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

REPORT
NO. 92-101

June 12, 1992

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (FINANCIAL MANAGEMENT)
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT)

SUBJECT: Quick-Reaction Report on Autoclave Equipment Used in the Repair of Advanced Composite Materials at the Naval Air Station, Lemoore, California (Project No. 1LB-0050.03)

Introduction

We are issuing this quick-reaction report as part of our Audit of the Repair of Weapon Systems Containing Advanced Composite Materials (Project No. 1LB-0050). The objective of this part of the audit was to evaluate the need for and use of the autoclave equipment that is currently at Naval Air Station, Lemoore, California, to repair weapon systems containing composite materials.

An autoclave at Lemoore, which was procured for repairing components constructed of advanced composite materials, was not being effectively used. This condition existed because the Navy did not have the ancillary equipment, technical manual revisions, tooling, and personnel required to make the autoclave fully operational. Additionally, the Navy did not have the work load that it expected when it justified procurement of the equipment. The Navy expects its future work load to decline further.

The Navy's autoclave should be transferred to the Corpus Christi Army Depot to enable the Army to repair parts made of advanced composite materials that cannot be repaired on its existing autoclave. The larger dimensions of the Navy's autoclave and its higher operating temperatures will increase the number of parts that the Army can repair. This additional repair capability would save the Army $3.5 million in parts replacement costs over the 6-year Future Years Defense Program ($582,000 annually). Additionally, the Army may be able to save $200,000 of expenditures that the Army plans to spend for refurbishment of its existing autoclave. The Army and the Navy both concurred with the recommendation to transfer the Navy's autoclave from Lemoore to Corpus Christi. The Army stated that it will only proceed with refurbishment of the autoclave that is currently at Corpus Christi if the need can be justified by valid economic and workload analyses.

Scope of Audit

We reviewed records covering the period from January 1985 through March 1992 documenting the justification, procurement, and use of an autoclave for the Navy's intermediate repair facility at the Naval Air Station, Lemoore. We also reviewed records and contacted Army, Navy, and Air Force depot level personnel about the requirements for autoclave equipment at the depots. This portion of the audit was made from December 1991 through March 1992 in accordance with auditing standards issued by the Comptroller General of the United States for economy and efficiency audits, as implemented by the Inspector General, DoD. Activities visited or contacted during the audit are listed in Enclosure 4.

Background

An autoclave is a pressurized oven used to heat patching materials during repair of components made from advanced composite materials. Autoclave equipment is normally used for depot level repairs, where engineering support and additional equipment and tooling exists to support its operation.

An autoclave (15 feet long by 10 feet in diameter) was installed at Naval Air Station, Lemoore, in October 1990. The Naval Air Station, Lemoore, is an intermediate repair facility. The cost of the autoclave was $443,275.

Discussion

The Naval Air Station, Lemoore's justification for procurement of an autoclave at an intermediate repair facility, stated that the equipment would be used in the repair of large surface damages to F/A-18 composite components. These items encompass 40 percent of the surface area of the F/A-18 aircraft. The justification for the autoclave also stated that 80 percent of the damaged F/A-18 components at Lemoore were beyond the capability of the maintenance facility due to equipment limitations and repair procedures. Procurement and use of the autoclave would result in productivity improvements, such as reducing repair turn around time, reducing the possibility of damage due to shipping and handling of extremely large and bulky items to the depots, reducing labor costs, and increasing fleet readiness.

The actual number of composite parts that require repair with the autoclave have been declining. In 1985, when personnel at the Naval Air Station, Lemoore, wrote the justification for the autoclave, they indicated that 34 components would be

submitted to the depot during 1985 because they would be unable to repair them. In 1991, the Lemoore facility received only 11 components that required repair using an autoclave.

The autoclave at Lemoore was not being effectively used. Maintenance personnel at Lemoore stated that only limited usage has been made of the autoclave because other methods for repairing damaged parts, including vacuum bags and heat blankets, have improved and thereby minimized the need for an autoclave. Items beyond this capability were sent to the depot for repair.

The Naval Air Station, Lemoore, was incapable of operating the autoclave as it would be operated in the depot. The Naval Air Station did not have the engineering support or inspection equipment to test the integrity of major repairs. In addition, technical data were not available to authorize and guide large scale repairs at the intermediate level. The Navy estimated it will need to spend $491,000 for an inspection system, revisions to technical manuals, and special tooling to make the system fully operational. Additionally, $170,000 of annual operating costs will be required for an on-site engineer, for training of operators, and to purchase supplies. At the time of the audit, the Navy had no plan to fund these additional logistic support items.

Autoclave Requirement's Study. The low potential work load and the requirement to procure the support necessary to make the system fully operational was brought to the Navy's attention in August 1986.

At the request of the Commander, Naval Air Force, U.S. Pacific Fleet, the Naval Air Systems Command contracted for a study with National Technologies Associates, Inc., to assess the feasibility of installing autoclaves at the intermediate level of maintenance. The contractor's study, "Autoclave Sitting At Aircraft Intermediate Maintenance Department Final Report," August 1986, indicated that the aircraft intermediate maintenance department's existing vacuum bagging and heat blanket equipment repair technique satisfied the repair demands and that the repair cycle pipeline was adequate to support the system's repair requirements.

The study also indicated that installation of an autoclave at an intermediate maintenance level would not allow additional repairs to be accomplished without incurring significant additional costs; including costs for revisions to the Structural Repair Manual, expanded training, hiring of an onsite materials engineer, updating support equipment, and expanding the amount of supplies on hand. The study showed that although an autoclave would increase the quality of repair, there was no evidence that an autoclave would enable an aircraft intermediate maintenance

facility to make any additional repairs beyond those authorized. Specifically, the study's cost analysis showed that the cost of placing an autoclave at any Navy aircraft intermediate maintenance facility could not be recovered without a significant increase in the number of autoclave repairs needed beyond those that were being experienced.

At the time the study was conducted, the contractor noted that of the 67 composite components that were inducted at the F/A-18's contractor locations for repair, only 8 components were repaired using an autoclave. The remaining 59 items were repaired using vacuum bagging and heat blanket equipment or were condemned and thrown away. The study also indicated that as the fleet units completed their transition and became more familiar with the equipment, the Navy learning curve on handling composite repairs would drive the number of autoclave repairs down.

Although the study concluded that autoclave processing of advanced composite materials was a critical function suitable for depot maintenance only, the contractor recommended that the Navy install an autoclave at Naval Air Station, Lemoore, as a research and development effort to determine the usefulness of autoclaves at other aircraft intermediate maintenance facilities.

The study recommended that the Navy revise the composite materials repair criteria and develop a facilities requirements document and site activation plan that would completely identify all the technical requirements and budgetary impacts of installing and supporting an autoclave. The contractor recommended that the Navy perform a detailed logistics element impact analysis to completely define the resource requirements.

Productivity Investment Fund. The autoclave at Naval Air Station, Lemoore, was purchased in FY 1988 with funds from the Productivity Investment Fund. DoD Instruction 5010.36 states that Productivity Investment Fund projects are competitively selected and are subject to an annual reporting and payback requirement. The project must return all investment costs within 4 years of the operational date of the item purchased. An annual report is required on all Productivity Investment Fund projects after the project has become operational and until it has reached the payback.

Although the autoclave has had little usage since it was installed in October 1990, Naval Air Station, Lemoore, reported an annual cost avoidance of $120,600, from October 19, 1990, to September 30, 1991, in its Productivity Investment Fund Report for the autoclave. However, the cost avoidance was based on modifications of radomes performed before Operation Desert Storm.

Modifications are normally performed at the depot and the Navy does not expect modifications to be a recurring work load at the intermediate locations.

Naval Air Station personnel recognized that the expenses associated with attempts to make the autoclave fully operational at an intermediate maintenance level cannot be justified. In a memorandum issued in October 1991 to the Naval Aviation Depot, North Island, California, personnel at Lemoore stated that additional outlays needed to make the autoclave fully operational may not be justified because of additional risk and marginal returns at the intermediate level of maintenance. Lemoore personnel proposed that control of the autoclave be turned over to Naval Aviation Depot, North Island, to enhance turn around times on components returned to the depot and "to end the wasteful practice of parallel development efforts."

Personnel at the Naval Aviation Depot, North Island, stated that because repairs on components constructed of advanced composite materials were lower than expected, they were not fully using their existing autoclaves.

Need for Autoclave Equipment at Corpus Christi Army Depot. Corpus Christi Army Depot personnel have informed us that they are interested in the autoclave at Lemoore. Depot personnel indicated that they planned to refurbish their autoclave in May 1992. The autoclave, which has been operational for 12 years, can no longer meet operational needs. Depot personnel also indicated that their autoclave has outdated technology and does not operate with an automated process controller. In addition, the autoclave is not capable of reaching the temperature and pressure requirements established for curing advanced composite materials. Repairs of components made with advanced composite materials generally require a 350 degree cure temperature and rigid process control. Presently, the autoclave at Corpus Christi can operate at a maximum of 250 degrees.

Corpus Christi Army Depot personnel stated that their depot needs modernized autoclave equipment because of increased advanced composite repair work load on the UH-60A Blackhawk and AH-64 Apache helicopters. Personnel at Corpus Christi stated that the depot will not be able to perform some of the work load without modernizing its current autoclave.

Army documents showed that the autoclave at Corpus Christi Army Depot will have to be completely reconfigured to function effectively. This will require modification to several major systems, such as the compressor, pressure lines, control systems, heater boxes, pressure seals, and the power unit. The total estimated cost for refurbishment of the autoclave is $200,000.

Corpus Christi Army Depot Maintenance personnel stated that they currently have existing composite workload which can not be performed because of the lack of an appropriate autoclave. The depot personnel stated that if they had the Navy's autoclave, they could repair damaged components instead of procuring new ones. For example, new composite cargo loading ramps on the CH-47D helicopter are currently being procured from the manufacturer because Corpus Christi Army Depot does not have an autoclave that can be used to repair the ramps. These components will not fit into the existing 6-foot diameter autoclave at Corpus Christi Army Depot and the autoclave will not operate at the proper temperature for repairing the ramps.

The Army is currently buying new ramps to fill field unit requirements because the depot does not have the appropriate autoclave to repair them. The Army pays $83,247 more for each new ramp than to repair it. During the last 3 years, the Army Aviation Systems Command ordered an average of seven new ramps annually. We estimated that the Army could save at least $582,000 annually on these ramps if the autoclave from Naval Air Station, Lemoore, was transferred.

Corpus Christi Army Depot personnel indicated that the CH-47D helicopter ramp is only one example of multiple lost opportunities. Corpus Christi Army Depot has the required work force, production facility, and logistic support in place to make the autoclave at Naval Air Station, Lemoore, fully operational. Preliminary discussions with engineering personnel indicated that the autoclave at Lemoore would be a sufficient replacement for the autoclave at Corpus Christi. Estimated cost for disconnecting, shipping, installing, starting up, and testing the autoclave from Naval Air Station, Lemoore, to Corpus Christi Army Depot is $85,000. However, similar shipping and set up costs will be encountered by the Army if an overhaul of the existing autoclave is performed. The Army will be required to ship its autoclave from Corpus Christi, Texas, to Los Angeles, California, for the overhaul. We estimate that the Army could avoid the $200,000 cost of refurbishment by transferring the autoclave at Naval Air Station, Lemoore, to Corpus Christi Army Depot.

Conclusion

Naval Air Station, Lemoore's autoclave was not being effectively used; therefore, the Navy cannot achieve the payback it originally projected. Additional expenditures for tooling, equipment, technical manuals, and engineering support to make the autoclave fully operational are not justified. Transfer of the autoclave to Corpus Christi Army Depot would eliminate the need for additional expenditures by the Navy and may eliminate the cost of upgrading the autoclave at Corpus Christi.

Recommendations, Management Comments, and Audit Response

1. We recommend that the Commander, Naval Air Force, U.S. Pacific Fleet, develop an orderly plan for transfer of the autoclave to Corpus Christi Army Depot.

Navy comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) concurred with the recommendation, subject to funding being provided by the Army for costs associated with the transfer. The complete text of the Navy's comments is in Enclosure 1.

Audit response. The Navy's comments are responsive. No further comments are required.

2. We recommend that the Commander, Corpus Christi Army Depot, discontinue plans to upgrade its existing autoclave pending transfer of the autoclave from Lemoore.

Army comments. The Assistant Secretary of the Army (Installations, Logistics and Environment) concurred with the recommendation and stated that the Army expects to obtain significant savings from this action. The Army also stated that if Corpus Christi Army Depot can justify, by validated economic and workload analysis, the modification of its existing autoclave, the Depot should be allowed to do so. The complete text of the Army's comments is in Enclosure 2.

Audit response. The Army's comments are responsive. We have no objections to the Army refurbishing its existing autoclave at the Corpus Christi Army Depot if a valid economic and workload analysis shows that it will still be economical to do so after receiving the Navy autoclave.

Request for Comments

DoD Directive 7650.3 requires that all audit recommendations and monetary benefits be resolved promptly. Therefore, we request that the Army provide additional comments by August 11, 1992. The comments should identify the specific savings the Army expects to achieve from use of the Navy's autoclave over the 6-year Future Years Defense Program. The comments should also clarify that the Army will fund the costs associated with the transfer of the Navy's autoclave and associated peripheral equipment. If you nonconcur with the estimated benefits or any part thereof, you must state the amount you nonconcur with and the basis for the nonconcurrence. Estimated benefits are summarized in Enclosure 3. Potential monetary benefits are subject to resolution in accordance with DoD Directive 7650.3 in the event of nonconcurrence or failure to comment.

The courtesies extended to the audit staff are appreciated. If you have any questions on this audit, please contact Mr. Dennis E. Payne at (703) 692-3414 (DSN 222-3430) or Mr. James L. Kornides at (703) 692-3420 (DSN 222-3430). Audit team members are listed in Enclosure 5. The distribution of this report is listed in Enclosure 6.

Edward R. Jones
Deputy Assistant Inspector General
for Auditing

Enclosures

cc:
Assistant Secretary of Defense (Production and Logistics)
Secretary of the Army
Secretary of the Navy

DEPARTMENT OF THE NAVY COMMENTS

THE ASSISTANT SECRETARY OF THE NAVY
(Research, Development and Acquisition)
WASHINGTON, D.C. 20350-1000

MAY 19 1992

MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT INSPECTOR GENERAL FOR AUDITING

Subj: DODIG DRAFT QUICK-REACTION REPORT ON AUTOCLAVE EQUIPMENT USED IN THE REPAIR OF ADVANCED COMPOSITE MATERIALS AT THE NAVAL AIR STATION, LEMOORE, CALIFORNIA

Encl: (1) Department of the Navy (DON) Comments

In response to your memorandum of 14 April 1992, we have reviewed the subject report. Detailed comments on the recommendations are forwarded as enclosure (1).

The Navy concurs with recommendations one and two.

Gerald A. Cann

Copy to:
NAVINSGEN
NAVCOMPT (NCB-53)

DEPARTMENT OF THE NAVY RESPONSE
TO
DODIG DRAFT QUICK-REACTION REPORT
ON
AUTOCLAVE EQUIPMENT USED IN THE REPAIR OF ADVANCED COMPOSITE MATERIALS AT THE NAVAL AIR STATION, LEMOORE, CALIFORNIA
(PROJECT NO. 1LB-0050.03)

Recommendation 1:

1. Recommend that the Commander, Naval Air Force, U.S. Pacific Fleet develop an orderly plan for transfer of the autoclave to Corpus Christi Army Depot.

DON Position:

1. Concur. Estimated completion date of transfer is 30 July 1992. However, funding must be provided by the Army for all costs associated with the transfer of the autoclave and associated peripheral equipment.

Recommendation 2:

2. Recommend that the Commander, Corpus Christi Army Depot discontinue plans to upgrade its existing autoclave pending transfer of the autoclave from Lemoore.

DON Position:

2. Concur.

DEPARTMENT OF THE ARMY COMMENTS

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR LOGISTICS
WASHINGTON, DC 20310-0500

23 APR 1992

DALO-SMM

MEMORANDUM THRU

Eric A. Orsini
Deputy Assistant Secretary of the Army

ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, LOGISTICS AND ENVIRONMENT)

FOR INSPECTOR GENERAL, ATTN: AUDITING, DEPARTMENT OF DEFENSE

SUBJECT: Response to DODIG Project No. 1LB-0050.03, "Draft Quick-Reaction of advanced Composite Materials at the Naval Air Station, Lemoore California", April 10, 1992--INFORMATION PAPER

1. Provided is response to DODIG Project No. 1LB-0050.03 (TAB A).

2. This information is being provided IAW AR 36-2.

FOR THE DEPUTY CHIEF OF STAFF FOR LOGISTICS:

Encl

JAMES W. BALL
Major General, GS
Director of Supply and Maintenance

WILLIAM P. NEAL
Deputy/Assistant Director for Maintenance Management Supply and Maintenance

Mr. Norm Nagle/71543

Recommendations--Draft Quick-Reaction Report on Autoclave Equipment Used in the Repair of Advanced Composite Materials at the Naval Air Station, Lemoore, California (Project No. 1LB-0050.03)

Recommendation 2. We recommend that the Commander, Corpus Christi Army Depot discontinue plans to upgrade its existing autoclave pending transfer of the autoclave from Lemoore.

Action Taken: Concur. This action can result in significant savings for the U.S. Army. If the U.S. Navy concurs with recommendation 1, this action can be completed by 31 October 1992. However, if Corpus Christi Army Depot can justify, by validated economic analysis and workload analysis, the modification of the existing autoclave, they should be allowed to do so.

SUMMARY OF POTENTIAL BENEFITS RESULTING FROM AUDIT

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
1.	Economy and Efficiency. Helps ensure implementation of Recommendation 2.	Included in Recommendation 2.
2.	Economy and Efficiency. The Army can avoid the cost of refurbishment of its existing autoclave and the cost of buying new aircraft components rather than repairing existing damaged components.	Funds Put to Better Use of $3.7 million consisting of one-time savings of $200,000 of FY 1992 Operations and Maintenance, Army Funds and at least $3.5 million of Operations and Maintenance, Army Funds over the 6-Year Future Years Defense Program ($582,000 annually).

ACTIVITIES VISITED OR CONTACTED

Office of the Secretary of Defense

Assistant Secretary of Defense (Production and Logistics), Washington, DC
Assistant Secretary of Defense (Force Management and Personnel), Washington, DC

Department of the Army

Secretary of the Army (Deputy Chief of Staff for Logistics) Washington, DC
Corpus Christi Army Depot, Corpus Christi, TX

Department of the Navy

Chief of Naval Operations, Washington, DC
Naval Air Systems Command, Washington, DC
Naval Air Station, Lemoore, CA
Naval Aviation Depot, North Island, San Diego, CA

Department of the Air Force

Sacramento Air Logistics Center, Sacramento, CA

AUDIT TEAM MEMBERS

Shelton R. Young, Director, Logistics Support Directorate
Dennis E. Payne, Program Director
James L. Kornides, Project Manager
Vickie Nguyen, Auditor

REPORT DISTRIBUTION

Office of the Secretary of Defense

Assistant Secretary of Defense (Production and Logistics)
Assistant Secretary of Defense (Force Management and Personnel)
Assistant Secretary of Defense (Public Affairs)
Comptroller of the Department of Defense

Department of the Army

Secretary of the Army
Assistant Secretary of the Army (Financial Management)
Deputy Chief of Staff for Logistics
Commander, Corpus Christi Army Depot
Army Audit Agency

Department of the Navy

Secretary of the Navy
Assistant Secretary of the Navy (Financial Management)
Chief of Naval Operations
Naval Air Systems Command
Naval Air Force, U.S. Pacific Fleet
Naval Air Station, Lemoore
Naval Aviation Depot, North Island
Auditor General, Naval Audit Service

Department of the Air Force

Air Force Audit Agency

Defense Agencies

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, Defense Logistics Studies Information Exchange
Inspector General, Defense Intelligence Agency
Inspector General, National Security Agency

Non-DoD Activities

Office of Management and Budget
U.S. General Accounting Office
  NSIAD Technical Information Center
  NSIAD Director for Logistics

REPORT DISTRIBUTION (cont'd)

Congressional Committees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
Ranking Minority Member, Senate Committee on Armed Services
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
Ranking Minority Member, House Committee on Appropriations
House Committee on Armed Services
House Committee on Military Installations and Facilities, Committee on Armed Services
House Committee on Government Operations
House Subcommittee on Legislation and National Security, Committee on Government Operations