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Report to the Secretary of Defense

June 1986

ARMY DEPOTS

Planned Distribution Centers Are Not Adequately Justified

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GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division
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June 6, 1986

The Honorable Caspar W. Weinberger
Secretary of Defense

Dear Mr. Secretary:

We have reviewed the Army's Area Oriented Depot (AOD) modernization program, which is expected to cost over $500 million. The program is to provide three new, highly mechanized distribution centers at Sharpe, New Cumberland, and Red River Army Depots located at Lathrop, California; New Cumberland, Pennsylvania; and Texarkana, Texas, respectively.

This program was justified by the U.S. Army Materiel Command (AMC) and the U.S. Army Depot Systems Command (DESCOM) primarily on the basis that these new centers would be the most cost effective approach to respond to projected 1990 peacetime work load increases resulting from ongoing Army force modernization initiatives. The Army estimated an annual work load increase of 68 percent, from 7.3 million receipts and shipments to 12.3 million receipts and shipments, between 1980 to 1990. Future mobilization work load was another consideration cited by Army officials to justify these projects. In addition, Army officials testified that the existing facilities and material handling equipment were old and needed replacement.

Construction of the distribution centers will be staggered and is anticipated to begin at Sharpe and New Cumberland in 1986 and at Red River in mid-1987. Each project is expected to take about 30 months to complete. Our review concentrated on the Sharpe and New Cumberland projects because they are the first and largest, respectively.

New Facilities May Not Be Needed

We found important weaknesses in the analyses, assumptions, and documentation used to justify these projects. These raise serious doubts about whether the current scope of the AOD modernization program is appropriate in terms of cost and need. Specifically, we found the following:

- The projected 1990 peacetime work load increases used in Sharpe's and New Cumberland's original economic analyses and two subsequent recomputations appear to be overstated because of questionable

assumptions and procedures used in the computation process. The projected work loads are key factors because they must materialize by fiscal year 1990 to justify the new construction. (See app. II.)

- Although wartime mobilization requirements for fiscal year 1990 were not developed to support the need for these distribution centers, the centers are being designed with mobilization capacities equal to three times their projected 1990 peacetime work loads. Current AOD capacity exceeds current mobilization requirements, which are based on a factor of 1.6 times current peacetime work load. (See app. III.)
- Claimed problems with the AODs' equipment had not been documented, and existing material handling systems and facilities did not appear to have degraded AOD performance. Problems appeared to be limited to material handling systems which could be replaced. Further, substantial funds have been spent in the past several years for new equipment at Sharpe and New Cumberland. Some of this equipment would still be used if the distribution centers become operational; however, much of it would not. (See app. IV.)
- Contrary to Army regulations, the economic analyses done to justify the AOD program (1) did not identify viable, less costly alternatives to the new centers, other than maintaining the status quo, (2) excluded major costs directly attributable to the Sharpe and New Cumberland projects, i.e., design and software development costs, which would affect the economic viability and payback period for the new facilities, and (3) did not reflect the sensitivity of either alternative to changes in estimated costs, although relatively minor cost increases could reverse the analyses' conclusions regarding the preferred alternative. (See app. V.)
- Based on our analyses of the work loads at the two AODs, the highly mechanized operations being designed into the new centers might be unnecessary. (See app. VI.)
- Existing AOD work load distribution imbalances which create operational inefficiencies, such as significantly higher processing costs at Sharpe, would likely be perpetuated under the modernization program. (See app. VII.)

Conclusions and Recommendations

We do not question the need to improve certain aspects of current AOD operations; however, our work suggests that viable and less costly alternatives to the current program exist and should be fully considered. Further, the decision supporting a program of this scope should be based on analyses using sound principles which can be documented. Therefore, we recommend that before significant construction begins at Sharpe, the Secretary of Defense ensure that

- auditable AOD peacetime work load projections are developed using statistically valid forecasting principles,
- the information necessary to identify the amount of excess capacity or capability needed to support emergencies and mobilization is developed,
- options for improving the efficiency and capability of existing facilities to satisfy any projected work load increases developed in the effort recommended above are examined and the cost effectiveness of these options is compared with the current estimated cost of constructing new distribution centers, and
- the AODs' current operations and work load distribution imbalances are analyzed to identify potential economies and efficiencies to be gained by further consolidation or realignment of the AOD system.

Agency Comments and Our Evaluation

DOD agreed with most of our key findings concerning the analyses, assumptions, and documentation originally used to justify the AOD modernization projects. For example, DOD stated that (1) the documentation to support the peacetime work load projections contained in the original economic analyses, as well as the two subsequent recomputations by the Army, were not complete and the analyses raised questions about the need for the AOD modernization program, (2) mobilization requirements had not been developed to support the size and capacity of the planned distribution centers, (3) current AOD equipment maintenance problems were ill defined, (4) only two alternatives had been considered in the economic analyses performed to justify these projects, (5) the savings-to-investment ratios for the modernization projects were marginal, and (6) investment costs of $56.3 million, which were directly attributable to these projects, had been omitted from the economic analyses done to justify them.

Since DOD agreed that the different forecasting methodologies used in the original economic analyses and the two used in the Army's response to GAO's tentative findings raised questions about the AODs' work load projections, DOD decided to review the peacetime work load projections as suggested in our first recommendation. According to DOD, only auditable supporting documentation was used in this effort to substantiate the Army's requirement. DOD's review was made from November 18 to 22, 1985, and generated a fourth methodology and a fourth estimate of the AODs' 1990 work load, as well as selective modifications to the original economic analyses.

DOD concluded that its effort verified the need for and cost effectiveness of the AOD projects. Therefore, DOD disagreed with our recommendation

to delay the program to examine options for improving the efficiency and capability of existing facilities. In fact, the Army awarded the contract for the Sharpe Depot project before DOD provided official comments on our draft report. Funds programmed for Sharpe total $117 million, a 29-percent increase over the projected cost of $90.4 million developed about 1 year earlier. This increase was the result of cost underestimation, not an increase in the scope of the project, and required AMC to reprogram about $26 million from other activities.

Our evaluation of the fourth projection of the AODs' peacetime work load presented by DOD raised a number of the same questions regarding the adequacy of the analyses, assumptions, and documentation that we identified with the three previous computations. Our concerns about the work load projections and the assumptions used by DOD and the Army are discussed in appendix II.

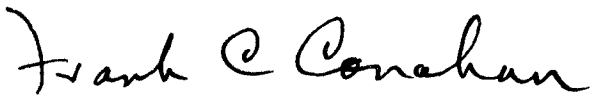
DOD also disagreed with our recommendation to analyze the AOD's current work load distribution, citing a recent Army study which recommended maintaining the three AOD system. As discussed in appendix VII, we do not believe the study cited supports DOD's position but actually supports the need for further refinement of the system. Since we had many of the same questions about DOD's work load computation analysis as with three previous analyses, we are retaining our recommendations.

The important points raised by DOD regarding each area discussed in this report are evaluated in each appendix. We have made changes to reflect DOD comments where appropriate.

As you know, 31 U.S.C. § 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Chairmen of the above Committees and of the House and Senate Committees on Armed Services and to the Director, Office of Management and Budget.

Sincerely yours,



Frank C. Conahan
Director

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Abbreviations

AMC	U.S. Army Materiel Command
AOD	Area Oriented Depot
AWARES	Automated Warehousing and Retrieval System
CCP	Containerization and Consolidation Point
CUCV	Commercial Utility Cargo Vehicle
DESCOM	U.S. Army Depot Systems Command
DLA	Defense Logistics Agency
DOD	Department of Defense
DODMDS	Department of Defense Materiel Distribution System
GAO	General Accounting Office
GSA	General Services Administration
HMMWV	High Mobility Multipurpose Wheeled Vehicle
MRC	materiel readiness command

Background

The Army's Area Oriented Depot (AOD) Modernization Program, expected to cost over $500 million, is a project to provide three very sophisticated, mechanized distribution centers at the Sharpe Depot, Lathrop, California; the Red River Depot, Texarkana, Texas; and the New Cumberland Depot, New Cumberland, Pennsylvania. Construction is planned to start at Sharpe and New Cumberland in 1986 and at Red River in 1987.

The basic function of the three AODs, which were established in 1976, is to receive, store, and ship secondary items (primarily repair parts and other support-type items) in response to Army unit requisitions for Army-managed items, such as repair parts for aircraft, missiles, and vehicles, plus some frequently used Defense Logistics Agency (DLA) and General Services Administration (GSA) items. Requisitions are filled either from inventories maintained at the AODs (referred to as mission stock) or shipments from other sources, such as vendors and other depots. Sharpe and New Cumberland also serve as consolidation points for the containerization of overseas shipments. The AODs are the custodian of mission stocks; however, they do not establish requisitioning objectives, order items to maintain inventories, or determine what items will pass through their consolidation points. These functions are performed by the Army's materiel readiness commands (MRCs).

According to Army Materiel Command (AMC) and Depot Systems Command (DESCOM) officials, the planned AOD distribution centers are the most cost effective method to respond to the current force modernization initiatives, which the Army states will increase the AOD peacetime work load 68 percent—from 7.3 million receipts and shipments in fiscal year 1980 to 12.3 million in fiscal year 1990. The Army is designing these centers to handle this entire work load on a single 8-hour shift with second and third shifts available for emergencies and mobilization. According to the Army, the major savings associated with the new distribution centers will be the cost avoidance of employing fewer people to process the forecasted 1990 work loads than would be required using the existing facilities.

According to project justifications (1) present facilities would have to operate on a three-shift basis to meet the projected peacetime work load, leaving little or no flexibility for responding to emergency or mobilization demands, and (2) most existing material handling equipment would have to be replaced whether or not new facilities are constructed. Total funding requirements for the modernization program, as of October 1984, are shown in table I.1.

Table I.1: Total Funding Requirements for Modernization Program, as of October 1984

Dollars in Millions

	Military construction	Army procurement	Total
Sharpe	$ 49.0	$ 41.4	$ 90.4
New Cumberland	93.8	79.1	172.9
Red River	87.7	52.7	140.4
Total	**$230.5**	**$173.2**	**$403.7**

In addition, the Army had programmed $84.4 million for transition, facility design, and systems software development costs.

AOD Inventory and Work Load Characteristics

The AODs' work load is measured in terms of the number of receipts, shipments, and transshipments processed during a fiscal year. Generally, receipts consist of items the MRCs ship to the depots to store as mission stock. Shipments consist of items issued directly from depot mission stocks to customers in the continental United States or issued to the Containerization and Consolidation Point (CCP). Transshipments are all items which pass through the CCP for consolidation before being sent overseas. New Cumberland and Sharpe have CCP sections; Red River does not; however, overseas shipments are made from that facility.

We compiled the following information on the inventory and work load characteristics for the Sharpe and New Cumberland AODs:

- At the end of fiscal year 1984, the largest AOD, New Cumberland, stocked a total of 182,409 lines,[1] including 105,546 Army-managed items and 53,375 DLA/GSA-managed items.
- At the end of fiscal year 1984, the smallest AOD, Sharpe, stocked 122,215 lines, including 90,835 Army items and 30,680 DLA/GSA items.
- Of the lines stocked at New Cumberland and Sharpe, about 96 percent weigh less than 45 pounds per individual item.
- Most of the lines stored have low demand. During fiscal year 1984, 81.9 percent of the lines stored at New Cumberland and Sharpe experienced nine or fewer demands; 41.7 percent of the total had no demands.
- A considerable part of the activity at each AOD was attributable to DLA/GSA-managed lines. These items accounted for about 44 percent and 21 percent of all 1984 shipments at New Cumberland and Sharpe, respectively, or about 40 percent for both AODs. DLA/GSA items, according to work load projections used in the economic analyses, were expected to

[1]Individual stock numbers.

remain stable at or near the fiscal year 1984 level for the foreseeable future.

- From 1980 to 1984, the number of Army-managed lines shipped from both AODs increased 3.3 percent—an average increase of less than 1 percent a year. As a percentage of total shipments, Army-managed lines dropped from 63 percent to 58 percent over this period.

Objectives, Scope, and Methodology

Our objectives were to evaluate the Army studies and other documentation addressing the justification for the AOD modernization program. Specifically, we sought to determine how work load projections, both peacetime and mobilization, had been used to justify this program and evaluate these analyses for soundness in program plans, cost analysis, and facility design concept.

Initially, our survey work focused on Sharpe's project because it would be the first one constructed and later included New Cumberland's because it was the largest in size and cost. We also obtained work load statistics and other background data for Red River for comparisons with the two other AODs. In addition to performing work at Sharpe and New Cumberland, we performed work at AMC, Alexandria, Virginia; DESCOM, Chambersburg, Pennsylvania; the U.S. Army Aviation Systems Command, St. Louis, Missouri; and the U.S. Army Tank-Automotive Command, Warren, Michigan.

Our work included interviews with officials at the above locations and an examination of records pertinent to our objectives. The Army's Logistics Control Activity at the Presidio of San Francisco, California, provided fiscal year 1984 worldwide shipment data for the Sharpe, New Cumberland, and Red River AODs.

We toured the Defense Logistics Agency's Automated Warehousing and Retrieval System at Richmond, Virginia, to become familiar with the sophisticated material handling and other features of a modern distribution center. We also interviewed officials at DLA Headquarters at Cameron Station, Alexandria, Virginia.

Our review was performed in accordance with generally accepted government auditing standards. Fieldwork on this assignment was performed from April 1984 through March 1985. On May 8, 1985, we gave the Commander, AMC, a statement of our tentative findings. We did additional work through August 1985 to evaluate new data contained in

AMC's response. Additional work was also done in January 1986 evaluating new data presented in DOD's official agency comments. A summary of AMC's and DOD's response and our evaluation is contained at the end of appendixes II through VII.

Questionable Peacetime Work Load Projections

The projected 1990 peacetime work load increases used in the economic analyses to justify the need for and size of the new distribution centers at the Sharpe and New Cumberland depots appeared to be overstated because of the questionable assumptions, procedures, and methodologies used to compute the forecasts. For example, we found the following:

- AMC could not document the validity of two key assumptions used to support the projected AOD work load increases, which are the primary justifications for the modernization program. These assumptions concern (1) the number of new lines expected to enter the Army's inventory as a result of force modernization and (2) the number of these new lines that would be stocked by each AOD.
- High demand lines managed by DLA were included in the historical receipt and shipment data used to project the anticipated work load associated with Army-managed items for New Cumberland. We believe this was improper since inclusion of DLA-managed lines significantly inflated the projected work load because Army-managed lines at New Cumberland, in general, experience a much lower demand than those managed by DLA.
- DESCOM used two different methodologies to forecast the work load increases for New Cumberland and Sharpe, each of which assumed that (1) contrary to past experience, the number of new lines entering the Army's inventory because of force modernization would not be offset by some current lines becoming inactive or less active and (2) the average activity for new lines would be the same as those currently in the inventory.

The projected work loads for the new facilities are key factors because the economic analyses for the two projects showed that the ratios of savings in operating costs to capital investment for the new distribution centers used to justify their construction were marginal and depended on the projected peacetime work load increases materializing by fiscal year 1990. For example, at least 90 percent of Sharpe's projected 1990 work load must be achieved in order to reach the break-even point, that is, for operating cost savings to equal the capital investment. Similarly, New Cumberland must realize at least 83 percent of its projected work load to be economically viable.

Force Modernization Impact on Army Inventory and AOD Operations Not Documented

The significant increase projected to occur in AOD activity from 1980 to 1990 was attributed by DESCOM and AMC officials to the number of new lines expected to enter the Army's total inventory as a result of force modernization. According to DESCOM, the primary rationale for the modernization program was based on two key assumptions: (1) about 172,000 new lines would enter the inventory to support approximately 860 new Army systems, with the AOD system stocking 125,000 of the new lines, and (2) each AOD would continue to stock the same percentage of Army lines in 1990 as it did in 1980. For example, New Cumberland's forecast was based on the assumption that this depot would stock 66,250 (or about 53 percent) of the 125,000 lines in 1990, which is the same percentage of Army items New Cumberland stocked in fiscal year 1980. However, neither AMC nor DESCOM could document either assumption.

Forecast Techniques Appear to Overstate Projections

The projected peacetime work loads used in the economic analyses to justify and determine the size of the distribution centers appeared to be overstated as a result of questionable forecast techniques used by DESCOM. While these projects are of standard design and were justified on the same basis (i.e., increased peacetime work load), different methods were used to project the work load for New Cumberland and Sharpe. These different methods produced different results. For example, New Cumberland's projected work load would have been reduced by about 27 percent if Sharpe's methodology had been used.

The following sections discuss how the fiscal year 1990 peacetime work loads were computed for the New Cumberland and Sharpe AODs and why we believe the methodologies were flawed.

New Cumberland Army Depot Forecast Methodology

To compute its 1990 design year work load, New Cumberland used fiscal year 1980 as the base year for calculating several averages and ratios. Computations applying these factors and several assumptions were used to develop the 1990 work load projections.

Projected Shipments

In computing design year shipments, New Cumberland's economic analysis assumed that the 127,000 lines that were active[1] in 1980 (55 percent of total stocked lines) would account for the same number of shipments in 1990 as they did in 1980. It was also assumed that new

[1]One or more demands in 1980.

lines entering the inventory due to force modernization would average the same number of shipments that active lines in 1980 averaged. That is, since the 127,000 active inventory lines in 1980 averaged 19.71 shipments, the 1990 projection assumed the 66,250 new lines from force modernization would also average 19.71 shipments annually. The New Cumberland projection for fiscal year 1990 also included 202,737 shipments for the Package Processing Point.[2] Thus, 1990 shipments were computed as shown in table II.1.

Table II.1: Computation of 1990 Shipments From New Cumberland

1980 actual shipments	2,502,826
Projected increase (66,250 X 19.71)	1,305,787
Package Processing Point work load	202,737
1990 projected shipments	**4,011,350**

We question the assumptions that all active lines in a base year will continue to be active 10 years later and that activity increases proportionally to the number of new lines received. Analysis of historical data at New Cumberland does not support these assumptions. For example, in fiscal year 1982, about 20,000 new lines entered the inventory at New Cumberland, yet total shipments in fiscal year 1983 were only 27,588 higher than in fiscal year 1982—not 394,200 that would be obtained by multiplying the average shipments (19.71) by the 20,000 new lines. Additionally, over 40 percent of the lines stored in fiscal years 1980-83 were not active, which suggests that new lines received are not totally additive because many inventory lines also become inactive. If the New Cumberland economic analysis had assumed that the percentage of inactive lines would remain constant through fiscal year 1990, as was assumed for other work load relationships, only about 36,400 more active lines would be added to the inventory by 1990—considerably less than the 66,250 additional lines the economic analysis used. Applying the 19.71 average to the 36,400 new lines reduces the projected 1990 shipment increase of 1.3 million by about 600,000 shipments, or 46 percent.

Based on the assumptions the Army used to compute the number of new lines entering New Cumberland's inventory, we believe the 19.71

[2]Subsequently changed to Unit Materiel Fielding Point. This section accumulates and forwards packages of initial spare parts to units receiving new systems. This projection was subsequently dropped by AMC and DOD in their recomputed projections in response to our tentative findings because this work load will not be processed in the new distribution center.

average used to project shipments was invalid because it would overstate shipment projections for Army lines. While projection computations assumed that the majority of new lines would be managed by the Army, the 19.71 average included the high activity generated by DLA/GSA-managed items. These lines accounted for over 43 percent of New Cumberland's shipments between fiscal years 1980 and 1984, although they constituted less than about one-fourth of the total lines stocked. Therefore, we believe including DLA/GSA activity in the average shipment figure inflated the 1990 shipment projection, because our analysis showed that the average activity per line in storage for fiscal years 1980-84 was 30 percent higher when DLA/GSA lines are included.

We believe it would be more appropriate to base projections of Army-managed lines on the demand associated with such items. Similarly, shipment projections for DLA/GSA-managed items should be based on the demand associated with the limited numbers of DLA/GSA lines which could meet the criteria set forth in DLA/GSA stockage agreements with New Cumberland if a determination is made that those items will be stored at New Cumberland.

Projected Receipts

To estimate design year receipts, New Cumberland applied a ratio of the fiscal year 1980 lines shipped and lines received to its projected fiscal year 1990 design year shipments which were developed as described above. Thus, 1990 receipts were computed as follows:

Table II.2: Computation of 1990 Receipts for New Cumberland

1980 shipments	2,502,826	=	9.44
1980 receipts	265,044		
1990 projected shipments	4,011,350	=	424,931
1980 ratio above	9.44		

Our analysis of the shipment and receipt data for fiscal years 1979-84 indicated that there was not a stable ratio between shipments and receipts. Although shipments increased each year, primarily because of increased DLA item activity, receipts decreased in 2 of 5 years. For instance, in fiscal year 1984, New Cumberland's shipments were 8 percent higher than in 1980 but receipts for 1984 were 14 percent lower. Further, the ratios for the period 1979-84 ranged from 9.44 to 12.07. Using these ratios, the projected receipts would range between 424,931,

as shown in the economic analysis, and 332,341—a work load 22 percent lower than projected by New Cumberland. This, coupled with the fact that these receipt projections were based on the shipment projections, which we believe are erroneous, raised questions about the validity of the receipts computation.

Projected CCP Work Load

In computing its forecast of the design year CCP work load, New Cumberland assumed that shipments through the CCP in fiscal year 1990 would increase at the same rate as all shipments. Thus, actual fiscal year 1980 CCP shipments of 1,838,223 were increased by the same 60.27-percent factor calculated for other shipments. The 1990 CCP projection was computed as follows:

Table II.3: Computation of 1990 CCP Work Load for New Cumberland

1990 shipment increase	(1,508,524)	=	60.27%
1980 shipments	(2,502,826)		
(1,838,223) X (.6027) + (1,838,223) = 2,946,120			

This projection appeared to be overstated because it is based on the questionable shipment projections discussed earlier and applied the computed growth factor to DLA/GSA line activity, which was projected to remain stable over this period. This is a significant factor because of the high percentage of DLA/GSA overseas shipments that were processed through the CCPs at both New Cumberland and Sharpe, as shown in table II.4.

Table II.4: FY 1984 Overseas Shipments From New Cumberland and Sharpe by Manager

Number of Items in Thousands

	DLA/GSA managed		Army managed		Total no. of items
	No. of items	Percent	No. of items	Percent	
New Cumberland	738	59.4	505	40.6	**1,243**
Sharpe	48	26.5	132	73.5	**180**

Sharpe Army Depot Forecast Methodology

Sharpe used an entirely different methodology to compute its 1990 design year work load, which was based on receipt and shipment forecasts provided by the MRCs for fiscal years 1984-88. DESCOM provided estimates for fiscal years 1989 and 1990. Sharpe also included a projection for its Package Processing Point work load, which we believe was

overstated. AMC and DOD have deleted this work load in their updated forecasts.

MRC Forecasts for Receipts and Shipments

Our review of fiscal years 1984-88 work load projections at the two largest of the six Army MRCs, which manage Sharpe's work load, showed that generally the projections were based on historical receipt and shipment work load data (fiscal years 1980-82) adjusted to reflect increases. However, the adjustment factors in the MRC forecast methodology were not documented and, therefore, it was not possible to evaluate their validity.

Work loads for fiscal years 1989 and 1990 were projected by DESCOM using a straight-line average of the annual increase shown by the MRCs' forecasts for fiscal years 1984-88. The projections showed 1.2 million receipts and shipments for Sharpe in fiscal year 1988. Of the 1.2 million, 530,000, or 44 percent, were merely straight-line projections of earlier periods. Most of this work load consisted of DLA/GSA lines which showed no work load change from 1984 through 1988. This shows that DESCOM did not forecast an increase in DLA/GSA work load due to force modernization for Sharpe in computing fiscal year 1990 work load projections. However, as discussed earlier, New Cumberland's 1990 forecast was increased significantly by including DLA/GSA line activity in its work load forecast.

AMC Views and Our Evaluation

In response to our statement of tentative findings of May 8, 1985, AMC stated that it had decided to update the three AODs' 1990 peacetime work load forecasts and to disregard the projections previously developed, along with the methodologies used to compute them. AMC prepared another forecast for each AOD based on a different methodology and reversed a number of basic assumptions used in the earlier economic analyses. We found the new methodology to also be flawed and the resulting projections equally questionable. Specific AMC comments and our evaluation follow.

Impact of Force Modernization

AMC reiterated its contention that new line items entering the Army inventory to support new systems would not be offset by current line items becoming less active as well as inactive. To support this contention, AMC stated that replaced systems would be (1) used as war reserves, (2) redistributed to Reserve components, and (3) made available to other countries through foreign military sales.

We questioned the validity of this position for the following reasons:

- The first two actions cited above by AMC, using material as war reserves and for Reserve components, should result in a net reduction in the activity of lines currently stored, not an increase in AOD activity. This is because (1) fewer parts are required as systems are placed in war reserve storage as compared with usage by active units and (2) systems placed in Reserve components are used less frequently than when operated by active forces. Historically, foreign military sales have been a small part of AOD activity—only 4 to 7 percent.
- AMC's contention also requires acceptance of what we believe to be questionable assumptions, i.e., that systems in the Army's inventory (1) have an infinite useful life and (2) do not become technically obsolete.
- AMC's assumptions were inconsistent with the fact that huge quantities of inactive stocks have been accumulating at both New Cumberland and Sharpe. For example, in recent years, New Cumberland has reduced the number of lines stocked from almost 240,000 at the beginning of fiscal year 1984 to 165,000 (as of April 1985) mostly by eliminating "dead" or inactive stocks; this was a mission stock reduction of almost 33 percent. Further, in 1984, almost 42 percent of the combined total lines stocked at Sharpe and New Cumberland experienced no demands at all.

With regard to force modernization, AMC, in its response to our tentative findings, increased its projection of the number of force modernization systems to be fielded from 860 to 1,200 and reduced the number of repair parts associated with modernization from 172,000 to 70,000. However, these changes had no effect on the work load projections, as discussed below. AMC officials stated that these changes were based on the latest Army Modernization Information Memorandum and other documents. However, when we contacted AMC to validate these revisions, AMC was unable to provide auditable documentation.

DLA and GSA Requirements

While AMC agreed that DLA/GSA lines accounted for a significant amount of AOD work load, it reversed its earlier position that DLA/GSA work load would remain relatively stable over the foreseeable future. AMC commented that such activity would be higher due to force modernization systems. AMC offered no estimate of how much higher this work load would be.

AMC also commented that the increase in active Army divisions would increase DLA/GSA item requirements. In our opinion, an increase due to

this factor seems highly unlikely. The Army, as reflected in recent congressional hearings, is establishing four new active light infantry divisions; however, these divisions are, for the most part, being established by conversions and modifications of existing units and will require no increases in personnel or quantities of force modernization systems. According to Army testimony, they will be much smaller, both in terms of people and equipment, than existing infantry divisions; thus, they should not require significant increased support.

Revised Work Load Computations

AMC stated it had developed and applied a different methodology to support work load projections for each AOD that, overall, supported a work load level that was 102 percent of the original fiscal year 1990 work load forecasts used in the economic analyses. Further, AMC provided another computation using adjusted MRC work load forecast data for all Army depots. Using this second approach, AMC computed a work load forecast for fiscal year 1990 that was 93 percent of the forecast used in the economic analyses. As discussed below, we believe each of these computations was flawed.

Mission Growth

Rather than compute separate forecasts for receipts and shipments, as was done in previous projections, the new methodology combined these two elements into one forecast. This new methodology was based on the premise that AOD work loads would increase due to increased requirements for customer support associated with current lines stocked in the supply system, as well as increases associated with new lines entering the supply system as a result of force modernization. AMC referred to these increases in activity, presumed not to be associated with force modernization, as "mission growth."

The computations used to forecast "mission growth" were based on fiscal years 1980 and 1984 actual receipts and shipments for the three AODs combined. The percentage increase between 1980 and 1984 was computed and then divided by 4 to determine the average growth per year, which was 2.8 percent. Fiscal year 1984 actual receipt and shipment work loads were used as the base to project mission growth by assuming 2.8-percent average growth for the 6 fiscal years 1985-90. Thus, the fiscal year 1990 combined work load for the three AODs associated with mission growth was projected to be 6,485,000.

We believe this procedure was unsound and did not represent a long-term trend or consider work load fluctuations in the intervening years.

For example, New Cumberland's fiscal year 1984 shipment work load increased 5 percent due to one-time shipments made to other depots to clear a site for constructing the new distribution center. Also, if the period between fiscal years 1981-85 had been chosen, rather than 1980-84, growth would have been only 1.7 percent per year. Thus, fiscal year 1990 receipts and shipments would have been reduced by 39 percent per year, or by about 364,000, by 1990.

Modernization Work Load

AMC's modernization work load methodology assumed that line item activity due to force modernization was not included in the "mission growth" increase discussed above, although a number of force modernization systems have been in the fielding process for a number of years. Table II.5 shows how fiscal year 1990 receipts and shipments due to force modernization were calculated by applying a ratio of the receipts and shipments per line items stored for fiscal year 1984 to the 70,000 new lines AMC now said would result from force modernization.

Table II.5: Projected 1990 AOD Receipts and Shipments Due to Force Modernization

Receipts and Shipments in Thousands

AOD	New lines	Average number of receipts and shipments per line stored (FY 1984)	1990 force modernization receipts and shipments
New Cumberland	70,000	15.8	1,106
Red River	70,000	8.9	623
Sharpe	70,000	7.1	497
Total			**2,226**

We believe this methodology used to compute the fiscal year 1990 force modernization work load was questionable because it assumes that each AOD will store all new modernization items, whereas the prior work load assumptions and economic analyses assumed that the AODs would store only a portion of the new lines. For example, in prior computations, it was assumed that New Cumberland would store 53 percent and Sharpe 35 percent of the new lines associated with modernization equipment. None of the AODs has stored all line items in the past.

Also, the average number of receipts and shipments per line shown in table II.5 above for New Cumberland was inflated by the recent stock relocation of 70,000 lines of "dead" or inactive stocks to clear space for

the new distribution center. These items accounted for nearly 30 percent of line items stored at New Cumberland at the time of relocation.

CCP Work Load

In revising fiscal year 1990 estimates for the CCP work load, AMC officials essentially used the same methodology used to compute mission growth. However, computations were based on each AOD instead of an aggregate of the three AODs. AMC computed the percentage increases in CCP work load for New Cumberland and Sharpe during fiscal years 1980-84. These percentages were divided by 4 to compute an average growth per year of 9 percent for New Cumberland and 10 percent for Sharpe. These percentages were then multiplied by 6 to reflect the average annual growth during fiscal years 1984-90. Table II.6 shows the results of this computation.

Table II.6: Projected 1990 CCP Growth at New Cumberland and Sharpe

	Average annual percentage increase in CCP shipments FYs 1980-84	Percentage growth to FY 1990	CCP shipments (thousands) FY 1984	CCP shipments (thousands) FY 1990
New Cumberland	9	54	2,501	3,852
Sharpe	10	60	740	1,184

Using the above methodology, the Army's revised CCP work load was 32 percent higher than in the original forecasts used in the economic analyses. We believe this computation was questionable because AMC chose to use simple averages which do not address significant fluctuations in CCP work load between fiscal years 1980 and 1984. For example, during fiscal year 1984, there was a huge increase in CCP work load at New Cumberland and Sharpe accounting for over half the growth for the 4-year period. However, AMC had not documented the reason this took place or determined whether it would occur again between 1984 and 1990. Once again, applying AMC's methodology to another period would result in significant differences. For example, if the work load for fiscal years 1980-83 were substituted for New Cumberland, the average annual increase for the period would be 4 percent, reducing New Cumberland's projected increase by almost 50 percent.

Validating Computation

To further support its contention that the original receipts and shipment projections were valid, DESCOM officials compared their projections

against computations based on forecasts by the MRCs. Because they considered these forecasts to be significantly understated, AMC raised them based on the variances computed between what the MRCs had forecast and the actual receipt and shipment work load for the last three forecasting cycles. DESCOM assumed that the MRCs' forecasts did not include force modernization items; therefore, DESCOM computed the projected activity associated with the 70,000 force modernization line items entering the inventory and added this amount to the adjusted MRC forecasts.

AMC stated that this further supported the work load projections used in the economic analyses, since the two projections were within 7 percent of each other. We question how this second computation could validate either the original projections or the revised projections for the following reasons:

- The second computation was based on MRC forecasts which AMC chose to disregard in computing its first revised computation in responding to our statement of tentative findings because it considered them unreliable. Further, AMC could not document that the MRCs had not considered force modernization items in their forecasts. In discussions with the two MRCs we visited, we were told that force modernization items had been included in their AOD work load forecasts.
- While the first and second revised computations were within 9 percent of each other, the receipts and shipments activity associated with force modernization in the first computation was 4 times greater than in the second computation—2,226,000 to 563,000—because of different procedures used to project this impact of force modernization items on AOD work load. We believe this raised more questions about the validity of these forecasts.

Agency Comments and Our Evaluation

DOD agreed that documentation to support the work load projections contained in the economic analyses and AMC's response to our tentative statement of findings, dated May 8, 1985, was not complete. According to DOD, a validation process was therefore undertaken to address the force modernization, mission growth, DLA/GSA work loads, and CCP work load. The results of this process were as follows:

- Force Modernization. DESCOM personnel identified the number of unique (additive) resupply repair parts expected to incur failures for 120 force modernization systems, some of which had been fielded and some which had not. DOD said this process had identified about 36,950 lines, or an

average of 308 per system. According to DOD, the number of individual force modernization systems requiring wholesale supply support ranged between 276 and 649. Therefore, the number of additional force modernization lines to be stocked at the AODs was estimated to range between 85,008 (276 x 308) and 199,892 (649 x 308). DOD stated that, according to U.S. Army Materiel Command Regulation 740-4, the stockage and issue of secondary items to support field activities worldwide would be limited to New Cumberland, Red River, and Sharpe Army Depots. Based on this policy, DOD said each AOD would receive 100 percent stockage of secondary items entering the inventory as a result of force modernization.

- Mission Growth. DOD stated that 1985 had been selected as the base year because it had been the most current and a zero growth factor was assumed for mission stock to compensate for an unknown amount of items displaced by force modernization.
- DLA/GSA/Other Work Load. In its revised work load computation, DOD used an increase of 15 percent (3 percent a year) between 1985 and 1990 in DLA-managed item activity at each of the three AODs. DOD stated that DLA had forecast a work load increase of 6 percent a year for items it managed. DOD stated that it assumed only half of this growth, or 3 percent per year, for its new computation. According to DOD, this 3-percent growth factor was further supported by the fact that DLA/GSA receipts and issues had increased at a rate of about 3 percent a year from fiscal year 1980 to fiscal year 1985.
- CCP Work Load. DOD agreed that the initial analysis posed questions. However, DOD stated that additional analysis of Sharpe and New Cumberland CCP work load from fiscal years 1975 to 1985 confirmed the reasonableness of AMC's projections in response to our tentative findings. Further, the 1985 CCP work load was 86 percent and 89 percent of the original economic analysis projection for New Cumberland and Sharpe, respectively. Using the average growth from 1978 to 1985, the CCP at Sharpe can expect to process 112 percent of the economic analysis volume and New Cumberland can expect to process 121 percent of the economic analysis volume. The net effect of the revised forecast is that the potential cost savings cited in the economic analyses are understated.

Based on the above, DOD stated that it believed the results of this effort supported the need to continue the planned AOD modernization program.

The Army and DOD have made a total of four work load computations using varied estimates of and assumptions about (1) the number of new systems the Army plans to introduce as part of its modernization

efforts, (2) the number of new spare parts that will be associated with these systems, and (3) how these systems and parts will influence the AODs' work load.

In its original projection of the 1990 AOD work load, the Army assumed that its force modernization program consisted of 860 new systems that would generate 172,000 new spare parts, of which 125,000 would be stocked by the AODs. We questioned the validity of these figures because the Army could not document the source or basis for assuming the addition of 172,000 new spare parts to its inventory. AMC subsequently discarded these assumptions and provided new work load projections which assumed that force modernization consisted of 1,200 systems for which 70,000 line items could be identified for stockage at the AODs. We questioned these assumptions and the validity of the computations in which they were used because the Army could not provide auditable documentation.

Regarding DOD's computation, which was the fourth done, we question the method used to estimate the number of new repair parts assumed to be associated with Army force modernization. The 120 systems used to develop the 308 average parts per system were not selected on a random basis. Therefore, it cannot be assumed, with any degree of confidence, that the average is representative of the systems universe. Accordingly, the range of new parts projected by DOD using that average is not statistically valid. Further, the lines identified were not screened to determine if they would be managed by the Army, as opposed to DLA or other item managers. In addition, we question DOD's contention that 100 percent of the repair parts which will enter the Army's inventory between 1985 and 1990 will be stocked at each AOD. This assertion is counter to past experience as discussed on pages 15 and 22. More importantly, the draft AMC Regulation 740-4 cited by DOD does not support this contention. While the draft regulation states that stockage of repair parts would be limited to the three AODs, it does not state that each AOD will stock 100 percent of the items. The draft regulation states that stockage at each AOD, both in terms of the range and quantity of items, would be based on customer demand data.

Second, we believe that DOD and the Army overstated the number of total repair parts that are projected for the Army inventory and that will be handled by the AODs. The mission growth assumptions do not account for any decrease in the stockage of repair parts which are associated with old and/or obsolete equipment that is being and will be replaced/superseded by new and product-improved systems. For

example, the Army is buying thousands of High Mobility Multipurpose Wheeled Vehicles (HMMWVs) and Commercial Utility Cargo Vehicles (CUCVs) to replace thousands of older vehicles, such as the 1-1/4-ton M561/M762 Gamma Goat trucks and the M880 pick-up-type trucks which have been in service for many years. The HMMWVs and CUCVs will require new repair parts; however, stockage and use of repair parts unique to Gamma Goats and other replaced equipment will likely be reduced as customer demand decreases.

Third, according to DOD's comments, the latest work load computations are based upon systems which have been fielded or are projected to be fielded but are not yet affecting AOD work load. Thus, DOD's comments suggest that Army modernization is an event expected to occur sometime after 1985. Army modernization is a continuing process and has been going on for some time. For example, since the late 1970's and early 1980's, the Army has fielded, and is in a continuing process of fielding, many new and/or improved systems including, among others, (1) the UH-60 Black Hawk helicopter, (2) the Stinger missile system, (3) the M60A3 and M1 tanks, (4) the AH-1S version of the Cobra helicopter, (5) the M88A2 tank recovery vehicles, (6) the CH-47D helicopter, (7) the M113A2 personnel carriers, (8) the M110A2, M109A1, and M198 howitzers, and (9) the improved TOW vehicle, as well as the improved TOW and TOW-2 missiles. During this period (1979-85), the increase in the number of active Army-managed items was about 53,000—from about 342,000 to about 395,000. For the same period, the AODs' receipts and shipments increased an average of about 2 percent a year—far less than the approximate 7-percent average that would have been required to coincide with the Army's original forecast. For the AODs to achieve DOD's latest 1990 work load projections, an annual average increase in the range of 10 and 22 percent will be required between 1986 and 1990.

Fourth, we are concerned with DOD's projection of DLA work load growth at the AODs. DOD did not provide any rationale for the assumption that AOD work load could be expressed as a percentage of DLA's work load. We are also concerned about the projections of growth in DLA activity at any of the AODs other than possibly at New Cumberland. The Army has no agreement with DLA to allow it to stock additional DLA items at the Sharpe and Red River AODs.

The DLA items now stocked at these two AODs were once Army-managed items and are stocked there as the result of an item manager transfer program in the early 1980's. DLA and the Army do have an agreement at New Cumberland to allow that AOD to stock certain high demand DLA

items to support Europe only.[3] However, DLA officials have stated that new DLA items would likely be stored at DLA's nearby depot in Mechanicsburg, Pennsylvania—not New Cumberland. Thus, in our view, there is not a sound basis to assume increasing DLA work loads at the Sharpe and Red River AODs and potentially no basis for increases at New Cumberland.

Further, we do not agree that DOD's analysis of CCP trends confirms the reasonableness of the CCP computations. DOD's analysis does not address the reasons that fluctuations have occurred or why they would continue. Its analysis did not address why CCP has grown to near 1990 levels. DOD's analysis also included the start-up period where CCP work load was growing at a much higher rate than it would normally. We do not believe that the periods DOD analyzed can be used as a representative baseline until the sources of the CCP growth are defined. Further, while the CCP has grown to levels near that computed in the economic analyses, the current CCP sections appear to have adequate capacity to process it. For example, while CCP has increased from 2.15 million shipments in 1983 to 2.61 million shipments in 1985 at New Cumberland, the CCP work force has decreased about 19 percent during this period.

[3]In 1976, a memorandum of understanding was initiated establishing stockage of certain high demand DLA lines (defined as six annual demands per line) at New Cumberland in support of Europe.

Mobilization Requirements Not Developed

The size of each new distribution center was based on its ability to process the projected 1990 peacetime work load on a single shift, leaving second and third shifts available for potential emergencies and wartime mobilization. Thus, each AOD will have a mobilization capability equal to three times the projected 1990 peace time work load, a planning factor almost twice the 1.6 multiplier now used in current readiness assessments. However, projected 1990 mobilization requirements have not been developed or analyzed.

Thus, the economic analyses did not address mobilization requirements, and we found no evidence to indicate that any evaluation had been made of the trade-offs between a facility with a single shift capacity versus a smaller capacity facility requiring multiple shifts to process peacetime work load. Further, the new distribution facilities may have to operate on multiple shifts to process priority requisitions arriving late in the day even though the capacity would exist for a single shift operation. Therefore, in our opinion, there is no assurance that the new facilities will be optimally sized or that they can be justified in terms of supporting mobilization.

Readiness Assessments

Recent AMC Readiness Evaluation System reports show that the existing facilities at each of the three AODs have more than sufficient capacity to meet current mobilization requirements and could be classified as "fully ready." In fact, current capabilities considerably exceed current requirements. However, DESCOM has downgraded the reports' readiness ratings citing facilities, personnel, equipment, and automatic data processing problems. As discussed on page 33, we could not document how these factors had negatively affected performance of depot operations.

The AMC Readiness Evaluation System permits readiness ratings to be changed on the basis of the command's or unit commanders' subjective evaluations of such factors as facilities, personnel, equipment, and ADP status. For example, in 1982, DESCOM assigned a "marginally ready" rating to supply missions at the three AODs, although the commanders at both New Cumberland and Red River had considered their supply missions to be "fully ready" because capacities far exceeded 100 percent of their stated mobilization requirements. DESCOM did not require the AODs to submit readiness reports in 1983. In 1984, when the AODs again submitted the readiness reports, the three AODs still had more than enough capacity to handle mobilization requirements and computations reflected a "fully ready" posture. This occurred even though DESCOM increased the mobilization work load over the requirements submitted

by the MRCs, because it considered the MRCs forecasts to be unrealistically low. DESCOM's revised forecasts were based on a mobilization work load multiplier of 1.6 of normal peacetime activity for the AODs. This is considerably below the work load multiplier capacity of 3 that will be available in the new facilities.

The Army has not developed fiscal year 1990 mobilization work load requirements to support its need for a second and third shift capability at its AODs to meet mobilization requirements. Consequently, the Army has no way of knowing whether the size of its new distribution centers will meet or exceed its requirements.

Furthermore, even though the capacity would exist, the AODs may never be able to operate on a single shift basis because certain priority work loads are subject to priority processing over which the AODs have little or no control. Sharpe uses a swing shift of about 60 people to process priority shipments that arrive late in the day. According to Sharpe, there will probably always be a need to stagger shifts, even in the new distribution centers, to meet priority shipment demands that cannot be processed during normal working hours.

AMC Views and Our Evaluation

AMC agreed that the mobilization work load was not a factor in sizing the distribution centers and stated that peacetime work load projections were the basis for determining the amount of space needed. Although no documentation was provided, AMC stated that operating on a single shift was Army policy and was consistent with industry practice. AMC commented that multiple shift operations should be avoided because of increased labor costs and excessive equipment wear.

While we agree that second and third shift operations would result in increased costs and equipment wear, no evidence was provided to indicate that an evaluation had been made of the trade-offs of a single shift versus a multiple shift operation in a smaller facility to handle total work load requirements.

Regarding mobilization planning, AMC officials stated that the 1.6 multiplier used to forecast current mobilization requirements was based on executing only the European Theater LOGPLAN and that requirements would be considerably higher if additional LOGPLANS were used in the projections. However, they did not state the likelihood of additional LOGPLANS being implemented which might warrant a mobilization work load three times peacetime requirements. They also did not

explain why such peak work loads could not be handled by increasing the number of shifts worked.

Agency Comments and Our Evaluation

DOD stated that we had correctly noted that the AOD modernization plan would accommodate a work load surge of about three times the 1990 peacetime work load estimates and that no mobilization requirements had been developed to justify the sizing of the planned facilities. Though the Army pointed out that mobilization requirements were not a factor in sizing, multiple shift capability could accommodate a surge of about 200 percent. In contrast, the last major distribution study which specifically addressed mobilization, the 1975-78 Joint Logistics Commanders' Department of Defense Materiel Distribution System (DODMDS) study, indicated that DOD depot system-wide issues would increase under mobilization by 99.2 to 375 percent, depending on the scenario. The 200-percent factor, therefore, was, according to DOD, inadequate in some scenarios.

DOD also stated that it was not Army policy to operate facilities on a single shift basis and agreed that multiple shift operations at Sharpe would be required to process 1990 peacetime priority requirements in the new facility as is now the case.

The objectives of the DODMDS study cited by DOD (which used 1975-76 as its baseline year) were to evaluate the then-current DOD materiel distribution system and recommend improvements which would effectively and economically support the services' operational readiness requirements in peacetime and modernization/wartime. Specifically, it was to determine what depots/distribution centers were needed and recommend facility closures, moves, etc. Overall, the study concluded that its proposed streamlined distribution system, which was not implemented, would

- support DOD's peacetime and mobilization/wartime requirements,
- improve system responsiveness, and
- reduce distribution system costs by about $100 million annually.

DOD commented that the study showed mobilization increases to be 99.2 to 375 percent of peacetime work loads, depending on the various wartime scenarios considered. However, we found that the study addressed only a European scenario and that the 99.2-percent factor was a comparison of two different forecasting techniques, not a mobilization work

load increase percentage. The study did indicate that the overall mobilization work load would increase about 375 percent; however, it also concluded that the proposed streamlined distribution system had sufficient capacity to process this increase. The study also acknowledged that its mobilization projections were likely to be overstated because its methodology did not address the degree to which (1) shipments to customers would bypass depots during mobilization and (2) individual shipments would get larger and heavier rather than increase in number.

DOD did not provide any rationale or documentation to indicate how a mobilization increase computed in the late 1970's for all service depots could be used to determine mobilization requirements for the Army AODs in 1990.

Claimed Problems With Equipment Were Not Documented

DESCOM officials, in fiscal year 1985 hearings before cognizant House and Senate committees, testified that the material handling equipment systems in the three AODs were old and needed replacement. But we found that the Army had spent considerable amounts in recent years on new AOD equipment and related facilities modifications. Further, the Army could not identify or document any extensive problems with most of the existing equipment.

Our review indicated that equipment problems were limited to two specific systems which could be replaced without constructing new distribution centers. Further, we found that performance standards at the AODs were being met with existing equipment.

During fiscal years 1979-84, New Cumberland spent about $5.2 million and Sharpe about $3.8 million on new equipment and improvements for AOD operations. Specific accomplishments include the following:

- Sharpe replaced one-third of its forklifts at a cost of $752,000 and purchased $2.8 million worth of other material handling equipment, including a mechanized storage carousel.
- New Cumberland established the Package Processing Point section at a cost of about $2 million with new storage equipment similar to that at Sharpe, including an automatic guided vehicle system.
- New Cumberland acquired mainframe computer hardware for about $1 million.
- New Cumberland also acquired forklifts and stock selector vehicles at a cost of about $1 million.

Except for a major conveyor system, called an overhead power free conveyor, at both Sharpe and New Cumberland, and a sortation and retrieval device at New Cumberland, we could not identify any significant problems associated with other material handling equipment or systems at either depot. Performance factors used to evaluate supply operations indicate that New Cumberland and Sharpe were operating satisfactorily and that Army goals for processing release orders had been routinely met or exceeded. The conveyor system at each depot continued to be a problem; however, a recent project analysis at Sharpe showed that the system could be replaced for about $600,000.

AMC Views and Our Evaluation

AMC agreed that AOD equipment problems had not been documented; however, officials stated that personnel familiar with the systems knew the systems were inefficient and that labor intensive measures must be used to keep the equipment operational to meet performance standards.

AMC officials said that much of the equipment purchased since 1979 for the AODs, such as forklifts, would continue to be used both within and outside the distribution centers once the new centers became operational. They said past material handling equipment modernization projects at Sharpe had resulted in equipment items and subsystems, such as the power free conveyor, with different maintenance and operational characteristics and controls. This has caused integration and interfacing problems, including differences in throughout, reliability, and remaining useful life.

Regarding the overhead power free conveyors, AMC stated the conveyor at Sharpe was being removed and the one at New Cumberland was now bypassed for all high-priority and dedicated truck shipments because it was faster to use conventional forklift transporters. AMC commented that while replacing these and other subsystems in existing facilities might appear less costly than installation of equipment to provide the same function in the new centers, other factors or disadvantages, such as continued lack of system integration, disruption to current operations during construction, and no increase in capacity, must be considered. AMC stated that these disadvantages would occur not only during replacement of the overhead conveyor, but would apply to every subsystem as the systems became inoperable. Therefore, according to AMC, it was decided to build the new highly mechanized centers.

We do not believe that an assumption can be made that replacement of older equipment in the present facilities is not a viable solution without a cost-benefit or cost-effectiveness analysis.

Agency Comments and Our Evaluation

DOD agreed that AOD equipment maintenance problems were ill defined. It concluded, however, that the economic analyses rightly assumed that existing equipment would need to be replaced to meet the projected work load because the existing equipment was inefficient or inoperable. DOD stated that even if this equipment was replaced, as envisioned in the economic analyses, this equipment would not have the capability necessary to handle anticipated work load increases.

Table V.1: Estimated One-Time Costs for Alternative 1 at Sharpe and New Cumberland

Dollars in Thousands

	Sharpe	New Cumberland	Total
Material handling equipment	$ 8,443	$13,968	$22,411
Information systems	2,174	1,979	4,153
Disruption costs	543	5,073	5,616
Rewarehousing	5,577	1,718	7,295
Total	**$16,737**	**$22,738**	**$39,475**

Fiscal year 1990 annual operating costs for this alternative, which primarily consist of personnel, were estimated to be $31,948,000 and $56,695,000 for Sharpe and New Cumberland, respectively.

Alternative 2 was to build new sophisticated distribution centers. The estimated costs for this alternative are shown in table V.2.

Table V.2: Estimated One-Time Costs for Alternative 2 at Sharpe and New Cumberland

Dollars in Thousands

	Sharpe	New Cumberland	Total
Construction	$45,752	$ 72,240	$117,992
Material handling equipment	37,932	72,026	109,958
Information systems	3,116	8,116	11,232
Personnel training	360	570	930
Rewarehousing/disruption	3,140	5,397	8,537
Site preparation	0	6,674	6,674
Total	**$90,300**	**$165,023**	**$255,323**

The annual operating costs for alternative 2, which were primarily for personnel, are estimated to be $19,130,000 and $29,120,000 for Sharpe and New Cumberland, respectively.

Savings-to-investment ratios were computed by dividing the present value of the estimated savings of the project over the 10-year life of the new equipment by the present value of the estimated cost of the investment. For Sharpe, the analysis estimated that the savings-to-investment ratio was only 1.11 and that the payback period for alternative 2 would be about 8 years by using present value analysis. For New Cumberland, the figures were 1.20 and 7.2 years.

Costs Not Included in Economic Analyses

The analyses for Sharpe and New Cumberland did not include significant software development, design, and other costs associated with alternative 2. For example, the following costs were not included:

- software development costs for new ADP systems, which were estimated to cost $29.2 million;
- project design costs of $25.4 million, of which about $13 million were associated with Sharpe's project alone;
- estimated costs of $7.4 million incurred to relocate about 70,000 line items to other depots to make space for construction of New Cumberland's distribution center;
- the cost of hiring additional personnel for several years to oversee construction. Sharpe anticipated that 13 new personnel would be hired, which we estimated will cost about $1.7 million. This does not include six additional positions which may be necessary. We based our estimate on new position projections provided by Sharpe for its distribution center project office and Office of Management and Budget Circular No. A-76 (Cost Comparison Handbook) procedures for computing personnel costs.

Our evaluation of Sharpe's economic analysis showed that by including the above costs and using the Army's methodology, it would take about 20 years after the center became operational, or about the year 2008, before the cumulative costs of alternative 1 exceeded the costs of alternative 2. This payback period compares with the 7.96 years shown in the Sharpe economic analysis and assumes that the equipment in the facility would be replaced at the end of its 10-year useful life. For New Cumberland, our analysis showed a payback period of almost 11 years under the same equipment replacement assumption compared with the 7.22 years shown in the economic analysis.

Impact of Changes on Projected Construction and Operating Costs

Conclusions of the economic analyses did not reflect sensitivity to changes in the costs of either or both alternatives. Our analysis showed that relatively minor escalation, particularly for Sharpe, in construction and/or recurring costs could change the analyses' conclusions regarding the preferred alternative.

Sharpe Analysis

Our analysis showed that if the Army's total estimated initial costs of $90.3 million for the Sharpe facility for alternative 2 increased about 11 percent—about $10.1 million—or more (and there was no other change

DOD's determination is based on the economic analyses assumption that replacing existing equipment with like equipment will not achieve any productivity gains. If current equipment breaks frequently and is often inoperable, then replacing that equipment with new equipment should produce some gains in productivity since the newer equipment should be operational for longer periods. We believe the economic analyses should include any gains in productivity from new equipment if the current equipment problems are affecting productivity.

Shortcomings in Economic Analyses May Not Ensure the Most Cost Effective Alternative

Alternatives evaluated by the design engineering firm in the economic analyses for DESCOM's New Cumberland and Sharpe projects compare (1) minimum capital investment by replacing existing equipment with like equipment in current facilities—the status quo—and (2) construction of the new distribution centers. We found the following:

- The estimated costs of the new distribution centers used in the economic analyses did not include significant software development, design, and other costs directly attributable to these projects. Review of the economic analyses showed that distribution center cost increases, particularly at Sharpe, could reverse the conclusion regarding the most cost effective alternative.
- The analyses did not consider alternatives to constructing new centers, such as upgrading existing facilities to provide features like bar coding, redesign of work flow, and computer-aided scheduling and progress reporting to increase efficiency and reduce cost of operations.

Objectives of Economic Analysis

According to Army Regulation 11-28, economic analysis is a systematic approach to the problem of choosing how to employ scarce resources and includes an investigation of the full implications of achieving a given objective in the most efficient and effective manner. Efficiency and effectiveness are determined by systematically identifying the benefits and costs associated with alternative programs, missions, and functions. The analysis should address all feasible alternatives and examine the cost for each in detail.

Costs of Alternatives Considered

The economic analyses for Sharpe and New Cumberland considered two alternatives. Alternative 1 would involve remaining in the existing facilities and replacing existing equipment with equivalent new equipment. The increased work load projected for fiscal year 1990 would be handled by increasing staff and operating on three shifts. According to the Army, this alternative would provide no extra capacity for surges and mobilization. The estimated one-time costs, developed by the design engineering firm for this alternative at Sharpe and New Cumberland, are shown in table V.1.

in costs), alternative 1 would become more cost effective than alternative 2.[1] If the annual recurring costs of $31.9 million estimated for alternative 1 were decreased by 5 percent, or about $1.6 million (without any change in other costs), alternative 1 again would become more cost effective than alternative 2.

New Cumberland Analysis

Our review of New Cumberland's economic analysis indicated that it is less sensitive to cost changes. Specifically, our analysis showed that a change of about 20 percent in either initial costs or recurring costs of alternative 2 would be required to change the analysis' conclusion regarding choice of alternatives.

Limited Alternatives Considered

The economic analyses for Sharpe and New Cumberland did not analyze how the work load could be handled more efficiently in the existing facilities by the use of bar coding and bar code scanners, redesign of work flow, different material handling systems, or computer-aided scheduling and progress reporting. An examination of certain design features of the new AODs suggests that the economic analyses should have explored other alternatives because the modernization program may be overly sophisticated for the AODs' basic operations and, in fact, may be less capable than current facilities in certain circumstances. (See app. VI.)

Other Potential Alternatives

The potential for improved efficiencies at relatively small cost are evidenced by (1) an October 1975 modernization plan prepared for Sharpe and (2) a DLA warehouse project called Automated Warehousing and Retrieval System (AWARES).

The purpose of the 1975 plan at Sharpe was to evaluate productivity-enhancing equipment which would enable the depot to handle an increased work load without a commensurate growth in personnel. The plan showed that for an investment of $5.7 million, efficiency could be increased and labor requirements reduced by an estimated 136 to 195 positions depending on work load variance assumptions. A similar effort, AWARES, was recently completed at one of DLA's least automated facilities. An existing warehouse which received, stored, and shipped items with characteristics (in terms of size, weight, and demand) similar

[1]The Army awarded the contract in December 1985. Total programmed cost is approximately $117 million, or about $27 million higher than the cost estimate in the Sharpe economic analysis.

to those of an AOD was modernized through upgrading various functional areas within the system. Improvements included the installation of a new conveyor system, increased computer capability, and acquisition of new material handling equipment which incorporates bar code technology. This effort cost about $14.6 million and, according to DLA officials, increased productivity.

We could not determine why alternatives such as these or similar ones had not been provided by DESCOM to the architect-engineer firm for consideration in the economic analyses. Personnel at Sharpe speculated that AMC's goal to standardize operations at the three AODs may have limited the number of alternatives for consideration.

AMC Views and Our Evaluation

AMC concurred that certain costs had been omitted from the economic analyses. It was of the opinion, however, that some of these costs should be applied to both alternatives, thus having a minimal effect on the economic analyses. Specifically, it believed that the following costs should have also been considered in alternative 1:

- 50 percent of software design costs,
- an unspecified portion of the facility design costs,
- all the equipment design costs, and
- all the stock relocation costs at New Cumberland.

Further, AMC commented that there were certain desirable intangible benefits, such as reduced security losses and transportation costs, which were associated with alternative 2.

We believe none of the software, facility, or equipment design costs apply to alternative 1 as this alternative is conceived in the present economic analyses. The AMC comments assumed that significant modifications and upgrades would be made under alternative 1 that would have enhanced productivity, if alternative 2 were not selected. This was not the assumption used in the economic analyses which evaluated replacing existing equipment with like equipment providing no productivity increases. Any significant facility or equipment upgrade should result in productivity gains, which would reduce operating costs under alternative 1. We believe that without such an analysis and inclusion of productivity gains, it would not be proper to include the associated costs in alternative 1.

AMC said that stock relocation costs for New Cumberland should also be included in alternative 1 because the stock relocation was planned regardless of whether the new distribution center was constructed. However, these "relocated" items were included in the 1990 projected stockage levels in New Cumberland's economic analysis. If these items had not been included, a $7 million annual recurring cost associated with outside storage would not be incurred, based on DESCOM's computations under alternative 1 in the economic analysis. Exclusion of these costs would stretch the payback period for alternative 2 past 20 years.

AMC also stated it had adequately considered all alternatives for processing the increased work load. However, the documentation provided to us included the same alternatives that were in the economic analyses. AMC further said the reason the 1975 modernization plan for Sharpe had not been implemented was that it did not meet its long-term requirements (greater than 10 years). However, according to the economic analyses, the economic life of the equipment in the new centers will be only 10 years.

Agency Comments and Our Evaluation

DOD agreed with our findings that the original Sharpe and New Cumberland economic analyses had omitted $56.3 million attributable to the new distribution centers, had marginal savings-to-investment ratios of 1.11 and 1.2, and considered only two alternatives—the status quo and the new distribution center. Therefore, DOD recalculated the analyses by including the costs originally excluded and making other major alterations to the original economic analyses. These alterations included

- adding a construction project to the status quo alternative at a cost of $74 million for New Cumberland and $23 million for Sharpe;
- extending the economic life for each alternative and for some of the material handling equipment from 10 to 25 years; and
- modifying selected costs estimates originally used in the economic analyses, including escalating the labor costs 3 percent a year.

DOD disagreed that the cost to relocate the 70,000 line items was an expense only to alternative 2 but did adjust its analysis to eliminate the $7 million annual cost associated with the outside storage of these items under alternative 1.

The results of DOD's recalculated analyses showed alternative 2 to still be more cost effective at each location, but the savings-to-investment ratio for Sharpe dropped from 1.11 to 1.03, while it increased at New Cumberland from 1.2 to 1.8.

DOD agreed that the formal economic analysis for each AOD had considered only two alternatives—the status quo and the new distribution center; however, methodologies developed to meet the projected work load had considered 19 major functional subsystems within the distribution centers. DOD stated that each subsystem analysis had included a life cycle cost evaluation of numerous types of alternative material handling equipment.

DOD contended that Sharpe's 1975 project considered a short-term solution to the increased work load projection for that time and today's work load exceeded the capability discussed in Sharpe's 1975 project. In addition, DOD stated that the AWARES project at DLA was considered incomplete in terms of meeting AOD operational requirements and that DLA was undertaking a major effort to enhance AWARES to achieve many of the benefits sought by the Army. However, DOD contended that an enhanced AWARES would not give the Army all the benefits that the new distribution centers would.

We question DOD's assumptions and believe the revised assumptions significantly alter the original analyses. The major changes to the original analyses follow.

- Warehouses. A large storage warehouse was added to the status quo alternative for each location because DOD maintained the warehouses would be necessary to store the new lines the AODs expected to store and to establish a covered storage utilization rate of 85 percent without storing any items outside.[2] These buildings were sized at 1.9 million square feet for New Cumberland and 600,000 square feet for Sharpe. Including the buildings raised the savings-to-investment ratio 50 percent for New Cumberland and 21 percent for Sharpe. For comparison purposes, the warehouse included for New Cumberland would be larger than the proposed distribution center in square footage and probably could not be placed at New Cumberland because of the lack of available land. These sizes appear to be based on large increases, due to force

[2]Storage utilization is the percentage of potential storage capacity that is occupied. A goal of 85 percent was deemed optimal to allow adequate space to receive new shipments without having to shift existing stocks to accommodate them.

modernization, in the number of lines to be stored at each location. As mentioned in appendix II, DOD and the Army have used methods which appear to overstate the estimated number of lines to be stored at each depot. Further, current stockage levels may be unnecessarily high. Sharpe, for instance, has accumulated significant amounts of dormant stock. New Cumberland has reduced its stockage by 120,000 lines since fiscal year 1984 by eliminating dormant stocks from its inventory, as well as transferring slow-moving DLA-managed lines back to DLA. A similar relocation of dormant stocks from Sharpe could significantly reduce the number of lines stored there. Further, Sharpe has a significant amount of DLA lines stocked there which, according to DLA officials, could be accommodated in DLA facilities if necessary. Further, as we point out in appendix VII, many out-of-area shipments have been made and may be the result of stock being positioned improperly. New Cumberland, for instance, in 1984, had more out-of-area shipments than the other two AODs combined. We, therefore, believe the proposed storage warehouses may be unnecessary and that other management options are available and could be explored to reduce storage levels at the AODs.

- Economic Life. DOD officials decided that one-half of the material handling equipment (primarily stationary items, such as storage racks and bins) would last the 25 years of the project, rather than the 10-year economic life originally used. Because most of the equipment costs are associated with alternative 2, this change makes alternative 2 more favorable. The revised expected equipment life is counter to the project's justification that most existing equipment needs replacement simply because it is past its 10-year economic life. This methodology, in light of the number of improvements made at Sharpe and New Cumberland since 1979, suggests that the urgency of the project may be overstated. (See app. IV.)
- Alternatives Considered. While the Army may have considered different configurations and types of material handling equipment to be used in the new distribution centers, no similar types of analyses were done to examine the life cycle costs associated with the different layout and equipment options available in the existing facilities. Therefore, we believe that the full range of options was not considered. While the 1975 Sharpe study may have addressed only conditions (in terms of work load and technology) in 1975, the study showed that using productivity-enhancing equipment and improved flow management in existing facilities could lead to substantial savings through increased productivity. Further, this principle is presently demonstrated by DLA in its AWARES facility in Richmond, Virginia, where an existing facility was upgraded to incorporate more current technology to produce productivity gains. While the Army has concluded that AWARES (as it exists at Richmond) is

incomplete for its needs, no attempt was made to see if the same principles could be expanded and upgraded as DLA is doing in its proposed integrated materials complex proposed for Mechanicsburg, Pennsylvania.

Questionable Design Features in the New Distribution Centers

Despite the extensive mechanization being built into the new distribution centers, representing 43 percent of projected cost, the most active items will be stored in a manual pick area while slower moving items will be processed mechanically. This suggests that some of the highly mechanized features being designed into the new facilities may be inconsistent and overly sophisticated for the basic AOD mission. The original distribution facility design for the new AODs provided quite limited electrical backup capability. According to DOD, additional capacity has since been identified which should allow adequate capability for most situations.

Most Active Items to Be Handled Manually

Extensive mechanization is planned throughout the facilities; however, the most active lines will be stored in a special manual pick area, where a stock selector will walk through the aisles with a pushcart and manually select items for shipment.

This feature was based on the design engineering firm determination that (1) 1.6 percent of the lines stored at New Cumberland accounted for 31 percent of the work load and (2) a manual pick method for high activity items offered greater efficiency than a mechanized system. Our analysis of fiscal year 1984 work loads for the two AODs showed results similar to the design engineer's and also showed that most lines had few or no demands, as shown in table VI.1.

Table VI.1: GAO Analysis of FY 1984 Demands for Lines Stocked at Sharpe and New Cumberland

	Percentages of stocked lines	
Demands per line	**Sharpe**	**New Cumberland**
None	55.4	33.3[a]
1-9	33.6	44.2[a]
10-19	4.9	9.3
20 and over	6.1	13.2
Total	**100.0**	**100.0**

[a]Adjusted to reflect status before dormant stock relocation program was implemented during the summer of 1984.

AMC Views and Our Evaluation

AMC officials stated that it was an industry-accepted standard that a manual pick method was the most efficient in an area where there were a restricted number of high-moving lines. They said this method was more efficient because items could be stored in a relatively restricted area and picked manually faster than with moving mobile equipment.

While this may be the case, we still have reservations about the need for highly mechanized facilities where most of the line items have nine or fewer demands in a year, including a high percentage which have no demands.

Agency Comments and Our Evaluation

DOD agreed with the facts as reported but not with our conclusions. According to DOD, cost analyses of available material handling systems which could accommodate the Army's AOD mission were developed during the facility design phase and were used to select the most economical degree of mechanization. The Army rationale for selecting a less mechanized pick operation in the highly active storage area and the more mechanized computer-controlled vehicles in the high-rise areas is based upon industrial engineering analyses. DOD stated that despite the relatively low demands per line, about 65 percent of the issue activity was in the high-rise storage area where travel distances supported mechanized movement as the most efficient method. Conversely, in the restricted-space high-volume area where travel distance is minimal, the handpick operation is the most efficient.

The cost analyses used to select the material handling systems for the new distribution centers were based on the large peacetime work load increases projected to occur by 1990. As discussed in appendix II, we believe these projected work loads are overstated due to weaknesses in the Army's assumptions and computations used to develop the forecasts. Accordingly, we believe that less sophisticated and less costly systems may be more appropriate for the basic AOD mission. Further, an analysis in the DODMDS study (see p. 31) indicated that small items generally used more conventional handling and storage concepts and that the potential to significantly reduce labor costs through mechanization was small.

Current Inefficiencies in AOD Operations to Continue

The Army justified the establishment of the three AODs, each with specific geographic areas of responsibility, on the bases that operational economies could be achieved and transportation costs would be reduced. However, we found that since 1975, the work load distribution among the AODs has shifted significantly from Sharpe and Red River to New Cumberland. This shift appeared to be the result of the high level of out-of-area shipments (shipments from one AOD to locations assigned to another AOD), as well as the transfer of responsibility for supporting Latin America from Red River to New Cumberland. As a result, operating costs and efficiency at the AODs varied widely. For example, the cost to process a material release order at Sharpe was about 65 percent higher than at New Cumberland.

The planned AOD modernization program will tend to build in or perpetuate these disparities and inefficiencies because the current work load distribution is projected to remain stable through the 1990 design year. Accordingly, we believe that an overall analysis should be made of the current organizational structure and operation of the AODs to address such issues as whether (1) three AODs are still required, (2) the geographic support areas should be reviewed to redistribute the work load, and (3) the extensive modernization currently planned is required for each AOD.

Out-Of-Area Shipments

During fiscal year 1984, 25.4 percent of all continental United States and 11.3 percent of all overseas shipments were out of area. Table VII.1 is our analysis of the percentage of each AOD's fiscal year 1984 out-of-area shipments.

Table VII.1: Percentage of Total Shipments Which Were Out-Of-Area From AODs in FY 1984

Numbers in Percent

	Continental United States		Overseas	
AOD	Line items	Tons	Line items	Tons
New Cumberland	39.0	49.5	2.6	4.1
Sharpe	30.7	36.0	20.1	28.8
Red River	13.9	19.7	100.0	100.0[a]

[a]Red River's overseas shipping responsibilities were transferred to New Cumberland in 1982; thus, all shipments overseas are out of area.

Table VII.2 shows our analysis of some of the locations to which significant percentages of the total number of shipments were out of area during fiscal year 1984.

Table VII.2: Examples of Locations Receiving Out-Of-Area Shipments in FY 1984

Shipped to	Percent of all line items	Percent of all tons	Should be shipped from
Japan/Okinawa	27.4	55.5	Sharpe
Korea	29.0	34.1	Sharpe
Germany	9.1	19.0	New Cumberland
Georgia	32.6	25.4	Red River
California	29.0	60.7	Sharpe
Texas	27.5	24.6	Red River

In many cases, out-of-area shipments were routinely scheduled shipments. For example, Sharpe had three weekly truckload shipments to New Cumberland and New Cumberland had three weekly truckload shipments to California, including two for Sharpe. These out-of-area shipments have contributed to a shift in the work load distribution and operating costs among the three AODs.

Work Load Distribution and Costs of Operation

Since the AODs began operations in 1976, the majority of the work load has shifted to New Cumberland—from 40 percent in 1976 to about 52 percent in 1984. DESCOM's projected work loads for the three AODs show that New Cumberland had and will continue to have, for the foreseeable future, a larger percentage of the work load than the other two AODs combined. Table VII.3 compares past, present, and future work load distribution at the three AODs.

Table VII.3: Work Load Distribution[a]

Numbers in-Percent

	FY 1976	FY 1984 Change from	FY 1976	FY 1990[b]
New Cumberland	39.8	52.2	+12.4	52.3
Red River	40.6	32.1	−8.5	31.9
Sharpe	19.6	15.7	−3.9	15.8
Total	**100.0**	**100.0**		**100.0**

[a]Does not include CCP work load.

[b]Projected.

Table VII.3 shows that (1) since fiscal year 1976, Sharpe and Red River's percentages of the work load have decreased by about 12 percent while New Cumberland's percentage increased by a like amount and (2) New Cumberland is expected to continue handling the major portion of the total AOD work load.

New Cumberland's work load increase has had a significant impact on the operating costs for the three AODs. Historically, material release order processing costs for the AODs have been the highest for Sharpe, which has the lowest work load. Table VII.4 compares fiscal year 1984 processing costs per material release order for shipments from Sharpe and New Cumberland.

Table VII.4: Processing Costs Per Material Release Order for FY 1984

	Sharpe	New Cumberland
Direct cost	$13.76	$9.34
Indirect cost	13.48	7.13
Total	**$27.23**	**$16.47**

Sharpe officials attributed the differences shown in table VII.4 to both higher labor and overhead costs per material release order at Sharpe; however, Sharpe's average cost per labor hour was only about 7 percent higher than that at New Cumberland.

A comparison of the number of similar line items processed per worker in the supply functions of the two AODs during fiscal year 1984 showed that New Cumberland processed about 67 percent more lines per labor hour than Sharpe. Although the number of short tons per labor hour at Sharpe was higher than that at New Cumberland, costs to process a short ton at Sharpe during fiscal year 1984 were more than double those at New Cumberland—$465.00 versus $221.30.

AMC Views and Our Evaluation

AMC stated that the AOD concept was not intended to provide equal distribution of work load among the AODs. Further, AMC stated that out-of-area shipments were not a sign of inefficiencies because they often were made due to availability of less costly means of transportation or need to ensure timely delivery to customers. AMC also stated that higher material release order costs at Sharpe were a natural result because costs were spread over a smaller work load but that this did not necessarily mean higher overall costs to the Army.

We agree that the AOD concept was not intended to provide equal distribution of work load among the AODs. However, we believe that when one depot has only 16 percent of the total work load in a three-depot system, the depot with the significantly smaller work load cannot achieve the economies of scale of the one with the larger work load. We believe the variances in material release order costs are indicators of this situation

and are a measure of inefficiency. AMC said a higher material release order cost at a depot did not necessarily mean a higher overall cost to the Army. We believe such a determination cannot accurately be made without analysis. Further, since a significant amount of out-of-area shipments were being made—regardless of the reason—we believe that benefits to be gained by further consolidation cannot be gauged unless an overall review of the system's operation is performed. We further believe that such an evaluation should be performed before the Army undertakes the AOD modernization program as currently planned.

Agency Comments and Our Evaluation

DOD agreed that in a three-depot system, an activity with only 16 percent of the work load cannot achieve the economies of scale of the depot with a larger work load. However, DOD did not agree that the Army should conduct a system distribution analysis. DOD stated that the Army had recently completed a 7-month study of its wholesale stock positioning and distribution policies and concluded that the existing three AOD depots should be retained, even though it also concluded that effort is required to improve the out-of-area shipment condition described in our draft report. According to DOD, the current Army AOD concept positions materiel closer to the customers, thereby alleviating user order-ship-time delays and increases in transportation cost. DOD further commented that as indicated in AMC's response to our tentative findings, the AODs satisfied over 85 percent of the demand from their respective geographic areas.

The Army's 7-month study of its wholesale stock positioning and distribution policies was a cost-benefit analysis performed on the continental United States physical distribution system for Army Class IX items (repair parts) to evaluate the impact of expanding the number of depots in which stocks were positioned. The study considered expanding the number of depots to as many as eight to see whether savings could be achieved by stocking items closer to customers, thereby reducing transportation costs and order-ship time.

The study concluded that any potential savings were offset by increased initial start-up costs and recurring costs associated with transportation and supply depot operations. Further, the study concluded that as the number of stock positioning points increased, total supply costs increased significantly. Accordingly, the existing distribution network was considered superior to an expanded one. However, the study also concluded that because of less than perfect stock positioning in the existing three depot-system, a considerable volume of shipments was

crossing geographical depot service boundaries, i.e., out-of-area shipments, which, if reduced, could significantly reduce total supply cost and time.

The study pointed out that the current goal for distribution effectiveness was 85 percent and that the 15-percent noneffectiveness representing out-of-area shipments, cost the Army about $1.5 million per year and added about one-half day to the average order-ship-time for shipments. It further stated that the distribution effectiveness rate (for the continental United States only) for 1984 was actually less than the 85-percent goal and that the New Cumberland Depot accounted for about half of all out-of-area shipments. Accordingly, the study recommended that further research be done to improve distribution effectiveness of the existing system and that policy changes, such as AOD boundary adjustments, as we suggested, be considered.

Comments From the Department of Defense

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-8000

LM/SD

ACQUISITION AND LOGISTICS

13 JAN 1986

Mr. Frank C. Conahan
Director, National Security and
International Affairs Division
General Accounting Office
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense response to the General Accounting Office (GAO) draft report, "The Army Area Oriented Depot Modernization Program Should be Reevaluated," dated November 5, 1985 (GAO Code 393001) - OSD Case 6876.

A contract for the Sharpe Depot modernization project was planned for the week following the receipt of the draft report. Award of that contract, therefore, was postponed and personnel from the Army Materiel Command, the Army Depot System Command, and New Cumberland, Sharpe and Red River Army Depots, under the direction of my staff, met to address the issues contained in the draft report.

These personnel reviewed the Army workload projections and economic analyses, as well as each of the findings contained in the draft report. We were concerned that the draft report pointed out a lack of supporting documentation for the workload projections and the economic analyses. My staff, therefore, was insistent that this response be supported by auditable documentation. The results of the review are that the Army Area Oriented Depot (AOD) modernization effort is required, the Army workload projections were conservative and the program is cost effective.

The Department, therefore, does not agree that the program should be delayed in order to examine other options for improving and enhancing the efficiency of existing facilities or to explore realignment of the Army AOD mission. First, as shown in the enclosure (response to Finding H), the planned AOD Modernization Program is cost effective when compared with a status quo alternative of replacing existing equipment with new equipment. Except for reduced maintenance, this alternative would not provide for increased efficiency of operations. The addition of efficiency features would most likely increase the cost to the status quo alternative and thus make the planned AOD modernization more cost effective. In addition, a further delay in proceeding with the planned program, particularly at Sharpe, will increase its cost.

As to conducting a distribution system analysis, the Army recently completed a seven-month study of its wholesale stock positioning and distribution policies. The Army concluded that the existing three AOD depots should be retained and that follow-up effort is required to improve the out-of-area shipment condition described in the draft report. The Department supports the three AOD concept as it positions materiel closer to the customers and thereby precludes user order-ship-time delays and increases in transportation cost.

Specific responses to individual findings and recommendations contained in the draft report are enclosed.

Sincerely,

James P. Wade, Jr.

Enclosure

GAO DRAFT REPORT - DATED NOVEMBER 5, 1985
(GAO CODE 393001) - OSD CASE 6876
"THE ARMY AREA ORIENTED DEPOT MODERNIZATION
PROGRAM SHOULD BE REEVALUATED"
DOD COMMENTS

FINDINGS

FINDING A: The Area Oriented Depot Modernization Program May Not Be Needed. GAO reported that the Army Area Oriented Depot (AOD) Modernization Program is a $488 million project to provide three very sophisticated mechanized distribution centers at Sharpe Army Depot (SHAD) in California, Red River Army Depot (RRAD) in Texas, and New Cumberland Army Depot (NCAD) in Pennsylvania. GAO noted that the basic function of the AODs is to consolidate and ship secondary items managed by the Army Materiel Readiness Commands (MRCs), the Defense Logistics Agency (DLA) and the General Services Administration (GSA). According to GAO, Army justified and planned AOD distribution centers on the basis that they are the most cost effective method to respond to the current force modernization initiatives, which Army projected will increase AOD peacetime workload 68 percent. GAO found that the major savings, projected by Army, would be in the cost avoidance of employing fewer people to process the projected 1990 workloads. GAO also found that the new centers are being designed to handle the entire workload on a single 8-hour shift. After reviewing the Army analyses for the AOD Modernization Program (concentrating on SHAD and NCAD), GAO concluded that there are serious doubts about whether the current scope of the AOD Modernization Program is appropriate in terms of both cost and need. (pp. 1, 2 Letter and 1-3 Appendix I, GAO Draft Report)

Now on pp. 1, 2, 10-12.

DOD POSITION: Partially concur. The DoD concurs that the initial Army analyses raised these types of questions. After corrections, however, the need for the Area Oriented Depot Modernization project is evidenced by the increasing workloads resulting from mission growth and force modernization discussed elsewhere in this response. Though all the analyses of this project, including GAO's, look to the year 1990 as a basis for need, growth beyond 1990 should be expected and planned for. The Area Oriented Depot modernization design allows processing of the conservative workloads, which have been corrected, on a one shift basis. The status quo with quick fixes and 3-shift operations would not be capable of handling the peacetime workload projections, much less store the materiel. Mobilization requirements, peacetime growth beyond 1990, deteriorating equipment and systems, and inefficient facilities designed and built over 40 years ago support continuing with this program. Added to these are the benefits derived from modernization, which are not addressed in the economic analyses, but which are real when comparing status quo to the modernization effort. Improved inventory accuracy, accountability, visibility over operations, and real time capability to respond to emergency requirements are but a few of these benefits.

FINDING B: Workload Projection Methodology for AOD Justification is Questionable. GAO found that Army, in response to GAO's tentative findings of May 8, 1985, performed a second economic analysis of the AOD Modernization Program. In this second analysis, GAO found that Army forecast receipt and shipment workload together. GAO also found that Army projected both an increased use of current line items called "mission growth" and a separate increase in workload by adding Force Modernization items to the inventory. GAO further found that:

-- Army was unable to provide documentation of either the number of new systems (end items) or the number of new Army supply items associated with those end items;

-- Army assumed that new line items entering the supply system would not be offset by current line items becoming less active or inactive;

-- Army included high demand DLA/GSA managed lines in the historical data used to project anticipated Army items demand rates;

-- Army considered Force Modernization demand separate from mission stock demands;

-- Army considered that DLA/GSA item demand would increase due to the impact of Force Modernization and due to new active Army divisions; and,

-- Army assumed that all new lines would be stocked at each AOD.

GAO found, however, that historically, Army did not stock all lines at all three AODs. GAO concluded, therefore, that such an assumption is questionable. GAO pointed out the large quantities of dormant stock, and found that depot demand history shows many items with little or no activity. GAO concluded, therefore, that the assumption that new stocks, force modernization and mission growth are totally additive is flawed. GAO also disagreed that force modernization demand could appropriately be considered separate from mission growth, since history includes both. GAO further concluded that including DLA/GSA demand in historical data, used to forecast Army demand, is inappropriate, and concluded that Army and DLA/GSA demands should be forecasted separately. GAO also concluded that since the new Army divisions are, for the most part, being created by conversion/modification of existing units there should be no new demand increases or increases in personnel or equipment. GAO finally concluded that for these reasons, the AOD distribution center workload projections are questionable. (pp. 4, 8-14, 17-23 Appendix II, GAO Draft Report)

Now on pp. 15-17 and 19-24.

DOD POSITION: Partially concur. The DoD agrees that documentation to support the workload projections contained in the economic analyses and the Army's response to the GAO findings was not complete. A validation process, therefore, was undertaken to address force modernization, mission growth, and DLA/GSA workload. The results of this validation process are as follows:

Force Modernization

Since issuance of the GAO tentative findings in May 1985, HQ Depot System Command (DESCOM) initiated efforts to obtain more concrete data on force modernization workload. Using the automated data base of all secondary items in the Army supply system and Provisioning Master Record Files provided to the HQ U.S. Army Materiel Command's Materiel Readiness Activity from the Materiel Readiness Commands, HQDESCOM personnel were able to identify the number of unique (additive) resupply repair parts expected to incur failures for 120 force modernization systems. According to these automated files, about 36,950 line items or an average of 308 lines per system will be entering the inventory. Additionally, reviews of force modernization systems already fielded that have not yet significantly affected AOD workload showed the number of individual systems requiring wholesale supply support ranged between 276 and 649 systems fielded after October 1983 (fielding dates for the 373 systems were not readily available). Therefore, the number of additional force modernization line items to be stocked at the AOD's is estimated to range between 85,008 (276 x 308) and 199,892 (649 x 308) lines. According to U.S. Army Materiel Command Regulation 740-4, the stockage and issue of secondary items to support field activities worldwide will be limited to New Cumberland, Red River and Sharpe Army Depots. Based on this policy, each AOD will receive 100 percent stockage of secondary items entering the inventory as a result of force modernization. This projected workload is probably understated, as some of the additive secondary items for support equipment (test, measurement, components, etc.) were not included in the correct workload computations. For example, DESCOM identified at least 241 additive items of associated support equipment for the AHF64 Attack Helicopter that will enter the inventory as a result of force modernization, but that are not included in this projected workload.

Mission Growth

FY 1985 actual receipts and shipments were used as the base year. This year was selected because it was the most current and did not have the unusual FY 1984 workload associated with the New Cumberland Army Depot transfer of about 70,000 dormant and high cube line items. Unlike prior calculations, a zero growth factor for Army mission stocks was used. (Though historically there

has been mission growth, the zero growth factor was used to compensate for an unknown amount of items displaced by force modernization.)

DLA/GSA/Other Workload

DLA forecasts a 6 percent increase in workload per year for items under its management. To remain on the conservative side, only half of this growth, or 3 percent per year, was used for computation purposes. This 3 percent growth factor is further supported as DLA/GSA receipts and issues have increased at a rate of about 3 percent a year from FY 1980 to FY 1985. The accumulative impact was a 15 percent growth added to the FY 1985 DLA/GSA workload to achieve a FY 1990 projection. All other stocks, including those owned by the Air Force, Coast Guard, Marines and Navy, were assumed to have a zero growth from FY 1985 workload levels.

Workload Computations

As a result of the new information available on force modernization, the following is a corrected FY 1990 workload projection for New Cumberland, Red River and Sharpe.

NEW CUMBERLAND

The workload projections show that FY 1990 receipts and issues range between 4.0 and 5.5 million. This workload is thus between 90 and 124 percent of that projected in the Second Army economic analysis. The computations are as follows:

ARMY:

Mission

Lines in Storage (30 Sep 1985) = 117,212	
FY 1985 Army Issues	1,358,328
FY 1985 Army Receipts	156,858
Total Transactions	1,515,186

Transactions/Line Item 1,515,186 ÷ 117,212 = 12.93

Force Modernization

Average Lines/System	308
Systems Supported	276 to 649
New Line Items	85,008 to 199,892
Times Transaction Rate (12.93)	
Projected Workload	1,099,153 to 2,584,604

DLA/GSA:

Lines in Storage (30 Sep 1985) = 45,351

FY 1985 DLA/GSA Issues	1,075,987
FY 1985 DLA/GSA Receipts	44,927
Total Transactions	1,120,914

Transactions/Line Item 1,120,914 ÷ 45,351 = 24.72
Projected Workload Increase 3%/Year (FY 1985 - FY 1990 = 15%)
15% x 45,351 = 6803 Lines
6803 x 24.72 = 168,170 Transactions

FY 1990 DLA/GSA Projection:	1,120,914	(FY 1985)
	168,170	(Increase)
	1,289,084	

OTHER:

FY 1985 Receipts	26,255
FY 1985 Issues	72,170
	98,425

(No increase projected)

TOTAL FY 1990 PROJECTION:

FY 1990 Projected Workload (Receipts and Issues)
(in Millions)

	HIGH	LOW
Army Mission	1,515,186	1,515,186
Force Modernization	2,584,604	1,099,153
DLA/GSA	1,289,084	1,289,084
Other	98,425	98,425
Total	5,487,299	4,001,848
Economic Analysis	4,436,000	
Difference	+24%	-10%

RED RIVER

The workload projections show that FY 1990 receipts and issues will be between 2.8 and 4.0 million. This workload is between 101 and 144 percent of that projected in the Army economic analysis. The computations are as follows:

ARMY:

Mission

Lines in storage (30 Sep 1985) = 170,400	
FY 1985 Army Issues	1,374,137
FY 1985 Army Receipts	386,735
Total Transactions	1,760,872

Transactions/Line Item 1,760,872 ÷ 170,400 = 10.33

Force Modernization

Average Line Items/System	308
Systems to Support	276 to 649
Line Items to Support	85,008 to 199,892
Times Transaction Rate (10.33)	
Projected Workload	878,133 to 2,064,884

DLA/GSA:

Lines in Storage (30 Sep 1985) = 21,831	
FY 1985 Issues	157,259
FY 1985 Receipts	11,543
Total Transactions	168,802

Transactions/Line Item 168,802 ÷ 21,831 = 7.73

Projected Workload Increase (FY 1985 - FY 1990 = 15%)
15% x 21,831 x 7.73 = 25,313 Transactions

FY 1990 DLA/GSA Projections:	168,802 (FY 1985)
	25,313 (Increase)
	194,115

OTHER:

Total FY 1985 receipts and issues 646
(no projected increase)

TOTAL FY 1990 PROJECTION:

Total FY 1990 Projected Workload (Receipts and Issues)
(in Millions)

	HIGH	LOW
Army Mission	1,760,872	1,760,872
Force Modernization	2,064,884	878,133
DLA/GSA	194,115	194,115
Other	646	646
Total	4,020,517	2,833,766
Economic Analysis	2,800,000	
Difference	+44%	+1%

SHARPE

The workload projections show that FY 1990 receipts and issues will be between 1.4 and 2.1 million. This workload is between 111 and 165 percent of that projected in the Army economic analysis. The computations are as follows:

ARMY:

Mission

Lines in Storage (30 Sep 1985) = 117,877

FY 1985 Army Issues	587,622
FY 1985 Army Receipts	126,146
Total	713,768

Transactions/Line Item 713,768 ÷ 117,877 = 6.06

Force Modernization

Average Line Items Per System	308
Systems to Support	276 to 649
Line Items to Support	85,008 to 199,892
Times Transaction Rate (6.06)	
Projected Workload	515,149 to 1,211,346

DLA/GSA:

Lines in Storage (30 Sep 1985) = 26,338

FY 1985 Issues	148,510
FY 1985 Receipts	13,890
Total Transactions	162,400

Transactions/Line Item 162,400 ÷ 26,338 = 6.17

Projected Workload Increase (FY 1985 - FY 1990 = 15%)
15% x 26,338 x 6.17 = 24,376

FY 1990 DLA/GSA Projection:	162,400	(FY 1985)
	24,376	(Increase)
	186,776	

OTHER:

Total FY 1985 receipts and issues 660
(no projected increase)

TOTAL FY 1990 PROJECTION:

FY 1990 Projected Workload (Receipts and Issues)
(in Millions)

	HIGH	LOW
Army	713,768	713,768
Force Modernization	1,211,346	515,149
DLA/GSA	186,776	186,776
Other	660	660
Total	2,112,550	1,416,353
Economic Analysis	1,278,000	
Difference	+65%	+11%

Now on p. 16.

FINDING C: Package Processing Point Workload Should Not Be Included. GAO found that the workload projections at NCAD included shipments from the Package Processing Point (PPP). GAO also found that most of the PPP workload will be handled in a recently renovated existing facility and will not be included in the proposed new distribution center. GAO concluded, therefore, that it appears inappropriate to include this workload as part of the justification for a new facility. (The Army removed this workload from its later calculations as noted in its reply to GAO's tentative findings. The Army also informed GAO that many items destined for the PPP, now termed the Unit Material Fielding Point (UMFP), will be received and processed in the depot before being issued to the UMFP, thus creating workload not addressed in the computations.) (pp. 10-12 Appendix II, GAO Draft Report)

DOD POSITION: Partially concur. The UMFP is integrated into the designed Sharpe distribution center and, as such, its workload should be and is included in the justification for the facility. The report notes correctly that the New Cumberland UMFP facility is new and will not be integrated into the distribution center and, therefore, UMFP workload should not be included in the distribution center workload. The New Cumberland distribution center UMFP related workload provided in the Army's response to GAO's tentative findings includes only issues from depot stock to the UMFP and receipts processed by the distribution center for the UMFP.

Now on p. 23.

FINDING D: Container Consolidation Point Workload Calculation is Questionable. GAO found that in revising 1990 workload estimates for the Container Consolidation Point (CCP), Army computed the average annual workload increase over fiscal years 1980 to 1984, and using 1984 as a base year, projected the 1990 CCP workload. GAO found an increase in CCP workload at NCAD and SHAD during FY 1984 accounting for over half of the total growth for the 4-year period. Because Army neither documented the reason why this took place nor determined that it would reoccur between 1984 and 1990, GAO concluded that including this one-time increase renders this calculation questionable. (pp. 23, 24 Appendix II, GAO Draft Report)

DOD POSITION: Partially concur. The DoD agrees that the initial analysis posed questions. Additional analysis of Sharpe and New Cumberland CCP workload data from FY 1975-FY 1985 confirms the reasonableness of the workload projections cited by the Army in response to GAO's tentative findings. Changes in CCP workload from one year to the next do vary substantially, but the overall trend is clearly increasing. In FY 1985, Sharpe and New Cumberland processed 86% and 89%, respectively, of the projected 1990 workload cited in the Army economic analyses (EA). This demonstrates the conservative nature of the Army EA forecasts. Using the FY 1978-FY 1985 versus FY 1981-FY 1984 average annual increase, which would be an even more conservative estimate of expected annual growth (6.0 percent for Sharpe and 7.2 percent for New Cumberland), indicates both depots can expect workload volumes greater than those used in the economic analysis. Using this latter basis, Sharpe can expect to process 112% and New Cumberland can expect to process 121% of the EA volume. Recognizing that short term fluctuations do not affect the long term growth in CCP workload, and the conservative nature of the methodology used to validate this growth, the CCP workload calculations are not questionable. (The net effect of the revised forecast methodology is to under state the potential cost savings cited in the EA.)

FINDING E: Use of MRC Forecasts And Great Differences In Force Modernization Workload Between Methodologies Raises Questions. GAO found that Army, to further support its contention that the original receipts and shipment projections were valid, compared the projections with computations based on forecasts by the Materiel Readiness Commands (MRCs). GAO further found that because Army considers the MRC forecasts to be understated, they were adjusted upward based on the variances between the MRC forecast and the actual workload for the last three years. GAO also found that a projected workload for force modernization was also calculated and added (assuming that force modernization is not included in the MRC forecast), resulting in a total calculated workload within 7 percent of the original economic analyses. According to GAO, Army concluded that this result validates the original calculations. GAO, however, pointed out that:

-- the second computation is based on MRC forecasts that Army disregarded in the original calculations because they were considered unreliable;

-- Army could not document that force modernization is not included in the MRC forecasts and, in fact, GAO was told by the two MRCs visited that force modernization is included in the forecasts of AOD workload; and

-- while the first and second revised estimates are within 8 percent of each other, the force modernization workload in the first computation was four times greater than in the second -- because of the different methodologies for projection, raising more questions about the validity of these forecasts.

GAO concluded, therefore, that it is questionable how this second computation can validate either the original or the revised projections. (pp. 24-26 Appendix II, GAO Draft Report)

Now on pp. 23-24.

DOD POSITION: Concur. The DoD agrees that the different forecasting methodologies used in the Economic Analyses and the Army response to GAO's tentative findings raise questions about the AOD workload projections. Consequently the subsequent DoD review used only auditable data to substantiate the Army's requirements. Based on the methodology contained in this report, the Army's 1990 projections are conservative.

FINDING F: Mobilization Requirement Not Determined And Mobilization Capability May Be Excessive.

GAO found that the AOD distribution centers were sized to process the projected 1990 peacetime workload in one shift, leaving two work shifts available for potential emergencies and to meet mobilization needs. GAO also found that projected 1990 mobilization requirements have not been developed or analyzed. GAO found no evidence to indicate that any evaluation had been made of the trade-offs of a single shift versus a multiple shift operation in a smaller facility to handle total projected workloads. GAO concluded, therefore, that each AOD will have a mobilization capability of three times the peacetime workload, which is nearly twice the planning factor of 1.6 currently in use. GAO further concluded that Army has no way of knowing whether the sizes of the new distribution centers will meet or exceed the requirements. In reporting the Army responses to GAO's tentative findings, GAO noted that Army agreed that mobilization workload was not a factor in sizing the distribution centers. GAO also noted the Army stated that operating in a single shift is Department of the Army policy and consistent with industry practice, although no supporting documentation was provided. GAO agreed that multiple shift operations increase costs and equipment wear, but reiterated that no evaluation had been made of the trade off between single and multiple shift operations. According to GAO, Army stated that the 1.6 mobilization workload planning factor was based on executing only the European theater LOGPLAN, and requirements would be considerably higher if additional LOGPLANs were used in the projections. GAO agreed that workload would be higher if additional LOGPLANs were implemented simultaneously with Europe. GAO pointed out, however, that DoD guidance does not anticipate such an occurrence. GAO concluded, therefore, that it is inappropriate for Army to use multiple LOGPLANs as justification for constructing facilities with capacities far in excess of the 1.6 workload planning factor. (pp. 27-30 Appendix III, GAO Draft Report)

Now on pp. 29-31.

DOD POSITION: Partially concur. The GAO correctly notes that the AOD modernization plan will accommodate a workload surge of approximately three times peacetime requirements and that no mobilization requirements were developed to justify the sizing of the Area Oriented Depots. Though the Army points out that mobilization requirements were not a factor in sizing, multiple shift capability could accommodate a surge of about 200 percent. In contrast, the last major distribution study specifically addressing mobilization, the 1975-1978 Joint Logistic Commanders' Department of Defense Materiel Distribution System (DODMDS) study, indicated that DoD depot system-wide issues would increase under mobilization by 99.2 to 375 percent, depending on the scenario. The 200 percent factor, therefore, is inadequate in some scenarios. In addition, the DoD does not concur that the defense guidance restricts mobilization planning beyond the

European LOGPLAN. Given that the Army has a three AOD concept of storing and resupplying materiel, the mobilization impact on these three depots will be greater than the system-wide DODMDS projections. The Army, accordingly, properly did not restrict its planning to only the European scenario. The GAO in evaluating the Army's response to the tentative findings, apparently misinterpreted the statement that "Army policy and standard industry practices were justifications used in sizing the facilities..." to mean that "...operating on a single shift is Department of Army policy..." This is not the case. A multiple shift operation will be required at Sharpe to process the 1990 peacetime priority requirements.

FINDING G: AOD Equipment Problems Not Documented. GAO reported that Army officials testified, in FY 1985 hearings before House and Senate Committees, that the material handling equipment system in the AODs were old and needed replacement. GAO found that during fiscal years 1979-1984, NCAD spent about $5.2 million and SHAD about $3.8 million on new equipment and improvements in AOD operations. GAO further found that equipment problems were limited to two specific systems -- an overhead power free conveyor at SHAD and NCAD, and a sortation retrieval device at NCAD. GAO found that Army could not identify or document any significant problems associated with other material handling equipment or systems at either depot. Further, GAO found that performance standards at the AODs were being met with existing equipment. According to GAO, Army's response to the tentative findings agreed that AOD equipment problems had not been documented. However, GAO noted, Army officials commented that personnel familiar with the systems know they are inefficient and that labor intensive measures must be taken to keep the equipment operational and to meet the performance standards. Army further commented that past installation of equipment items and subsystems of differing characteristics causing problems in system integration and interfacing. Army also commented that replacement of these systems in existing facilities may appear less costly than installation of new equipment, but other factors or disadvantages must be considered --continued lack of integration, disruption of operations during construction and no increase in capacity. Therefore, GAO noted, Army decided to build new, highly mechanized centers. GAO concluded that it is inappropriate to assume that replacement of older equipment in the present facilities is not a viable solution without a cost-benefit or cost-effectiveness analysis. GAO also concluded that much of the new equipment purchased for NCAD and SHAD over the past 5 years may not be used if the planned new centers become operational. (pp. 31-34 Appendix IV, GAO Draft Report)

Now on pp. 33-34.

DOD POSITION: Partially concur. The DoD agrees that AOD equipment maintenance problems are ill defined; however, the economic analyses for the AOD modernization projects provide adequate documentation. Under Alternative I, it is assumed rightly that existing inefficient or inoperable equipment or equipment exceeding its economic life will be replaced and additional equipment will be procured to meet forecasted workloads. Further, meeting work standards with existing equipment around which the standards have been developed does not indicate the lack of need for equipment with enhanced capabilities. The workload expected from current force modernization initiatives is beyond the capability of the AODs to handle by merely upgrading existing facilities as envisioned in Alternative I. Under Alternative II, existing operable equipment will be used throughout the distribution center and in nonmechanized bulk storage warehouses. The DoD, therefore, also does not agree that current equipment will not be used if the new centers become operational.

FINDING H: Economic Analyses Show Marginal Cost Effectiveness. GAO noted that the Army economic analyses for SHAD and NCAD considered two alternatives: (1) remaining in existing facilities and replacing existing equipment with equivalent new equipment, and (2) building new sophisticated distribution centers. GAO found that Army calculated savings-to-investment ratios (SIRs) based on an economic life of ten years, and under alternative two, the SIR for SHAD is only 1.11 with an 8-year payback period and the SIR for NCAD is 1.2 with a 7.2 year payback period. GAO concluded that the SIRs are, at best, marginal. GAO, however, also found that significant investment costs were omitted -- at least $63.7 million of software development, design and associated costs, as well as the cost of hiring additional personnel to oversee construction and the cost of relocating 70,000 items from NCAD. According to GAO, Army agreed that certain costs were omitted from the economic analyses; however, most of these costs, Army contended, should be applied to both alternatives and would have a minimal overall effect on the analyses. GAO disagreed, concluding that none of the software, facility or equipment design costs are applicable to alternative one as conceived in the present economic analyses. GAO also concluded that Army should not include the 70,000 relocated items and the resulting $7 million recurring outside storage cost in its NCAD analysis without also including the additional $7.4 million of one-time relocation cost for the items. GAO pointed out that excluding both the recurring storage cost and the nonrecurring relocation cost causes the NCAD payback period to exceed 20 years. GAO also pointed out that, if all the costs are included in the NCAD and SHAD analyses, the SHAD breakeven point is about 20 years and the NCAD breakeven point is about 11 years. Finally, GAO concluded that relatively minor escalation in construction and/or recurring costs, particularly for SHAD, could change the preferred alternative, i.e., if the initial $90.3 million SHAD distribution center cost was increased approximately 11 percent to about $100.4 million, alternative one would be preferable. GAO noted that, as of October 1985, contractor bids have been considerably higher than $100.4 million. (As of November 8, 1985, the OSD staff estimated the cost of SHAD to be $117 million.) (pp. 35-40, 42, 43 Appendix V, GAO Draft Report)

Now on pp. 36-39.

DOD POSITION: Partially concur. The DoD agrees that the SHAD and NCAD Economic Analyses considered two alternatives, a "status quo" and new sophisticated distribution centers. The DoD also agrees that the SIRs for SHAD and NCAD are 1.11 and 1.2 respectively, for 10 year economic lives, and that the SIRs are marginal. In addition, the DoD agrees that certain investment costs were omitted -- software development, design, and the cost of hiring amounting to $56.3 million. These costs have, therefore, been included in the current analyses. The DoD, however, disagrees with including the cost of relocating about 70,000 line items from NCAD since it is a cost to both

alternatives and, therefore, may correctly be omitted. To allow storage space to house these items at the optimum storage space utilization rate of 85%, which is already exceeded at each of the affected depots, a warehouse construction project was added to alternative one, and the recurring annual outside storage cost was eliminated. In addition to these alterations, the DoD restructured the Sharpe and New Cumberland Army Depots economic analyses, extending the economic life of each alternative to 25 years, assuming replacement of automated data processing and depot equipment at 10 year intervals, including escalated annual labor costs of a constant 3 percent and making several other alternations of a conservative nature. All the changes were in accordance with, or permitted by, the DoD regulations. If SHAD costs are escalated to an estimated $117 million, the restructured analysis indicates that the western distribution center is economically viable, with an estimated savings to investment ratio of 1.03. For the Eastern Distribution Center, using the same method showed a savings to investment ratio of 1.8.

FINDING I: Economic Analyses Did Not Treat All Viable Alternatives. GAO found that the SHAD and NCAD economic analyses did not consider alternatives for more efficiently handling the workload in the existing facilities. GAO pointed out possibilities for bar-coding, redesign of work flow, different material handling systems and computer aided scheduling and progress reporting. GAO noted a 1975 SHAD modernization plan, that for an investment of $5.7 million, estimated a labor requirements reduction of 136-195 positions. GAO also noted a similar effort, the Automated Warehousing and Retrieval System (AWARES), recently completed at one of DLA's least automated depots. The AWARES improvements, according to GAO, included a new conveyor system, increased computer capability and material handling equipment with bar-coding capability at a cost of $14.6 million. According to GAO, DLA officials also claim increased productivity. GAO concluded that the economic analyses should address all feasible alternatives and examine the cost of each in detail. Army, in commenting on the GAO tentative findings, advised that all alternatives for processing the increased workload were considered. GAO disagreed, noting that the documentation provided by Army showed the same alternatives were considered in both the original and revised Army analyses. (pp. 35, 36, 40-44 Appendix V, GAO Draft Report)

Now on pp. 39-41.

DOD POSITION: Partially concur. The DoD agrees that the formal Economic Analysis for each AOD documented savings for only two alternatives, i.e., the status quo and the distribution center; however, the development of methodologies to meet the projected forecast considered numerous alternatives. In addition to the economic analyses, the Area Oriented Depot design development documentation included three discrete volumes, which provided engineering and cost analysis for 19 major functional subsystems within the distribution center. Each subsystem analysis included a life cycle cost evaluation of numerous types of alternative material handling equipment. GAO described two projects that provided evidence of the potential for improved efficiencies; a 1975 SHAD project entitled "Modernization Plan for the Western Distribution Facilities," and a 1980 DLA project entitled "Automated Warehousing and Retrieval System" (AWARES). The 1975 SHAD project considered a short term solution to increased workload known at that time. The SHAD line item workload today is more than double what it was in 1975 and exceeds the capability discussed in the SHAD 1975 project. An Army review of AWARES found it to be incomplete in terms of meeting Area Oriented Depot operational requirements. Originally conceived as the "Defense Integrated Storage and Retrieval System (DISARS) in 1974, a contract for the project was awarded in July 1978. The selected contractor was unable to successfully implement the full scope of the project, resulting in termination of the contract. Redesignated as AWARES, the equipment and facility requirements have been completed while software development proceeded as an in-house effort to a lower scope than initially conceived under

DISARS. DLA is now undertaking a major effort to enhance AWARES to achieve many of the benefits sought by the Army. However, such benefits will not include all those resulting from implementation of Area Oriented Depot functions (e.g. Consolidation and Containerization Point operations, receiving, and transportation).

FINDING J: Modernization Mechanization May Be Overly Sophisticated for The Basic AOD Mission. GAO found that despite the extensive mechanization being built into the new distribution centers, the most active items will be stored in a manual picking area. GAO noted that, according to the Army's design-engineering firm (1) 1.6 percent of the lines stored at NCAD accounted for 31 percent of the workload, and (2) the pick method for high activity items would offer greater efficiency than mechanization. GAO found that most Army line items had few or no demands in FY 1984, as follows:

Demands Per Line Per Year	Percentage of Stocked Items	
	SHAD	NCAD
None	55.4	23.3 a/
1 - 9	33.6	44.2 a/
10-19	4.9	9.3
20 and over	6.1	13.2
	100.0	100.0

a/ Adjusted to reflect status before dormant stock relocation program implementation in summer of 1984.

GAO concluded that some of the highly mechanized features being designed into the new facilities may be inconsistent and overly sophisticated for the basic AOD mission. In responding to GAO's tentative findings, Army officials advised it is an industry accepted standard that the manual pick method is most efficient in an area where there is a restricted number of fast moving lines. GAO concluded that this may be the case, but continued to have reservations about the need for highly mechanized facilities where most of the line items have nine or fewer demands in a year (89 percent for SHAD, 77.5 percent for NCAD). (pp. 45-47 Appendix VI, GAO Draft Report)

Now on pp. 45-46.

DOD POSITION: Partially concur. The DoD agrees with the facts but not with the GAO conclusions. During the facility design, cost analyses of available material handling systems which could accommodate the Army's AOD mission were developed. The complexity of systems analyzed ranged from labor intensive to highly mechanized systems. These analyses were utilized to select the most economical degree of mechanization. The Army rationale for selecting a less mechanized pick operation in the highly active storage area and the more mechanized computer controlled vehicles in the high-rise areas is based upon industrial engineering analyses. Despite the relatively low activity per line item, approximately 65 percent of the issue activity is in the high-rise storage area where travel distances support mechanized movement as the most efficient method. Conversely, in the restricted-space, high-volume area where travel distance is minimum, the hand pick operation is the most efficient.

FINDING K: Lack of Backup Electrical Power Makes Modernized AODs Less Capable In A Power Outage Than The Present Depots. GAO found that the new distribution centers will depend very heavily on electrical power due to the new material handling and other equipment. GAO also found that because of limited backup power available at SHAD, the new distribution center will operate at about 50 percent of normal capability during power emergencies -- NCAD will have an even lesser capability. GAO noted that in current facilities, with 20-foot high storage areas and battery or gasoline powered present equipment, work could continue. GAO concluded that because of the increased dependency on electrical power and only limited backup capability being provided, some of the features of the new centers may cause the facilities to be less capable in certain situations than the current facilities. According to GAO, in commenting on the tentative findings, Army said that sufficient provisions have been made to minimize the effect of power disruptions, and power outages are not a problem at the depots. GAO, however, concluded that a loss of power for any extended period of time will significantly degrade the performance of the depots, particularly if the disruption occurs during a period of mobilization. (pp. 45-48 Appendix VI, GAO Draft Report)

Now on p. 45.

DOD POSITION: Nonconcur. Both SHAD and NCAD have highly reliable electrical power sources with only SHAD experiencing a sustained power outage in the last decade. With additional electrical generation provided with the Sharpe Area Oriented Depot project, the distribution center will have emergency backup electrical power to satisfy almost 80 percent of the total electrical load. SHAD will, therefore, be capable of sustaining full peacetime workload with limited overtime and will have the capability to provide mobilization support. The New cumberland Area Oriented Depot will be provided with emergency backup electrical power to satisfy over 56 percent of the total load. Additional portable generation can be provided within 24 hours to sustain full operation. Despite the increased reliance on electrical power in the distribution centers, the available generation capacity will ensure the modernized Area Oriented Depots will not suffer greater degradation of performance than the present depots in a power outage.

FINDING L: An Evaluation Of The Current Organizational Structure And Operation Of The AODs Should Be Made Before Modernization Of The Depots Is Begun. GAO found that since 1975, the workload distribution among the AODs has shifted significantly from SHAD and RRAD to NCAD (NCAD had 40 percent of the workload in 1976, increasing to about 52 percent in 1984). GAO also found that during FY 1984, 25.4 percent of CONUS and 11.3 percent of overseas shipments were out-of-area (shipments from one AOD to locations assigned to another AOD). GAO concluded that this workload shift appears to be the result of the high level of out-of-area shipments and the transfer of responsibility for supporting Latin America from RRAD to NCAD. GAO noted Army forecasts that NCAD will continue having a workload greater than the other AODs combined. This workload shift, GAO concluded, has resulted in a wide disparity in operating costs and efficiency among the AODs (SHAD material release order (MRO) costs were $27.33, vice $16.47 at NCAD). Because the current workload distribution is projected to remain stable through 1990, GAO concluded that the planned AOD Modernization Program will tend to perpetuate these disparities and inefficiencies. GAO further concluded, therefore, that an overall analysis should be made of the current organizational structure and operation of the AODs. GAO reported that Army, in commenting on the tentative findings, stated that (1) the AOD concept was not intended to equalize workload among the AODs, (2) out-of-area shipments are not a sign of inefficiencies, and (3) higher MRO costs at SHAD are a natural result of costs being spread over a smaller workload, but this does not necessarily mean higher overall costs to the Army. GAO agreed that the AOD concept was not instituted to provide and equal distribution of workload among AODs. GAO concluded, however, that in a three depot system, the depot with only 16 percent of the workload cannot achieve the economies of scale of the depot with a larger workload, and the variances in MRO costs are basic indicators of this situation and a measure of inefficiency. GAO also concluded that the Army statement of a higher MRO costs at a depot not necessarily meaning a higher overall cost cannot be made without analysis. GAO reiterated its earlier conclusion that since a significant amount of out-of-area shipments are made--regardless of the reason--the benefits to be gained by further consolidation cannot be gauged unless an overall review of the system is performed. GAO finally concluded that such an evaluation should be performed before the Army undertakes the AOD Modernization Program as currently planned. (pp. 49-54 Appendix VII, GAO Draft Report)

Now on pp. 47-50.

DOD POSITION: Partially concur. The DoD agrees that in a three depot system, an activity with only 16 percent of the workload cannot achieve the economies of scale of the depot with a larger workload. Specific calculations are not required, however, for the DoD to know that the economics involved in any diversion of workload from the larger to the smaller Army depots would be offset by existing economy of scale benefits, and would result in

additional transportation costs due to longer shipping distances and would reduce the level of service to the customer. In August 1985, the Army completed a seven month study of its wholesale stock positioning and distribution policies and concluded that the existing three AOD system should be maintained, after recognizing that out-of-area shipments have a detrimental effect in total supply cost and customer service. As indicated in the Army response to GAO's tentative findings, however, the AODs satisfy over 85 percent of the demand from their respective geographic areas.

RECOMMENDATIONS

RECOMMENDATION 1: GAO recommended that the Secretary of the Army direct the Commander, United States Army Materiel Command to reevaluate the AOD peacetime workload projections using statistically valid forecasting principles and develop capacity or capability needed to support emergencies and mobilization. (p. 4, GAO Draft Report)

Now on pp. 2,3.

DOD POSITION: Concur. The recommended review was conducted during November 18 - 22, 1985, at New Cumberland Army Depot, Pennsylvania, under the direction of the Office of the Assistant Secretary of Defense (Acquisition and Logistics). This review demonstrated the reasonableness of the Army projected 1990 workload (see response to Findings B, C, D, and E) and addressed the amount of excess capacity or capability needed to support emergencies or mobilization (see response to Finding F).

RECOMMENDATION 2: GAO recommended that the Secretary of the Army direct the Commander, United States Army Materiel Command to examine options for improving and enhancing the efficiency and capability of existing facilities and compare the cost effectiveness of these options to the total cost of constructing new distribution centers. (p. 4, GAO Draft Report)

DOD POSITION: Nonconcur. The Department does not agree that the program should be delayed further in order to examine other options for improving and enhancing the efficiency of existing facilities or to explore realignment of the Army AOD missions. First, as shown in the response to Finding H, the designed AOD modernization plan is cost effective when compared with a status-quo alternative of replacing existing equipment with new equipment. Except for reduced maintenance, this alternative does not provide for increased efficiency of operations. The addition of efficiency features to the status-quo alternative would make the planned AOD modernization more cost effective. Furthermore, a delay in proceeding with the planned program, particularly at Sharpe, will increase the program cost.

RECOMMENDATION 3: GAO recommended that the Secretary of the Army direct the Commander, United States Army Materiel Command to analyze the AOD's current operations and workload distribution imbalances to identify potential economies and efficiencies to be gained by further consolidation and realignment of the AOD system. (p. 4, GAO Draft Report)

Now on p. 3.

DOD POSITION: Nonconcur. The Department does not agree that the Army should conduct a distribution system analysis. The Army recently completed a seven-month study of its wholesale stock positioning and distribution policies and concluded that the existing three AOD depots should be retained, even though it also concluded that effort is required to improve the out-of-area shipment condition described in the draft report (Finding L). The current Army AOD concept positions materiel closer to the customers, thereby alleviating user order-ship-time delays and increases in transportation cost.

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