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REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES

Information On The Coast Guard's Polar-Class Icebreaker Ship Construction Program And Operational Testing

Department of Transportation

This report updates a GAO staff study issued in June 1975 on the Coast Guard's procurement of two polar-class icebreakers, the Polar Star and the Polar Sea.

The first ship was delivered 1 year later than provided by the contract with the Lockheed Shipbuilding and Construction Company. It has experienced numerous problems during operations.

The second ship will be 9 months late if delivery is made as scheduled by the contractor. Numerous claims against the Government for contract price increases are still pending, making total costs uncertain.

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COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

B-133170

The Honorable James L. Oberstar
House of Representatives

Dear Mr. Oberstar:

Your letter of May 14, 1976, asked for updated information on the procurement of the two Coast Guard polar-class icebreaker ships--the Polar Star and the Polar Sea. We issued a staff study on this procurement program in June 1975 (PSAD-75-104).

The program is continuing to experience problems. The Polar Star was delivered 1 year later than provided by contract. The Polar Sea will be 9 months late if delivery is made as scheduled by the contractor. Numerous claims against the Government for contract price increases are still pending, making total program costs uncertain. Generally, contractor performance on the Polar Sea has improved over that on the Polar Star.

In December 1975 the Coast Guard conditionally accepted the Polar Star pending the satisfactory correction of a number of deficiencies primarily in workmanship and materials. Since that time, many deficiencies have been corrected, but the ship has experienced a number of new problems. The Polar Star went aground due to human error on its first time out. Subsequently, the ship had steering system problems resulting in controversy over warranty coverage. During operational testing under ice conditions in the Bering Straits in June 1976, the Polar Star experienced failures in two of its three propulsion shaft systems, necessitating return to Seattle for drydocking and repair.

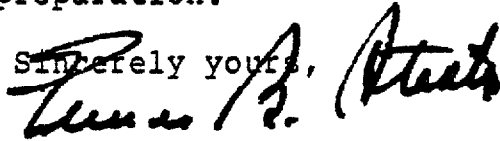
The exact nature and cause of the most recent failures has not yet been determined. Equally uncertain are the effects of this most recent problem on future deployment of

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the Polar Star or in the cost and schedule of the Polar Sea. As agreed with your office, we are forwarding the report to you at this time rather than wait until these matters are resolved. In addition, as agreed, we are sending a copy of the report to the Chairman, Subcommittee on Coast Guard and Navigation, Committee on Merchant Marine and Fisheries.

Appendix I summarizes the icebreaker program in greater detail. We did not get written comments from the Coast Guard on the summary; however, their oral comments were obtained and considered in its final preparation.

Sincerely yours,


Comptroller General
of the United States

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INFORMATION ON THE COAST GUARD'SPOLAR-CLASS ICEBREAKER SHIPCONSTRUCTION PROGRAM AND OPERATIONAL TESTINGINTRODUCTION

Our June 1975 staff study reported cost, schedule, and performance information and discussed the nature and status of claims by the Lockheed Shipbuilding and Construction Company against the Government resulting from construction of the two icebreaker ships--the Polar Star and the Polar Sea. We did limited review work at Lockheed in Seattle, Washington, to obtain information on the program covering the period after our staff study. We reviewed pertinent documents at Lockheed and held discussions with the Coast Guard Resident Inspector.

The Polar Star has experienced numerous problems since our last report. While many of these problems have been corrected, serious difficulties remain that must be resolved.

COST

As of May 17, 1976, there have been 200 modifications to the construction contract with Lockheed. The contract price for the first ship, the Polar Star, is \$53,023,898, and the contract price for the second ship, the Polar Sea, is \$50,910,456. Progress payments made to Lockheed under this contract as of May 17, 1976, are summarized below.

	<u>Contract price plus modifi- cations</u>	<u>Percent complete</u>	<u>Amount earned</u>	<u>Contract reserve</u>	<u>Amount paid</u>
Polar					
Star	\$53,023,898	a/100.00	\$53,023,898	\$1,060,478	\$51,963,420
Polar					
Sea	50,910,456	93.04	47,367,088	b/509,105	<u>46,857,983</u>
Total					<u>\$98,821,403</u>

a/Based on preliminary acceptance of the ship and subject to satisfactory adjustment of any deficiencies remaining at time of delivery.

b/Reserve amount reduced to relieve the contractor's cash flow problems.

Contractor's cash flow

In September 1975 Lockheed advised the Coast Guard that its financial forecast showed a serious cash situation that could affect its ability to complete the Polar Sea. Lockheed asked the Coast Guard to provide cash relief, citing alternatives under which it could be done.

In response to Lockheed's request, the Coast Guard modified the construction contract in December 1975 as follows:

- Reduction in reserves for the Polar Sea to allow payment to Lockheed of \$2,035,000.
- Postponement of a \$990,000-contract-price reduction (liquidated damages) for late delivery of the Polar Star to allow payment to Lockheed of \$970,200. (The Coast Guard retained \$19,800 as part of the contract reserve.)

As consideration for the Coast Guard's early payment of money to grant relief, the Polar Sea contract amount was reduced by \$195,000. Lockheed agreed to pay additional interest at 8-7/8 percent a year on the amount advanced if the Polar Sea delivery is later than the target date of September 26, 1976. Such interest would accrue from September 27, 1976, and run until delivery of the Polar Sea.

As a condition of being granted cash relief, Lockheed gave the Coast Guard a note for \$1,500,000, payable upon delivery of the Polar Sea. Repayment of this note will restore the contract reserves for liquidated damages and contingencies. The note was countersigned unconditionally by the contractor's parent company--the Lockheed Aircraft Corporation.

DELIVERY SCHEDULE

The contractually required delivery dates of the Polar Star and the Polar Sea are December 1974 and January 1976, respectively. Actual delivery of the Polar Star was made on December 28, 1975, or 369 days later than contractually required, resulting in the aforementioned liquidated damages of \$990,000 for late delivery.

Delivery of the Polar Sea is now scheduled by the contractor for September 26, 1976. If the contractor meets its present schedule and the contract requirement for delivery remains unchanged, the Polar Sea will be 249 days

late, which would result in assessment of liquidated damages for late delivery in the amount of \$747,000. Before the Polar Star propulsion casualty in June 1976 (see p. 5), we discussed the Polar Sea's progress with the Coast Guard Resident Inspector at Lockheed. He believes that the contractor's September 26 estimate for delivery is optimistic and that November 1, 1976, is a more realistic delivery date. At this time, however, the impact of the Polar Star propulsion system casualties on the Polar Sea work cannot be measured.

POLAR STAR PERFORMANCE

Preliminary acceptance of the Polar Star was made on December 28, 1975. Acceptance was made pending satisfactory correction by the contractor of numerous specified deficiencies. According to the Resident Inspector, the main single deficiency at the time of acceptance was the failure of interior and exterior paint. The nature of deficiencies in the Polar Star at delivery and the status of them as of June 4, 1976, are summarized in the following table.

<u>Nature</u>	<u>Number of deficiencies</u>	<u>Status</u>	
		<u>Number corrected</u>	<u>Number open</u>
Workmanship, material, and/or design	79	51	28
Contractor-furnished software	18	11	7
Contractor-furnished outfitting material	36	35	1
Government-furnished material (received by the contractor but not on board at delivery)	<u>34</u>	<u>34</u>	<u>0</u>
Total	<u>167</u>	<u>131</u>	<u>36</u>

In addition, subsequent to preliminary acceptance of the Polar Star, the Coast Guard advised the contractor of 149 items the Coast Guard considered to be covered by the warranty clause of the contract, thereby requiring correction by Lockheed.

As of June 4, 1976, 140 of the items had been corrected with the remaining 9 yet to be resolved.

The Coast Guard Resident Inspector and the contracting officer both consider the deficiency and warranty items which have not yet been completed to be such that they do not adversely effect the operation of the Polar Star. They said the items corrected had been done to the full satisfaction of the Coast Guard.

Grounding of Polar Star

The Polar Star grounded on January 19, 1976, its first day of operation after the contractor delivered the ship. Damage was minimal. The Commander, 13th Coast Guard District, ordered an investigation that was conducted on January 22, 1976.

In his report, the investigating officer concluded that the primary cause of grounding was an error in ship personnel judgment. The District Commander concurred in this conclusion and closed the incident administratively without punitive action.

We reviewed the Coast Guard's investigation report, including related ship's records and the testimony of ship personnel. Our review did not disclose any information which was not in concurrence with the investigating officer's findings.

Steering failure on Polar Star

During local operations on February 2, 1976, the Polar Star experienced steering problems and returned to Seattle. Before arriving back in port, the ship's crew determined that the steering problems were caused by failure of one of two steering pumps. The failed pump was isolated from the system, and the remaining pump was used for steering.

Disagreement developed between Lockheed and the Coast Guard over whether the steering failure was covered by the warranty, and the Coast Guard elected to repair the steering itself. The Contracting Officer advised Lockheed of Coast Guard intentions to repair the steering and that an invoice for the cost of repair would be sent to Lockheed if the failure was determined to be covered by the warranty. Coast Guard costs to repair the steering, including replacement of the damaged pump, were estimated at 254 man-hours of Coast

Guard time and \$14,819 for vendor's charges. On June 7, 1976, the Coast Guard submitted this information to Lockheed and requested that a contract price reduction be negotiated.

The damaged pump was returned to the factory for inspection with a condition that the Coast Guard be advised of the determined cause of failure. Lockheed advised the Coast Guard that factory inspection showed damage resulted from a manufacturing defect. Although the factory inspection results appear to have resolved the question of warranty coverage for the February 2 steering problems, there is a question concerning future warranty coverage. Lockheed advised the Coast Guard that the warranty may be in jeopardy because of Coast Guard repair work on the system. This matter is pending resolution between the contractor and its vendor. Under the contract, steering system components are covered by warranty for 1 year after delivery of the ship.

Since the steering pump failure and repair, the Polar Star also experienced steering problems related to system design. Modifications were made to the system, and in May 1976 the problems with the Polar Star were reported to be corrected.

Deployment of Polar Star

Polar Star departed Seattle on May 24, 1976, for limited ice trials in waters around Alaska. Objectives of the trials were to

- test the engineering plant under icebreaking conditions,
- expose the crew to ice operations,
- assess the Polar Star's ice-operating capabilities, and
- collect ice resistance data.

After encountering ice, initial reports from the ship indicated performance was satisfactory. On June 6, 1976, however, problems developed in the starboard propulsion shaft system. Trials were canceled and the ship began its return to Seattle. On June 8, the portside shaft system experienced problems similar to those of the starboard system. The ship arrived in Seattle on June 25 using its

remaining (centerline) shaft system and experienced no problems with that system during the return trip.

After its return to Seattle, divers inspected the propellers and visible portions of the shafts and, on the basis of their observations, tentatively concluded that the problems which resulted in the system failures involved the port and starboard controllable pitch propellers. The Polar Star was drydocked on July 13 at Lockheed's Seattle yard. As of July 21, the starboard propeller had been partially disassembled and some internal components had been found to be bent or broken. A Coast Guard official told us that it was difficult to estimate the length of time needed to analyze the affected components and determine the exact cause of this problem.

In the commanding officer's reports on the propulsion casualty, he indicated strong satisfaction with the operational performance of the ship.

Before the propulsion system failures, the ship was due to return to Seattle on July 7, 1976, where it would be available for correction of remaining delivery deficiencies and warranty items. During this time, the Polar Star was to be prepared for operation Deep Freeze 77, scheduled to begin in November 1976. Deep Freeze 77 is to be an operational mission; however, the Coast Guard expects to make additional ice trials.

The impact of the propulsion system casualty on the Polar Star's deployment for Deep Freeze 77 is unknown at this time. Equally uncertain is what impact, if any, this incident will have on the cost and schedule of the Polar Sea.

CONTRACTOR PERFORMANCE ON POLAR SEA

In our June 1975 staff study we reported that welding on the Polar Sea had improved over that of the Polar Star. The Resident Inspector told us that the noted improvement continued until major structural welding was essentially completed in October 1975.

The Resident Inspector's monthly progress reports covering April 1975 through April 1976 indicate that progress on the Polar Sea has been generally satisfactory. While some problems were experienced during that period, the Resident Inspector does not consider them to have substantially affected the ship's future performance. Modifications

made to the Polar Star have been made to the Polar Sea where appropriate.

STATUS OF CONTRACT CLAIMS
AGAINST THE GOVERNMENT

In our June 1975 staff study, we reported that Lockheed submitted seven claims to the Coast Guard for increases in the contract price and that two of these had been settled. A December 30, 1974, claim for equitable adjustment alleging congested machinery spaces, which was not included in our last staff study, was denied by the Coast Guard in January 1975. As of June 4, 1976, Lockheed had not appealed the claim.

As of June 16, 1976, the remaining five claims or appeals were pending before the Contract Appeals Board of the Department of Transportation. They involve (1) an appeal of the contracting officer's established price for the Polar Sea, (2) radiographic inspection requirements, (3) alleged difficulties in welding certain steel, (4) equipment contamination and damage, and (5) additional costs resulting from amendments to the Longshoreman's and Harbor Workers' Compensation Act. These claims are described fully in chapter 5 of our June 1975 staff study, a copy of which is included as appendix II.

A Coast Guard official told us the Polar Sea price claim and the Longshoreman's and Harbor Workers' Compensation Act claim have been heard and the Board's decisions are pending. The other three claims will not be heard until the Board decides on the Polar Sea price claim. The five unresolved claims represent a potential price increase in excess of \$20 million.

NATURE AND STATUS OF CONTRACTOR CLAIMS UNDER
SELF-INSURANCE PROVISION OF THE CONTRACT

In 1970 the Coast Guard agreed to our recommendation that it adopt a policy of self-insurance on contracts for construction of vessels. Insurance under vessel construction contracts is of the type known as builders' risk and covers the hazards peculiar to ship construction.

Under self-insurance provisions of the polar-class icebreaker contract, the contractor is to bear the first \$1,000 of loss of damage from an incident which would otherwise have been assumed by the Government. For damage

above \$1,000, the Coast Guard's position is that it will assume liability for damage due to fortuitous (chance) events but not damage due to defective design or improper workmanship.

As of June 1, 1976, Lockheed had submitted 31 claims to the Coast Guard for settlement under the self-insurance provisions of the contract. Eleven of the claims have been settled, resulting in an increase of \$49,000 to the contract price.

Twenty claims, representing a potential price increase of about \$900,000, were pending resolution by the Coast Guard contracting officer as of June 1, 1976. Of the 20 claims, the 2 discussed below represent a major portion of the total dollars involved.

Damage to Polar Star port propulsion shaft

In August 1975 a major casualty to the port propulsion shaft (shaft seizure) occurred. Inspection revealed extensive damage to the shaft. Under the self-insurance provisions of the contract, Lockheed submitted a claim of \$662,515, including a profit of \$58,113, for repair to the shaft.

The Coast Guard technical review of the incident concluded that this incident was caused by overheating of bearings resulting from defective design. On the basis of the review, the Coast Guard's legal advisor recommended that the Lockheed claim be denied. As of June 1, 1976, the Coast Guard contracting officer had not made a decision on the claim.

Damage to Polar Star starboard reduction gear

In December 1975 Lockheed submitted three claims, totaling \$88,625, under the self-insurance provisions of the contract, relating to starboard reduction gear damage. The Coast Guard is reviewing the three claims together because they are related by a series of chronological events.

Claim 1--bearings repair, \$13,098

On November 1, 1975, Lockheed repaired a leak in the starboard reduction gear lube oil cooler. The repair was made without removing it from the ship, although the Coast

Guard had recommended removal. Later it was discovered that three bearings in the starboard reduction gear had to be replaced due to damage caused by metal particles originating from the lube oil cooler repair.

Claim 2--gear teeth damage, \$54,653

Following repair of the bearings, the starboard reduction gear was flushed and readied for preliminary acceptance trials. However, on December 10, metal particles were found in the lubricating oil. An investigation revealed that a dowel pin had been inadvertently left in the reduction gear, causing gear teeth damage. The teeth were repaired by December 23.

Claim 3--bronze particles in bearings, \$20,874

During the period the gear teeth were being repaired, an additional inspection revealed particles of brass-bronze and other materials in the bearing. The particles were a result of insufficient cleanup of the lube oil cooler system during replacement of the three bearings.

Coast Guard investigation of the claims

The Coast Guard Resident Inspector concluded that damage leading to claims 1 and 3 was entirely avoidable. He concluded that claim 2 was an inadvertent accident. On the basis of these conclusions, the Coast Guard legal advisor recommended that claims 1 and 3 be denied and that claim 2 be paid. The contracting officer had not made a decision on any of the three as of June 1, 1976.

CHAPTER 5 (note a)CONTRACTOR CLAIMS AGAINST THE GOVERNMENT

Lockheed, as of December 1974, had either submitted or given notice of intent to submit seven significant claims to the Coast Guard for increases in the contract price. Two claims had been settled. The five unresolved claims represent a potential price increase in excess of \$20 million. In addition, the claims on Polar Star call for contract extensions totaling 106 days. We believe, however, the number of additional days requested will go significantly higher.

POLAR SEA PRICE

In February 1974, Lockheed appealed the unilateral price, including adjustments, of \$50.76 million set by the Coast Guard in January 1974. Prior to that time a ceiling price of \$53.75 million had been agreed to. Lockheed later claimed that the unilateral price was not reasonable and that the actual cost of the second icebreaker will exceed \$61 million. Lockheed asked the Appeal Board to determine a reasonable price, to include profit, of not less than \$66 million. Hearings have been scheduled for May through July 1975.

RADIOGRAPHIC INSPECTION
REQUIREMENTS

In March 1974, the Coast Guard was notified that Lockheed considered a Coast Guard ruling on certain radiographic test requirements to be in excess of contractual obligations. Lockheed subsequently advised the Coast Guard that additional costs of \$990,000 and delays of 44 days accrued through June 1974 from following the Coast Guard ruling. The contractor estimated that the additional cost on Polar Star will exceed \$1,120,000 and that the additional cost of Polar Sea will at least equal that of Polar Star.

The claim involves the extent of radiographic tests and repair work required after an initial radiograph shows

a/This is ch. 5 of the GAO Staff Study on Polar Class Icebreaker Ships, dated June 1975 (PSAD-75-104).

a weld defect. Lockheed's interpretation of the contract specifications would require substantially fewer radiographs and repair work than required under the Coast Guard's ruling.

The Appeal Board has permitted Lockheed to include this claim in the appeal of the steel claim. (See p. 12.)

MAGNETIC PARTICLE INSPECTION
REQUIREMENT

In July 1974, the Coast Guard was notified that Lockheed considered its ruling on certain magnetic particle inspection requirements to be in excess of contractual obligations. Lockheed agreed to follow the ruling but advised the Coast Guard that a claim for increased costs and increased performance time will be submitted when such facts are determined.

The claim involves the extent of magnetic particle inspections required on weldments made with Lockheed weld procedure 2A3-2-05. This procedure was approved for production in July 1973 and discontinued by Lockheed in January 1974. The contractor stated that contract modification 77 provides for a reduction from full to spot testing after a history of good weld production is established. Lockheed maintains that a good history was established and that inspections should be on a spot test basis.

The Coast Guard acknowledged that at the time the contract modification was issued, a good weld performance record was established with weld processes in effect at that time. It noted, however, that weld procedure 2A3-2-05 was not approved for production until after the issuance of modifi-[sic] 77 and that a number of cracks had been found in weldments made with the procedure. The agency concluded that the procedure could not have been included in the good production record upon which the contract modification was based. The Coast Guard, therefore, ruled that except on two relatively inaccessible compartments, weldments are to be subjected to full testing.

This claim was settled in the Coast Guard's favor under contract modification 165, effective February 14, 1975, under which the price of the first icebreaker was slightly reduced in recognition of the two compartments that were not required to be inspected.

STEEL

In February 1973, Lockheed filed a claim with the Coast Guard for a price increase due to alleged difficulties in welding certain specified CGA537M steel. A detailed statement in support of the claim called for a price increase of about \$2.1 million and a contract extension of 62 days.

Lockheed asserted that the steel is a product whose chemistry was devised by the Government and which had not been industrially produced or tested prior to award of the contract. The steel was depicted by Lockheed as a "novel" material for which welding procedures had to be devised. Lockheed stated that its experience with the steel, together with stringent Coast Guard test requirements, caused use of a welding procedure less efficient than contemplated in the original bid price.

In November 1973, the Coast Guard denied Lockheed's claim. The basic position of the Coast Guard is that the steel in question is not unique but is from a family of commercially available, low-carbon, heat-treated steels, and that such steels have been used for some time in ship and off-shore oil-rig tower construction. The Coast Guard maintains that Lockheed did not present any information supporting a finding that contract specifications were defective. The Coast Guard noted Lockheed's contractual obligation to develop welding procedures for the steel, and said that the Government cannot accept responsibility for Lockheed's alleged failure to recognize in its bid the factors essential to produce acceptable and reliable welds.

In December 1973, Lockheed appealed the decision. Hearings are scheduled in September 1975.

EQUIPMENT CONTAMINATION
AND DAMAGE

On May 8, 1974, Lockheed submitted to the Coast Guard an accident and loss claim report on the sandblasting incident discussed on page 25 [see GAO note, p. 14] of this report. The claim involves the cost to repair equipment contaminated from sandblasting operations. Agency officials informed us that the claim originally included the cost of removing rust from machinery surfaces; that part of the claim was dropped. The amount of the claim, however, had not been determined as of April 1975.

Lockheed maintains that the Government self-insurance provisions of the contract provide for reimbursement of the repair costs. Lockheed maintains that the Government is liable for "all risks" while the ships are under construction and being outfitted.

However, contract specifications require that the contractor take special measures to minimize damage incident to storage, installation, and construction. Further, the contract specifies that all damages of the ship, its parts, fittings, and outfit be corrected at the contractor's expense.

As of May 1975, the Coast Guard had not ruled on Lockheed's claim since the contractor, according to agency officials, had not submitted supporting cost data.

LONGSHOREMEN'S AND HARBOR WORKERS' COMPENSATION ACT

During February 1973, Lockheed submitted a claim for a \$386,000 price increase because of additional costs resulting from amendments to the Longshoremen's and Harbor Workers' Compensation Act. The amendments increased the contractor's premium costs for statutory workman's compensation.

The Coast Guard denied Lockheed's claim. The agency maintained that the specific clauses cited by Lockheed did not provide a basis for recovering increased workman's compensation premiums.

Lockheed appealed the agency's decision. A hearing was held in February 1974, and the decision is still pending.

SOCIAL SECURITY TAX

During February 1973, the contractor submitted a claim for a \$134,000 price increase because of additional contractor costs resulting from the Social Security Amendments of 1972. The amendments increased social security taxes payable by an employer for wages paid during 1973 and in subsequent years.

The Coast Guard and Lockheed reached a final settlement of \$111,000 and a contract modification was issued in September 1974 to increase the contract by that amount.

GAO note: Page number refers to a page in the June 1975 GAO staff study which is not included in this report.