on the audit on a line by line basis but rather a recitation of the pertinent facts and the conclusions which flow therefrom focused specifically on what we believe to be the principal inaccuracies in the audit.

One thing must be set straight right at the outset in order that the entire situation be kept in perspective. At no time has the investigation into either area produced evidence of a problem with hull safety or the technical adequacy of the welding or the materials in the pressure boundary.

III. Welding Problem

1. Scope of Electric Boat Division Review.

   a. Since the situation first came to light on SSN698, our investigation initially was focused on SSN698 and 699 since Fast Cruise and First Sea Trials for those ships were being delayed but ultimately the scope would include all ships under construction at Electric Boat.

   b. Specific reviews were made of identified problems to determine their significance, develop corrective action and establish the scope of further investigations.

   c. Sizeable samples from a significant number of drawings requiring MT inspection were taken to establish a program for reinspection of welds, correction of defects and an engineering determination of the adequacy of the weld from a strength standpoint in the unrepaired condition for its intended service. This effort was monitored by top management on a continuous basis and modified appropriately in light of the results obtained.

   As the investigation proceeded, interim status reports were provided to the Navy on January 14, 1980 and February 26, 1980. The Electric Boat review was comprehensive, as indicated in the following summary from the February 26th report:

   > "To summarize, each problem in the structural welding areas of SSN698 was investigated through extensive supplemental inspections to the point where we were able to conclude that the area being investigated was of acceptable quality. Where our investigation disclosed the existence of additional problems,

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the scope of our investigation was expanded to include those problem areas. All deficiencies identified, whether significant or not, were corrected. The limits of our inquiry were determined entirely by our findings. We set no arbitrary limits in advance; neither did we assume the existence of problem areas unless we encountered, in the course of our inquiry, evidence which would affirmatively indicate that a particular area had problems. In the case of the other ships under construction at Electric Boat, we are undertaking inquiries to the extent dictated by our experience on the SSN698 and their individual status of completion."

2. Results of Investigation

The early reports furnished to the Navy identified between 70-80,000 inches of weld which had been reinspected in many different structural areas of SSN698 to ascertain the extent of the problem and the nature of the corrective action. The results of this investigation indicated the following:

a. Welding involving the pressure hull boundary is satisfactory. All QAL Type I records needed to establish this fact have been identified on a one for one basis.

b. The extent of the problem was not as great as originally thought. The data shows that the problem welds, rather than involving hull integrity, involve welds in less critical areas such as hangers, deck support members, and miscellaneous structural attachments.

c. While we do not have all the details concerning operating restrictions on the delivered ships, we conclude from the fact that these restrictions have been lifted for some of the delivered ships reinspected by the Navy that the results of the Navy's investigation parallel our own. A copy of the Navy's findings on the SSN697 was furnished to us. There were 100 reported deficiencies, three of which were reported in the Subsafe area. One of these was a non-relevant surface indication which was removed by minor grinding. The other two reported indications could not be detected by magnetic particle (MT) inspection (DC prod) performed by us, which is a more stringent inspection technique than the specifications require. Of the remaining 97 reported deficiencies 90 of the items were determined to be technically adequate for their intended purpose but will be repaired during a normal post-delivery availability. The remaining items which constitute seven deficiencies were:

Item 6 - Crack in Stanchion - EN CS 95806 has been issued for this repair.

Item 20 - Missing Retainer Pin in Stanchion Clevis Pin - Installed retainer pin.

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Item 24 - Pipe Hanger - Restore to plan requirements.

Item 44 - Deck Clip Frame 111 - Restore to plan requirements.

These items were repaired on the SSN697 during a temporary availability from March 7, to March 26, 1980.

3. Current Status of Electric Boat Program

An engineered program has been developed which consists of identifying all of the structural steel welds, subdividing them by area of the ship, further subdividing them by level of importance, for example Subsafe QAL Type 1 welds and then further by type of inspection required.

The SSN698 was used as a pilot ship to establish this program. Using the data from shipboard investigations reviews will be made of any suspect welds. That portion of the Engineering program required to support reactor criticality has been completed on the SSN700 and SSBN726 and the results furnished to the Navy to obtain concurrence to proceed to criticality. The next priority is to complete the entire program on the SSN698 and 699 in order to proceed to Sea Trials. Concurrently with this, investigations as appropriate will be made on the remaining ships under construction.

IV. Non-Conforming Steel

1. The non-conforming carbon steel material problem was uncovered by an Electric Boat Procurement Quality Control audit of warehouse material conducted in November, 1978. The initial determination was that five sizes of carbon steel bar stock had chemical properties not in accordance with purchase order requirements (QQ-S-741D). A review of the purchase order files at Receiving Inspection indicated that in some cases the chemical test reports supplied by the vendor with the material were inaccurate while in other cases the material was accepted even though the chemical test reports supplied by the vendor showed that it did not meet the purchase order requirements. A further review of other purchase orders from that supplier, and purchase orders for similar commodities from other vendors, raised a concern regarding M1020 appearing as a heat number of material test reports submitted by the supplier. As a result of these concerns, a complete investigation was conducted of all 622 purchase orders for QQ-S-741D steel received from 1970 to 1979, involving 6100 tons of material. This investigation revealed that discrepant material had been received by Electric Boat during the period between the third quarter of 1970 and the third quarter of 1977. The investigation also identified the fact that there was not just one problem but multiple

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problems that had gone undetected for years by either Electric Boat's or the Navy's quality assurance activities. Consequently, we consider our detection of these problems to be evidence of the improvements made in our quality assurance system during the past two and one-half years, rather than evidence of failure of the system. Causes of the problem were determined to be:

- Personnel errors at Receiving Inspection.
- MIL Spec. QQ-S-741D does not require mechanical and test reports to be provided by the vendor.
- Chemical test reports provided by the vendor did not represent the material provided.
- Steel mill practice of providing industry M1020 for QQ-S-741D.
- Distributors providing single test reports for commingled heats.

2. Actions Taken to Identify and Correct Problem.

A summary of actions taken to correct specific problems and preclude recurrence is as follows:

- Definition of all part numbers having potentially nonconforming material.
- Physical removal out of stock of all potentially nonconforming material.
- Segregation, fencing and control of the physically removed material.
- Establishment of requirements for certification of future raw material procurements with traceability to mill certifications.
- Procurement of raw materials in accordance with the new requirements, including American Bureau of Shipping (ABS) certification at mills and distributors.
- Screening of those finished parts manufactured from the possibly discrepant material, which had not been installed at the time approval was granted, to prevent further installation of nonconforming QQ-S-741D materials.

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- Procurement Quality Assurance personnel were reinstructed in the requirements of Receiving Inspection, including the necessity for a careful review of software as well as the material itself. They were also retrained in the importance of preventing nonconforming products from being inadvertently allowed into the shipyard.

In addition to the above, Electric Boat has made an indepth review of our Receiving Inspection instructions to determine the adequacy of requirements for independent test to verify that material received meets specification requirements. All testing required by contract/specifications was being performed. Nevertheless, we decided to increase the amount of laboratory testing in both nuclear and nonnuclear receiving inspection so that material from each active vendor of bar stock, pipe, tubing, fasteners, and fittings is required to be tested at least once a year. The first three lots from a new vendor will be tested and the continued frequency of testing will not be less than one lot in twenty.

Finally, Electric Boat has also reviewed over 10,000 carbon steel raw material receiving reports for 879 purchase orders and 59,700 tons of material received for ten additional raw material specifications in order to satisfy itself that a condition similar to that found with QQ-S-741D did not exist in other carbon steel raw materials.

3. Results of Investigation

A conservative Electric Boat Engineering analysis of approximately 200 different sizes of possibly "non-conforming" steel involving 70,000 applications per hull on SSN688 Class and 120,000 applications per hull on Trident Class identified 486 candidates per hull on 688 and approximately 840 candidates per hull on Trident to be investigated to determine if in fact that they were manufactured from "non-conforming" steel. It must be emphasized that none of this steel was used in sea connected systems. In a recent letter from NavSea we were advised that the Navy's SSN688 class design agent, Newport News Shipbuilding, had concluded that it was necessary to inspect 235 items and upon further analysis NavSea determined that only 103 items were all that required investigation.

It was determined that it was the practice in the Steel Industry up to 1977 to supply M1020 steel for ASTMA36/QQS-741D in the smaller sizes of bar stock, rods and shapes. In fact for some sizes this is still the practice since the industry considers M1020 to be equivalent to ASTMA36/QQS-741D. Since this practice identified the problem as industry wide the Navy was so informed.

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V. Electric Boat Quality System

1. Status of System

The Electric Boat Quality Assurance system meets the requirements of MIL-Q-9858-A, the specifiation that has been in effect since 1969. Electric Boat's Quality System has been reviewed by the Navy for compliance during preaward surveys in 1971, 1973, 1975 and 1978 and at no time has the Navy questioned the basic effectiveness or acceptability of our Quality program in meeting the requirements of MIL-Q-9858-A.

Even though found to be in compliance as late as 1978, Electric Boat has nevertheless initiated and adopted improvements identified as effective and economical. Extensive programs for training personnel, improving procedures, improving construction methods and equipment and improving management systems have been underway since late 1977. In order to demonstrate the depth and range of this effort we have attached hereto two documents presenting considerable detail on this matter. The first is a letter to the Supervisor of Shipbuilding dated May 23, 1980, providing an indepth review of Electric Boat's quality program demonstrating its compliance with MIL-Q-9858-A. The second is a presentation dated June 9, 1980 to the Navy Team which audited Electric Boat's Quality System to assess its compliance with MIL-Q-9858-A as part of the Pre-award Survey prior to the award of new contracts for the construction of Trident and 688 Class Submarines expected towards the end of July, 1980. As the presentation clearly shows, the Company has made on its own initiative and as part of its commitment to produce submarines which meet the required quality standards, substantial changes and improvements to its systems.

VI. Ship Delays

We note that you were informed that "the steel problem along with other concurrent problems in 1979 caused delays of from three to five months on the SSN's 697-699." The only major problem we were aware of in late 1979, which we do not consider for the most part a concurrent one, is that associated with the defective Government-furnished Main Propulsion Turbines. The components required significant work to make internal repairs and modifications to preclude serious malfunctions during operation.

VII. Conclusion

It is difficult in any summary to provide a clear understanding and appreciation of events that have taken place over a considerable period of time, which involve complex technical concepts and judgements and thousands of pages of correspondence, technical documentation and records. Nevertheless, we must advise you that your report as a whole taken as an assessment of this situation

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is not an accurate one. We therefore request that you delete that part of it which is not germane to the purpose of the audit.

If you do not see fit to delete it, we request that you refer to these comments in the audit and append this letter and its enclosures as part of the final audit report.

Very truly yours,

GENERAL DYNAMICS
Electric Boat Division

A. M. Barton
Division Comptroller

(950589)

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