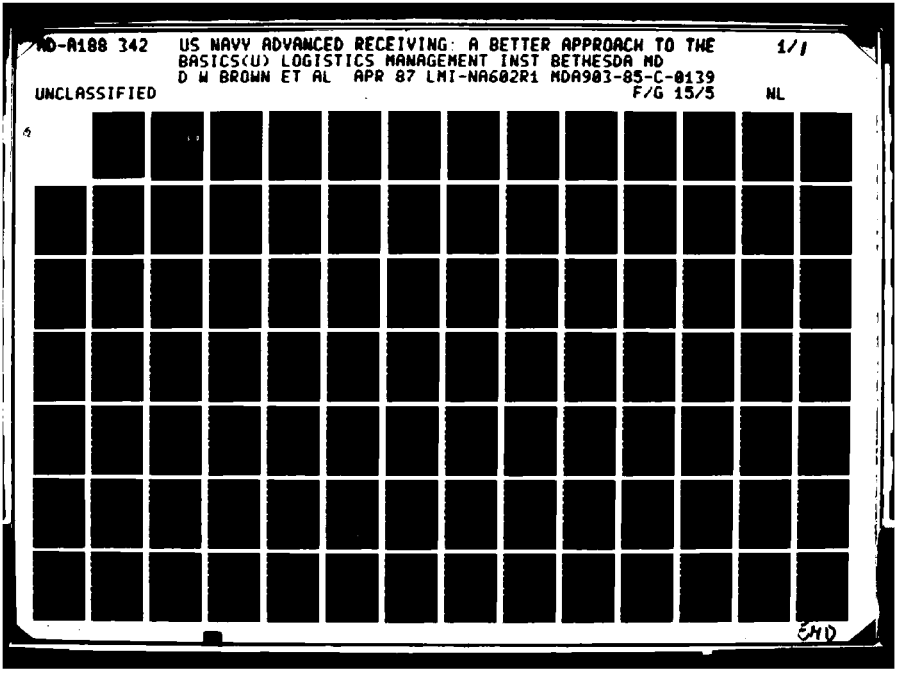
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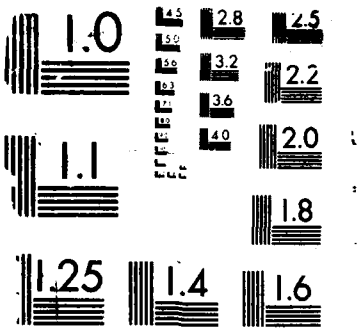

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U.S. NAVY ADVANCED RECEIVING: A BETTER APPROACH TO THE BASICS

Report NA602R1

April 1987

Douglas W. Brown
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To reduce the time and cost necessary to receive material into Naval Supply Center (NSC) inventories and to improve control of material in transit, the Naval Supply Systems Command (NAVSUP) is considering a major restructuring of its wholesale distribution process. That change, called Advanced Receiving, consists of introducing a receipt into the Navy's physical distribution system near its origin rather than at its destination (the NSC); consolidating and transporting the material using Navy-contracted freight carriers; and delivering it directly to an NSC storage location without using a central receiving function.

This study evaluates the feasibility of Advanced Receiving. We conclude that it will: improve the traceability and control of material in transit, lower the cost of transportation to DoD, reduce order and ship time (and inventory pipeline), and lower the cost of labor and supplies now required to ship and receive Navy material. It also cautions that Advanced Receiving must be carefully designed to take advantage of those benefits. Specific recommendations in the areas of quality, accountability, training, and material consolidation are presented.

We recommend that Advanced Receiving be implemented, and that it be operated by a commercial contractor. After implementation, we recommend that NAVSUP consider expansion to include first-destination contract material, GSA issues and repairable material into Advanced Receiving's transportation network.

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Executive Summary

U.S. NAVY ADVANCED RECEIVING: A BETTER APPROACH TO THE BASICS

To reduce the time and cost necessary to receive material into Naval Supply Center (NSC) inventories and to improve control of material in transit, the Naval Supply Systems Command (NAVSUP) is considering a major restructuring of its wholesale distribution process. That change, called Advanced Receiving, consists of introducing material into the Navy's physical distribution system near its origin rather than at its destination (the NSC); consolidating and transporting the material using Navy-contracted freight carriers; and delivering it directly to an NSC storage location without central receiving.

We support Advanced Receiving. It takes advantage of recent improvements in telecommunications, transportation services, and material control to reduce the cost of processing Navy receipts and improve their visibility and control. We have concerns, however, about quality, accountability, training and material consolidation that must be addressed to realize the full potential of the benefits.

Based on analysis of material movements from the Defense Logistics Agency (DLA) to NSCs, from NSCs back to DLA, and between NSCs, we have identified the benefits and steps to take maximum advantage of them.

- **Material in transit will be more readily traced and more effectively controlled.** With records for each requisition being created at the source and used throughout the system, specific line-item tracking will be possible. To make best use of that capability, several features should be designed into Advanced Receiving from the start. Direct delivery will require a manifest for each delivery location. Acceptance at each destination will be required to show that material is on-site and is no longer under the contractor's control. NAVSUP should design the manifest and acceptance processes to assure that it does not simply shift the costs of central receiving from one location to another. Both processes must be automated for labor savings to occur. We recommend that the Navy's inventory management system be modified to categorize receipts as "in-transit" or "in-process" (within the NSC) to prevent loss of material and to aid in monitoring carrier and NSC performance.

- **Transportation costs will be lower than DLA now pays.** The transportation costs that DLA now pays are generally quite low. In the Richmond-Norfolk corridor, however, existing guaranteed freight rates are very high. We project that the Navy could save $600,000 per year by negotiating better rates in that corridor alone. In addition, the Navy could divert expensive small-parcel shipments to less expensive truck shipments at a savings of $3.2 million per year. We do not foresee significant savings from including backhaul shipments (from NSCs to DLA), shipments between NSCs, or local deliveries from NSCs to outlying Navy activities in Advanced Receiving.

- **Order and shipping time will be reduced by eliminating DLA consolidation at the origin and by delivering material directly to the storage location at its NSC destination.** Shipments will still be consolidated, but the material will be held for less time than it is under present DLA procedures. Reduced order and shipping time (OST) will gradually reduce inventory investment as NSC computers recognize OST reductions and recalculate reorder levels to correspond. We see a potential for saving $460,000 for each one-day reduction in OST between DLA and NSC Norfolk. When it consolidates material, the Navy must truck in sufficient volumes to take advantage of low transportation rates or OST savings will be offset. Direct delivery will also reduce OST because it eliminates receiving queues and reduces handling.

- **Labor and material costs will be reduced.** Reduced material handling and lower processing costs will result under Advanced Receiving as DLA depots perform less packaging and NSC receiving sections experience smaller workloads. Management and oversight of the Advanced Receiving contract will increase labor costs, but not nearly to the exclusion of savings. Critical to the reduction of labor costs is the design of the mechanism for transferring material from the carrier to the NSC. Bar coded Material Movement Documents should be scanned at point of delivery as part of the acceptance process. Accountability, throughput, and costs will all depend on a quick and accurate transfer.

We recommend that NAVSUP use a commercial contractor to operate Advanced Receiving. While DLA could process and consolidate material at lower initial cost, a commercial contract offers the Navy greater flexibility in the formative stages of the system when rapid changes may be necessary. After implementation, it is likely that General Services Administration receipts, repairable returns and commercial vendor receipts could be incorporated into Advanced Receiving. Such material would provide sufficient additional volume to assure low unit costs within the short consolidation period NAVSUP desires. Finally, we recommend that costly double counting of material be eliminated. Statistical sampling at DLA and the

NSCs will suffice for contractor accountability. It will provide ample inventory accuracy at a fraction of the cost of complete counts.

For the long term, the Navy and DLA should begin now to plan for electronic interchange of data between their inventory management systems. This would eliminate the duplication of data entry cost that exists under the present system and is retained under Advanced Receiving. Efficient integration of supplier and customer operations is now possible and should be jointly pursued.

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CONTENTS (Continued)

CHAPTER 1

INTRODUCTION

The U.S. Navy operates a wholesale physical distribution system that maintains an inventory worth $16 billion. As part of a continuing effort to improve that system, the Naval Supply Systems Command (NAVSUP) has focused on receiving functions at its Naval Supply Centers (NSCs) as an area in which material control could be improved and money saved. LMI was tasked by NAVSUP to examine the feasibility of its proposed changes for achieving these goals.

PROPOSED CHANGES

Collectively called Advanced Receiving, NAVSUP's changes significantly alter the receiving process. Material would be processed into the Navy's physical distribution system at a processing hub near its point of issue, rather than at a destination NSC where it is stored. It would be loaded into a truck in storage-location sequence and consolidated with other Navy material bound for the same area. It would then be transported in cost-effective, truckload quantities directly to its NSC storage location without using the NSC Central Receiving facility.

EXPECTED BENEFITS TO THE SYSTEM

The Navy expects to realize the following benefits from Advanced Receiving:

- Improved control, traceability, and visibility of incoming material receipts from the point of issue to final storage through the use of material manifests and automatic identification
- Decreased time for ordering, shipping, and storing material because of reduced consolidation time and fewer processing queues
- Major transportation cost savings because improved consolidation and reduced use of small-parcel shipments lead to better freight rates
- Productivity improvement and labor savings from work simplification, improved material handling, and better work load planning

- Material savings from reduced packaging and use of reusable shipping containers.

SCOPE OF ADVANCED RECEIVING

NAVSUP chose to limit the scope of its initial Advanced Receiving distribution network to facilitate the identification of operating costs, to work out start-up problems, and to perfect operating procedures. In total, NSCs receive material from many sources. The Defense Logistics Agency (DLA), the General Services Administration (GSA), and outside commercial vendors ship large volumes, while other NSCs, other Navy sources, and other Services ship smaller volumes. NAVSUP has selected the following movements for its initial Advanced Receiving system:

- From DLA depots to NSCs
- To DLA depots from NSCs and activities in the vicinity of NSCs
- Between Navy activities (NSCs, Navy outports, and activities in their vicinity) in the continental United States.

When limited to that scope, the initial Advanced Receiving network includes the 19 Navy and DLA points listed in Table 1-1.

TABLE 1-1

THE ADVANCED RECEIVING NETWORK

Navy	DLA
Norfolk, VA	Tracy, CA
Charleston, SC	Ogden, UT
Pensacola, FL	Mechanicsburg, PA
Jacksonville, FL	Columbus, OH
San Diego, CA	Richmond, VA
Oakland, CA	Memphis, TN
Bremerton, WA	
Oakland, CA (Outport)	
Long Beach, CA (Outport)	
Seattle, WA (Outport)	
Cape Canaveral, FL (Outport)	
Bayonne, NJ (Outport)	
New Orleans, LA (Outport)	

Under NAVSUP's Advanced Receiving design, Navy material issued from DLA depots will be processed and consolidated in a hub at or near the depots. Material flowing in the opposite direction, from the Navy to DLA, will be consolidated at the NSCs or, to a lesser extent, at other Navy activities in the vicinity of the NSCs. Material being shipped from one NSC to another will be consolidated with other Navy material originating in the vicinity of the receiving NSC. All material will be shipped under Navy control. By analogy, Advanced Receiving transportation will be a big pipeline with a funnel at each end. Since the cost of Advanced Receiving transportation is in many respects fixed, the more that goes into the funnel, the lower the cost of moving each pound of material through it.

We support Advanced Receiving. We think it offers the potential for significant cost savings and much improved material control. We also believe that Advanced Receiving must be carefully designed to avoid problems in the areas of quality, accountability, training, and material consolidation that might rob it of its cost savings and adversely affect inventory accuracy.

STUDY APPROACH

We used a computer to model 11 different ways of moving material among the 19 points; one was the current Navy/DLA system, and the other 10 were possible alternative Advanced Receiving systems. By comparing the costs of the current system to alternative systems, we projected potential savings for each alternative. Based on first-hand observation and a review of lessons learned from a limited Navy test of Advanced Receiving conducted in 1986, we also identified those actions we think Navy should consider in its design of its initial Advanced Receiving system.

CHAPTER 2

BACKGROUND

CURRENT RECEIVING PROCEDURES

The NSCs process two basic types of receipts, stock and direct turnover (DTO) material. Stock, the largest category, consists of material that the NSC stores to satisfy future customer demands. Direct turnover consists of material that belongs to NSC customers, particularly afloat customers who may not always be available, for whom the NSC provides receiving services.

A small percentage of receipts, particularly of DTO items, are critical customer requirements that warrant expensive overnight air shipment. Most receipts, however, are low-priority Issue Group Two and Group Three material for which delivery time is driven by the desire to minimize cost rather than to expedite service.[1] That material is shipped by truck after a period of consolidation at the source to build larger shipments for movement at lower unit rates.

Transportation Costs

Transportation costs are quoted in terms of the expense to ship each hundred pounds, or hundredweight (CWT) in a shipment. Costs are highest for low-weight shipments, such as mail and small parcels, and lowest for truckloads of 40,000 pounds. At DLA, for example, we found costs of approximately $55/CWT for mail and small-parcel shipments and $4/CWT for a 40,000-pound truckload. In many cases, these rates are established as a result of contractual negotiations.

An understanding of the reasons that transportation costs vary so widely is important because those variations affect the costs of any future Advanced Receiving system. Smaller weight shipments cost a carrier more to process because they require more handling to pickup, consolidate, and deliver. Larger shipments cost a

[1]Issue Group is the common term for Issue Priority Groups: Codes which express the relative importance of requisitions and material movement transactions in terms of competition for logistics system resources. There are three Issue Groups, with Issue Group One denoting the highest priority of transactions and Issue Group Three the lowest priority.

carrier less to deliver because they allow him to distribute such fixed costs as driver salary and equipment over more CWT units in a shipment. All of these factors are reflected in the rates that carriers offer.

Transportation rates are known generally as less-than-truck load (LTL) and truckload rates. LTL rates are usually quoted for shipments of less than 10,000 pounds. Carriers pick up and consolidate such shipments with other LTL shipments to build truckload quantities for cross-country movement. Truckload rates apply to shipments that are usually over 10,000 pounds and that move directly from one point to another without further consolidation. The greater the weight shipped in either rate category, the lower the cost per CWT to the shipper. For a given carrier over the same route, rates for truckload quantities are always less than LTL rates.

Freight Consolidation

The degree of freight consolidation at a source is determined primarily by DoD customer-service time standards. The DoD Uniform Material Movement Issue Priority System (UMMIPS) sets the maximum time that a source distribution manager has to get material to the customer. That time begins when a material requisition is received at a source and ends when the material is physically delivered to the customer. The standards depend on the priority that the NSC assigns when requesting material. For Issue Group Three stock material, the source has 21 days to get material to the NSC.

For planning purposes, source distribution managers use the following equation to determine maximum consolidation time:

Maximum consolidation time = 21 days – (in-house requisition processing time + material transit time to the customer)

Distribution managers use the maximum consolidation time to generate the most efficient shipping quantities and to maximize their own warehouse issue productivity. For example, at DLA incoming material requisitions are accumulated in the computer. If the computer indicates that a full truckload of issues is available before the maximum consolidation time has elapsed, the distribution manager can issue material at any time up to the end of the consolidation period. He then notifies a carrier, packs material, and ships it. If consolidation time runs out before truckload

quantities are achieved, accumulated material is shipped. Whether a shipment moves at truckload or LTL rates depends on the amount of material accumulated at the time of shipment.

Within the limits imposed by the maximum consolidation time, a distribution manager also considers the efficiency of the warehouse workforce before directing the computer to release issues to an NSC. He recognizes that large volumes of issues improve depot labor productivity and decrease labor costs. He also knows that his only obligation is to get the material to the NSC within 21 days. As a result, issues will often accumulate in the computer past the point of truckload quantities so that they can be picked in scheduled weekly or biweekly production runs. Given the variables of the maximum consolidation period equation, truckload quantities may be held for as much as 2 weeks before being picked if the requisitioning NSC is close to the DLA depot and the transit time is short.

This practice has several adverse effects for the Navy. First, order and shipment time is extended when truckloads are not shipped as they occur. That extension generates a cost to the Navy which must fund sufficient safety stock to prevent outages until reorders arrive. The costs that are so generated are commonly referred to as pipeline costs. Second, multiple, simultaneous truckload arrivals at an NSC create workload surges in the receiving functions and increase labor costs when overtime must be used to process receipts in accordance with NAVSUP-imposed receipt performance standards.

NSC Receiving

Once delivered to an NSC Central Receiving facility, stock receipts move through several processing steps and multiple queues before being stored. They are first unloaded from the truck and queued for receipt processing on a first-in, first-out basis. When a worker becomes available, material is counted and checked to ensure that the receipts comply with requisition specifications. Data on the received material are then processed into the NSC computer to produce a Material Movement Document (MMD), which provides the stock number, and document number, storage bin location and the date on which material must be stored to meet NAVSUP receipt performance standards.

Keying on location and "must stow" date, NSC warehouse workers and transportation personnel schedule and then physically move material to its storage

building. In many cases, the storage location is not in the same building as Central Receiving and multiple material handling steps (local delivery trucks, fork lifts, conveyor systems, and human effort) are required. Queues often develop for each step.

Final processing and storage of received material also involves several actions. As material is placed in its storage location, a warehouse worker counts and checks it again to ensure that the quantity and stock number match those on the MMD he must sign. The storage action is posted to the computer by inputting a unique five-digit receipt control number that is printed on the MMD. With this action, master inventory levels on the computer are increased by the amount of the receipt.

Duplicate counts and checks at Central Receiving and at storage are expensive features of the current system. Experts have contended for some time that double counts increase handling costs and may actually decrease accuracy. NSCs engage in such double counting because of a conviction that two counts are better than one, especially in light of the current NAVSUP emphasis on inventory accuracy.

NAVSUP material handling standards allow 7 calendar days for the entire period from material arrival at Central Receiving to the point at which the completed receipt is posted to the computer. Within that 7-day period, 90 percent of received material must be stored. The 7 calendar days begin on the day the material arrives at Central Receiving (commonly referred to as the tailgate date) and not the date that material is processed in Central Receiving. Because of backlogs, caused in part by unexpected surges in incoming receipts, Central Receiving may not process a shipment for several days.

CURRENT METHODS OF MATERIAL CONTROL

Various features to control and track the flow of material and to minimize material loss are designed into current receipt processing routines. As stock is ordered from DLA by the NSC computer, a "due-in" record is created to establish that material is on order but not yet received. The due-in record is closed when the material is subsequently processed for receipt by the NSC, and at that point, an "in-process" record is created. These two types of records allow the NSC to track orders

that remain outstanding, to measure internal performance against time standards, and to notify storage managers of "late stows"[2] that may have gone awry. In-process records also provide the receipt visibility that material expeditors need to satisfy critical customer needs.

Custody Transfer

Control procedures center around how material custody for shipment is transferred, first between DLA and a carrier and then between the carrier and the NSC. At DLA depots, packed material is released to a carrier when the driver accepts the shipment by validating and signing for a shipment's pieces, weight, and volume. Upon arrival at the NSC, the driver turns material over to the Navy after Central Receiving validates the number of pieces, weight, and volume.

While each piece or container that a carrier delivers may contain several hundred issues, each of which is distinguished by its own document number, the carrier is unaware of what is in each container and is only concerned with making the delivery and obtaining a signature for the items that he originally signed for and picked up at the DLA depot. Carrier liability for loss or damage is limited to a set dollar value per pound, not the value of the contents.

NSC Receiving

In one current system, an NSC warehouse worker has no way of knowing what should be in a shipment since no manifest exists against which to check incoming material. What does exist is a bundle of documents in each shipping container that duplicate those attached to material within. If an item is left out of a shipment, the NSC has no way of knowing that it should have been included. Only after its due-in record becomes delinquent will NSC clerical personnel attempt to resolve an overdue receipt by matching the outstanding due-in record against the shipping status provided by DLA. Even this practice is not foolproof since, for various reasons, due-in records may still exist after material is physically received and properly placed on the shelf. The process of identifying and tracking lost material is tedious and time consuming, requires significant computer skill, and is often not successful in resolving discrepancies for which an NSC must pay.

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[2]Receipts that have been "in process" for an excessive period of time.

Many of the same NSC receiving procedures are used for DTO material. Centrally received, queued, counted, and checked against enclosed paperwork, DTO material is initially processed much the same as stock material. The difference occurs in the type and number of computer actions required to process the receipt. Although some NSCs use a computer to track DTO receipts after they are counted and checked, the computer files are different from those used or stock material. After processing, DTO receipts are forwarded either to the NSC local delivery function for transportation to local customers or to the NSC shipping office for transshipment to customers, usually ships, that may have left the area permanently.

SUMMARY OF CURRENT SYSTEM DEFICIENCIES

The current procedures furnish little capability to effectively track material as it moves through the issue-transport-receipt process from DLA depots to NSCs. Both DLA and Navy inventory management systems are designed to provide control within their respective activities, but both fall short of controlling material between systems. Current transportation procedures fail to provide adequate accountability of material in transit.

The cost of material handling is high because material is sequentially queued, moved, queued, and moved again throughout the process. Each movement requires manpower and equipment, and each queue takes time. Requisition-to-receipt times are extended and additional stock is needed to cover pipeline time.

Many procedures in effect now are designed to optimize a portion of the receiving process. DLA's use of maximum consolidation time for improving labor productivity is an example. Unfortunately, some of these procedures make the whole process less efficient. Advanced Receiving is intended to minimize the cost of the entire receiving process while improving control.

CHAPTER 3

THE MECHANICS OF ADVANCED RECEIVING

The procedures to be used under Advanced Receiving would streamline the receiving process and begin it much closer to the source of issue. Advanced Receiving would use telecommunications, automatic identification, and improved transportation management to introduce material into NAVSUP's inventory more quickly and accurately and at lower cost than under current procedures.

ADVANCED RECEIVING OBJECTIVES

The primary objectives of Advanced Receiving are to gain better control of material ordered by NSCs and to reduce the costs of material handling, pipeline inventory, and transportation services to the DoD. The deficiencies of the current system in these areas are described in Chapter 2.

ADVANCED RECEIVING PROCEDURES

Issues

Under Advanced Receiving, Navy material will be issued on a daily basis by DLA depots and other suppliers. Navy requisitions will no longer be held at DLA for consolidation. Moving in reusable shipping containers, material will flow to Navy consolidation hubs located near the sources of supply. Smart use of reusable containers will allow source activities to avoid labor and material costs by minimizing the amount of protective packaging necessary to get material safely to the hubs.

Consolidation Hubs

Consolidation hubs will process material first through Navy receiving software to determine where each item is to be stored and then through manifesting software to establish in-transit control. In addition to incoming NSC receipts, the hubs will also process source issues to activities in the area of an NSC, material moving from the area of one NSC to the area of another NSC, and material returned to the source from NSCs or activities in their areas. Incoming receipts for other activities will be

processed as DTO receipts. Manifests will be prepared to provide document-number control for all material, and the material will be consolidated with NSC wholesale receipts to achieve greater, less-expensive freight volumes. Processed material will be sorted by delivery location for direct drop at those locations (for NSC material, material will be sorted by storage location). To the maximum extent possible, material will be placed in protective, reusable shipment containers and consolidated into truckload shipments. When sufficient material has been accumulated or when consolidation time frames are exhausted, the hub will release a truckload shipment bound for an NSC area.

The hub will produce manifests that will travel with the shipment to allow the destination to rapidly check material as it is delivered. NAVSUP envisions manifests to be electronic records, using microcircuit and bar-coding technologies for rapid checkoffs. The hub will also produce performance data on its own operation for use in management control.

Hub procedures will include making provisions for identifying issue discrepancies by the source and for quickly resolving such problems with minimal paperwork early in the receiving process. Hubs will correct discrepancies before the material is transported. Such a feature will require a high level of cooperation between the source and the hub operator who will act as the Navy's agent.

Current NAVSUP plans call for hubs to be operated by contractor personnel.

Delivery

At the destination, deliveries will bypass Central Receiving and be made directly to the locations at which the material is to be stored. Large shipments of DTO material will be dropped at the activity for whom the NSC would normally have provided DTO receiving services. Small quantities of stock or DTO material will be delivered to the NSC local-delivery facility where it will be consolidated with issues from the NSC and delivered.

Manifests accompanying each delivery will provide positive identification of the material contained in that delivery. After the material is offloaded, it will be checked against the manifest, and information on missing items will be provided to the contractor at the hub for correction since he will be held financially accountable

for all loses. NAVSUP's plans to use bar code data as input for manifest processing should minimize processing queues.

After manifests are used to transfer accountability, information from them will be transferred to the computer to close out in-transit records. This action will provide a record of contractor performance. In the long term, an interface with the Uniform Automatic Data Processing System (UADPS) inventory management system will simultaneously create an in-process record to measure how fast an NSC stores material.

NAVSUP FEASIBILITY TEST

In May and June 1986, NAVSUP conducted a short feasibility test of the Advanced Receiving concept. A terminal linked to the inventory management system at NSC Jacksonville was placed at the end of the shipping line at the Defense General Supply Center (DGSC) in Richmond, VA. At Jacksonville, material was counted and checked for issue accuracy as it came off the line, and errors were immediately brought to the attention of the issue supervisor and corrected on the spot. Material was not packed; rather, it was placed into cardboard tote-pan inserts for transit after its receipt had been processed, the storage location in Jacksonville determined, and all material for the same storage location consolidated. Three times each week, material was loaded in roll-on/roll-off carts that were transported in a dedicated truck directly to storage locations at NSC Jacksonville. Central Receiving in Jacksonville was not used.

At storage drop locations, warehouse personnel were to have received a manifest against which they could check receipts; however, during the test, manifests were not available because of problems in procuring manifest equipment. Warehouse workers were instructed not to count material unless its total value exceeded $100, but the specially annotated MMDs that were to identify "no count" receipts were not available for the test. Nevertheless, the primary objective of testing the feasibility of remote receiving was met.

While quantitative measures of time for various segments of receipt processing before and during the Advanced Receiving test were recorded, test sampling methods made labor saving conclusions difficult. The test's greatest value was in identifying problems that a full Advanced Receiving system would incur. In particular, issues of quality, training, accountability, consolidation, and savings

gained from minimum protective packing, all discussed in Chapter 4, were highlighted as potential areas for close management scrutiny.

CHAPTER 4

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

APPROACH

We determined baseline costs for material handling and transportation by collecting data on the current Navy distribution system for moving material between the 19 initial Advanced Receiving points shown in Table 1-1 and modeling it. Sources of data are listed in Appendix A. To identify the costs of the different approaches for implementing Advanced Receiving, we constructed computer models of the baseline and 10 different Advanced Receiving scenarios. Each scenario tested a different combination of transportation and processing alternatives. In the scenarios, we used two primary approaches, one in which a Navy contractor processed material and a second in which DLA performed that function. The baseline and Advanced Receiving scenarios are described in Table 4-1 (they are described further in Appendix B), and an overview of the receipt processing and transportation features of each scenario is shown in Table 4-2.

To validate our findings, we used such other information sources as the 1986 NAVSUP Advanced Receiving test, which provided valuable qualitative lessons. We also considered the opinions and observations of persons currently associated with receiving operations in formulating recommendations for NAVSUP implementation of Advanced Receiving.

ESTIMATED SAVINGS

Table 4-3 shows the estimated total DoD savings that we project from the implementation of Advanced Receiving between DLA depots and NSCs. The figures shown are derived from a comparison of Scenario 1 (the current method) and Scenario 9 (with carrier processing and NAVSUP-controlled transportation), the scenario with the lowest total projected cost. The savings shown in Table 4-3 are a gross estimate of total savings to the DoD and are not savings to the Navy alone. The inventory pipeline savings is a one-time savings that was extrapolated from an analysis of pipeline savings at NSC Norfolk (Appendix C).

TABLE 4-1

ADVANCED RECEIVING SCENARIOS TESTED

Scenario	Description
1	Baseline evaluation duplicating the current transportation, Central Receiving, and service mix.
2	DLA checks the required shipments and continues to ship to NSCs using DLA-negotiated rates.
3	DLA checks shipments and ships all truckload and LTL movements within its geographic region. Cross-country LTL volume is consolidated at Norfolk or San Diego and sent by CONTRUCK, the Navy's present cross-country contracted freight system.
4	An outside carrier checks incoming material in place of Central Receiving. The carrier delivers only that material. Material that is currently shipped directly to a location by DLA continues to be shipped by DLA.
5	The same as Scenario 4 except that transcontinental LTL freight is accumulated at Norfolk or San Diego and shipped by CONTRUCK.
6	Mechanicsburg, Richmond, and Columbus send all material except parcel post and truckloads to a consolidation point in Richmond. The consolidation point then ships truckloads to NSCs. West Coast DLA does not participate.
7	The same as Scenario 6, but instead of a common carrier, NAVSUP employs CONTRUCK to ship truckloads to NSCs.
8	NAVSUP controls transportation through a common carrier, which picks up at DLA depots and ships at a 30-percent discount of Class 50 rates. Processing is done in Central Receiving at each NSC.
9	NAVSUP controls transportation as in Scenario 8, but the carrier does the processing to by-pass Central Receiving.
10	The same as Scenario 8 but with a 20-percent discount.
11	NAVSUP controls transportation with a 20-percent discount, but the carrier processes receipts to by-pass Central Receiving.

MODEL RESULTS

The computer model that we used to compare the costs of the 11 scenarios calculated both transportation and material handling expenses. For clarity, we have separated the two in the discussion; however, the total system cost – the sum of the two expenses for each scenario – is the important number.

Table 4-4 presents the annual transportation expenses for all scenarios. The costs shown there are based on the weight of freight currently moving from DLA depots to NSCs (see Appendix D). For the entire network, 112 million pounds of

TABLE 4-2

SCENARIO OVERVIEW

Scenario	Receipt Processing				Transportation Features		
	DLA	Navy Central Receiving	Common carrier	Common carrier consolidating	DLA negotiated LTL & TL rates	Common carrier rates	CONTRUCK transcontinental
1		X			X		
2	X				X		
3	X				X		X
4			X		X	X	
5			X		X	X	X
6		X		X	X	X	
7		X		X	X	X	X
8		X				X	
9			X			X	X
10		X				X	
11			X			X	X

TABLE 4-3

ADVANCED RECEIVING SAVINGS FOR DoD

Functional area	Savings
Material handling	$1.9 million/year
Transportation	$4.1 million/year
Inventory pipeline	$1.0 million (one time)

material were moved annually. Of that, 6.36 million pounds (or about 6 percent) were shipped by small-parcel means, such as U.S. Postal Service or United Parcel Service (UPS). The remaining 94 percent moved by truck. The modeled costs for shipping these volumes are shown in Columns (2) and (4).

TABLE 4-4

DLA TO NSC TRANSPORTATION EXPENSES

($000)

(1) Scenario	(2) Small parcel	(3) Small parcel converted to truck	(4) TL and LTL	(5) Subtotal transportation
1	$3,475	N/A	$3,890	$7,365
2	$3,475	N/A	$3,890	$7,365
3	$3,475	N/A	$3,884	$7,359
4	$3,475	$253	$3,531	$3,784
5	$3,475	$253	$3,455	$3,708
6	$3,475	$253	$3,631	$3,884
7	$3,475	$253	$3,504	$3,757
8	$3,475	$253	$2,979	$3,232
9	$3,475	$253	$2,979	$3,232
10	$3,475	$253	$3,181	$3,434
11	$3,475	$253	$3,181	$3,434

Column (3) shows the cost of converting the 6.36 million pounds that is now moving as small parcels to truck shipments. It is not shown in Scenarios 1 (baseline), 2, and 3 because in those scenarios, we assumed current transportation methods would continue. Thus, the subtotal cost for Scenarios 1, 2, and 3 are the totals of Columns (2) and (4); for the other scenarios, the subtotals are determined by adding the expenses in Columns (3) and (4).

Material handling expenses are shown in Table 4-5. The per hundredweight costs contained at the head of each column are discussed in detail later in this chapter.

The final expense table, Table 4-6, shows the total cost of each of the scenarios. Scenario 9, with contract receipt processing and NAVSUP-controlled transportation for DLA-to-NSC material, has the lowest total cost.

TABLE 4-5

DLA-TO-NSC MATERIAL HANDLING EXPENSES

($000)

Scenario	DLA processing $0.16/CWT	Central receiving $3.51/CWT	Common carrier $1.15/CWT	LTL consolidation $1.25/CWT	Subtotal
1		$ 1,968			$ 1,968
2	$90				$ 90
3	$90	$ 141[a]			$ 231
4			$645		$ 645
5		$ 141[a]	$645		$ 786
6			$431	$465	$ 896
7			$431	$465	$ 896
8		$ 1,968			$ 1,968
9			$645		$ 645
10		$ 1,968			$ 1,968
11			$645		$ 645

[a] Cost of in-house processing of the 4 million pounds of freight that would be shipped via CONTRUCK.

ADVANCED RECEIVING BENEFITS

In addition to the cost savings that Advanced Receiving offers NAVSUP, we have identified a number of other benefits and describe them in this section.

Material Control and Traceability Will Be Improved

Advanced Receiving will improve material control and traceability if procedures are designed to take advantage of its capabilities. Accepting and processing material at its point of issue will give Navy immediate control and visibility of individual requisitions from the point of issue to final storage. Shipment information, if properly managed and used, will provide improved capability to expedite critical items or trace lost material. Material loss will be decreased and the persistent problem of overdue stock in transit will be significantly reduced. Manifests prepared in conjunction with receipt processing will, for the first time, provide the NSCs with the means to confirm receipt of what should be in a shipment. In addition, the input data used to create the manifest will provide Navy distribution

TABLE 4-6

DLA TO NSC TOTAL EXPENSES

($000)

Scenario	Subtotal transportation	Subtotal material handling	Total
1	$ 7,365	$ 1,968	$ 9,333
2	$ 7,365	$ 90	$ 7,455
3	$ 7,359	$ 231	$ 7,590
4	$ 3,784	$ 645	$ 4,429
5	$ 3,708	$ 786	$ 4,494
6	$ 3,884	$ 896	$ 4,780
7	$ 3,757	$ 896	$ 4,653
8	$ 3,232	$ 1,968	$ 5,200
9	$ 3,232	$ 645	$ 3,877
10	$ 3,434	$ 1,968	$ 5,402
11	$ 3,434	$ 645	$ 4,079
Most expensive system is current system	$ 7,365	$ 1,968	$ 9,333
Least expensive DLA system is	$ 7,365	$ 90	$ 7,455
Least expensive Navy system is	$ 3,232	$ 645	$ 3,877
Savings potential using DLA system	**$ 0**	**$ 1,878**	**$ 1,878**
Savings potential using Navy system	**$ 4,133**	**$ 1,323**	**$ 5,456**

managers with the ability to follow or find each requisition as it moves through the entire receipt cycle. Unlike current procedures in which a carrier only signs for pieces, weight, and volume, Advanced Receiving will give the Navy total process control over a carrier's actions by individual requisition.

Design Considerations

Commercial transportation/distribution systems – Federal Express and UPS, to name two – provide the same level of control as Advanced Receiving and have demonstrated the degree of success that Navy desires in Advanced Receiving. Each

has a well-deserved reputation for high reliability, excellent traceability, on-time performance, and low loss rates. Each uses a document number to control material throughout the life of a shipment. Each requires a signature to confirm delivery – and each is *very* expensive. Government and industry use these services for high-priority shipments only. For the Navy to attain the same level of control without substantially increasing costs for the 19 million typically low-priority, low cost consumable issues from DLA to NSCs each year will require considerable ingenuity and planning.

Automated Manifest Preparation. Manually tracking Advanced Receiving material by document number, creating manifests, and using the manifests at the destination for accountability at turnover would make Advanced Receiving too costly and slow. A review of several aspects of the anticipated Advanced Receiving manifesting requirements illustrates why.

Every item flowing through the Advanced Receiving transportation system must be manifested to gain the level of control NAVSUP desires. Direct delivery of material to by-pass Central Receiving will require a manifest to be created for each delivery point. We recommend that the manifest be prepared on a microcomputer by the receipt processing clerk at the hub as part of the receipt processing and data collection effort.

As a minimum, the manifest will have to include a location number and the five-digit receipt control number (RCN) that uniquely identifies it. We also believe a document number is necessary on the manifest. In the event that an MMD is detached from its material and is lost, the document number can be used by a warehouse worker as a unique material identifier. With the document number on the manifest, direct-dropped material arriving without an attached MMD could still be found on the manifest and checked off without having to forward such material to Central Receiving for additional investigative effort. A document number is essential for DTO receipts and other non-NSC material flowing through the Advanced Receiving transportation system since that material does not have an RCN.

The MMD created at the hub for NSC stock material (not DTO items) will provide these data for the manifest. While an RCN is now being bar coded on MMDs for fast and accurate entry to manifest preparation software, the 9-digit storage

location number and the 15-digit (suffix code included) document number are not bar coded on the MMD and will have to be manually keyed into the manifest computer. The consequences of keying the numbers inaccurately – material delivered to the right warehouse but showing up on the wrong manifest, or material without MMDs that cannot be identified in the warehouse – could result in major productivity drains that will decrease labor savings and increase processing time. For those reasons, we recommend that the MMD be modified.

MMD Modifications. To streamline manifest preparation and to avoid expensive processing costs from inaccurate manifest entries, we recommend that NAVSUP change its MMD to include bar codes for storage location number and the document number of material. We further recommend that the MMD include a plain-language printout of the delivery address. Whether DLA or contractor personnel do the sorting at the hub, the nine-digit location number on an MMD will give them no information on the building that material should be sorted to for sequenced loading of a truck.

Since no standard exists for location numbers, each NSC designs them in its own way. Thus, they are very difficult to understand without a table or without considerable experience. At a supply center, one of the first lessons a new warehouse worker learns is the scheme for deciphering location numbers on receipt documents. Conscientious personnel train for months with a table in their pocket. Frequently, when memory is used to decipher a location number and to route a receipt, material gets sent to the wrong location. That problem will be magnified sevenfold under Advanced Receiving as material is sorted for the seven NSCs. Thus, we believe that a plain-language delivery address on the MMD is essential.

Confirmation of Delivery at Destination. Establishing that material has been turned over to the Navy by a carrier will be critical for effective material control. Under Advanced Receiving, a lot of data will be available to Navy distribution managers. The receipt processing record, the manifest input, and a notice of truck departure from the source hub will clearly document that a receipt is in the custody of the carrier.

An effective method for recording material turned over from the carrier to the Navy must also be provided. Such a method is needed primarily to establish accountability records that will hold a carrier financially responsible for lost

material, but it will also help evaluate carrier delivery performance. Similarly, NSC receiving performance can only be measured if the time that material came under its control is known.

While a signature transfer for each item delivered on a manifest would be ideal (and appropriate if high-value components are eventually included in Advanced Receiving), such an approach is not cost-effective for low-value material. It is too expensive to have a driver stand by while every delivered item is signed for. For that reason, we recommend that transfer be accomplished using the bar coded RCN on the MMD and that MMDs be scanned to signify that material has been delivered. We also recommend that NAVSUP use statistical methods to assure that material that has been accepted is the correct type and quantity of material. Such procedures will assure accuracy at the lowest possible cost.

Statistical Process Control of Carrier Performance. To establish cost-effective measures of material accountability in the initial stages of Advanced Receiving, we recommend two measures.

First, NAVSUP should institute statistical process control over carrier performance, with the carrier submitting control charts to NAVSUP with each delivery truck. Such measures should be written into the contract as indicators of performance for payment and incentive fees.

Second, when material is delivered by a carrier to direct delivery locations, NSCs should carefully check material until they feel comfortable that statistical process control provides an accurate reflection of carrier performance. They should confirm that material has been delivered to the right location and inspect a sample of it for accuracy. Manifests should be signed and dated, with one copy remaining with the material and a second copy returned to the truck driver.

Statistical sampling requires that material be checked for both quantity and stock number accuracy prior to storage. If such checks indicate accuracy levels above current NAVSUP standards and if they agree with carrier-provided control charts, material should be stored without further checking or counting. If sampling indicates accuracy levels below NAVSUP standards or if sampling results do not agree with the carrier's control charts, the material should be checked in depth until the NSC is satisfied that the accuracy of material delivered is correctly reflected. Item discrepancies should be brought to the attention of the carrier for resolution.

Penalties for poor performance as well as charges for lost or damaged material should be provided for in the contract.

While some situations may require extensive short-term sampling, perhaps even to the 100-percent level, NAVSUP should ensure that NSCs manage carrier performance with the minimum sampling required for statistically significant findings. In the initial stages of Advanced Receiving, this will demand concerted effort and planning since most NSCs now double count everything they receive. Perpetuation of that practice will increase material handling labor costs without assuring improved accuracy.

Data Collection at the Hub. If Advanced Receiving is to improve material visibility, data will have to be collected at the point of receipt processing. Those data will be used to evaluate carrier and NSC performance, to provide visibility of material as it moves through the Advanced Receiving system, to provide for material accountability, and to allow workload planning. The data would be most valuable if they were integrated with NAVSUP's UADPS – Stock Point (UADPS-SP) standard programs to provide total process control. Unfortunately, NAVSUP's massive efforts to replace all stock-point hardware and software over the next 5 years has saturated current programming capabilities.

We recommend that NAVSUP satisfy the Advanced Receiving data requirements through an initial phase and a long-term phase as described in the following paragraphs.

In the initial phase, to support start-up initiatives, NAVSUP should include in its Advanced Receiving contract the generation, maintenance, and provision of certain data to be collected by the contractor from the hub operations. Those data should include the document number, RCN, and storage location number from the manifest data base prepared from each receipt. In addition, for each receipt data should be captured to show the date received at the hub, the date the receipt was processed, the date the material was shipped from the hub, and the expected date on which it should arrive at the destination NSC. Finally, we recommend inclusion of a truck/van license number that uniquely identifies a shipment, a hub identifier code to indicate where the data record originated, and the NSC routing identifier.

A valuable additional data element would be an indicator of in-transit location. That indicator could be as simple as the number of the reusable container into which

material was sorted at the hub. With the improved control and visibility that Advanced Receiving will give the Navy, we foresee that the need will arise to rapidly locate incoming material. Inclusion of such an indicator in data collection requirements at the start will provide this ability and will avoid revisions of data collection requirements in the future.

These data requirements may appear to be extensive and to require significant key entry. Most items, however, can be programmatically generated without manual key entry to the data base or can be rapidly collected using automatic identification.

After data are collected at the hub, we recommend that specific data elements be transmitted to the destination NSCs. To ensure that such data elements arrive at an NSC in sufficient time, the elements should be transmitted no later than the evening of the day material was shipped from the hub. The Defense Data Network (DDN) electronic mail service if available should be used for transmitting the data. If DDN services are not available, a commercial electronic mail service should be used until DDN comes on line. Using that service, transmissions from multiple hubs to each NSC will be aggregated and be available for processing each night by the destination NSC.

At the NSCs, the hub data should be received on a microcomputer and processed using a standard, commercially available data base management software package. (We recommend that programming specifications be included as a contract requirement.) The data will be used to produce a file of all in-transit material destined for the NSC, and that file can be used to identify material status by document number, can be updated when the material arrives, and can produce such management information for the NSC and NAVSUP such as average hub processing time and average transit time for material from each hub to each destination. A most important product of the data base would be a projection of material expected to arrive each day at the NSC by delivery point to facilitate workload planning.

Once receipt processing begins at the source, it will be necessary to make a change to UADPS-SP measures of in-house receiving performance because the measurement of the time between acceptance (tailgate date) and stow date of material will no longer show only NSC in-house performance. Until UADPS software can be changed, we recommend that NAVSUP use the carrier-transmitted

Advanced Receiving records in conjunction with bar-coded MMDs to measure in-house NSC receipt-to-storage times.

At the Advanced Receiving manager's level, data records provided to each NSC should be summarized by the contractor to demonstrate performance. We recommend the following data be provided monthly for the current month and the year to date.

- Average processing times for receipt processing and consolidation at each hub (with back-up detail)
- In-transit times from each hub to each NSC
- Average weight, number of shipments, and average cost per CWT from each hub to each NSC
- Summaries of statistical process control results by hub, NSC, and total system.

In addition to these reports, we also recommend that NAVSUP require the contractor to produce a tape for each Supply Center that would be periodically compared to its requisition status file to identify the following:

- Those items reported to have been turned over to the carrier by DLA but not on the contractor's records
- Those items for which a disparity exists between the date of DLA-reported turnover and the contractor's reported date of receipt at the hub to detect possible performance data manipulation.

The second phase of the approach for satisfying NAVSUP's Advanced Receiving data requirements is the long-term modification of software. We recommend UADPS-SP receiving software be changed to track in-transit and in-process segments of a receipt's movement toward final storage. This change should be made in the context of the total process control and visibility of Advanced Receiving material in the entire system that new stock-point automated data processing (ADP) equipment and software will allow.

Transportation Costs Will Be Lower Than DLA Now Pays

In Table 4-3, we stated that with Advanced Receiving, DoD could save about $4.1 million annually over the costs of the current DLA transportation system.

These savings are the result of control of small parcel shipments and improved rate negotiations.

Current Material Flows

Appendix D is a summary of the weight of material currently moving between what would become Advanced Receiving nodes. Table 4 7 summarizes those weights.

TABLE 4-7

MATERIAL VOLUME BETWEEN ADVANCED RECEIVING NODES

Source	Destination	Pounds shipped (per year)	Percent of total
DLA	NSCs	112,010,000	56
NSCs	DLA	12,600,000	6
NSCs	NSCs	74,480,000	38

As noted previously, NSC-to-NSC material includes Navy freight from all activities in the source NSC region to all Navy activities in the destination NSC region. Similarly, material movements from NSCs to DLA include movements from all activities in the originating NSC region. This approach shows the maximum potential system volume for estimating freight shipment between Advanced Receiving nodes. While further discussion of such freight refers only to the primary points (i.e., NSC to NSC), that discussion includes freight from or to other activities as well.

Control of Small Parcel Shipments

We found that DLA is negotiating very favorable freight rates and is effectively consolidating material for shipment. We identified a potential for saving approximately $3.2 million in transportation costs per year by diverting low-priority Navy material from expensive, small-parcel shipment mode ($55/CWT) to less-expensive truckloads ($4/CWT). Although these small-parcel movements represent only 6 percent of the total annual weight of the baseline (6,357,400 of

112,150,000 pounds), they represented 54 percent of the baseline's total annual shipment costs.

The $3.2 million savings should be achievable with little or no degradation of service. Since Advanced Receiving eliminates holding up requisitions at the DLA source for more efficient production, material that would previously be shipped by small-parcel mode would be shipped by truck as part of the next consolidated shipment for the NSC destination. We found, for example, that DLA's largest volume of small-parcel shipments was between Richmond and Norfolk. Coincidentally, truckload shipments between these two cities are also the heaviest, occurring at the rate of 10 to 12 a week. With trucks arriving at Norfolk at the rate of two a day, DLA should have no need to move low-priority material there by small-parcel modes.

Improved Freight Rates

We found a potential for savings in improved negotiation of freight rates. We compared the rates being paid under DLA's current freight rate program with a commercial data base of common-carrier rates for similar sources and destinations. We noted a large difference between the rates DLA pays and the commercial rates for intrastate movements between Richmond and Norfolk. We verified this observation by soliciting rates from Wilson Trucking, a large regional carrier that operates a freight terminal adjacent to DLA's depot at Richmond. Rates from Wilson were then used to estimate savings of some $600,000 on this route alone. In total, we found a potential for $911,000 in savings from renegotiation of system rates.

Backhaul Movements

In a truck shipment from DLA to an NSC, for example, backhaul movement would consist of material shipped on the same truck on the return trip from the NSC to DLA. Backhaul material has the effect of decreasing transportation costs between two points because it defrays a carrier's expense to return his equipment to its starting point. Generally, the greater the backhaul volume, the lower the unit rate will be for transportation between two points. In examining system flows, we found very little backhaul movement from NSCs to DLA. For Advanced Receiving, backhaul volumes are too small to substantially underwrite a carrier's equipment

return costs. As a consequence, these costs must be recouped in the rates charged from DLA depots to NSCs.

In addition, the absence of substantial material moving back to DLA means that NAVSUP will incur higher transportation costs if it decides to use reusable containers. Using such containers can help to minimize material handling labor and consumable material costs (for packing material), but the savings will be at least partially offset by the costs to return empty containers. For that reason, we strongly recommend that NAVSUP's design specifications for reusable containers incorporate the ability to disassemble them when not in use. In this way, more containers can be shipped on a return truck at one time and return costs will be minimized.

NSC-to-NSC Movements

We also considered the impact on system costs of the 74 million pounds of freight moving from NSCs to NSCs. That volume is 38 percent of the total expected annual volume in Advanced Receiving. Our analysis, however, indicates that Advanced Receiving, as currently defined, will offer little benefit in this area because of the conditions currently imposed on the movement of such freight. It generally moves on CONTRUCK, a cross-country, contracted Navy freight operation. Although CONTRUCK is a truck operation, it is viewed primarily as a means of moving high-priority cargo that either did not go (not enough room) or could not go (would not fit) on the QUICKTRANS contracted air-delivery system. Although low-priority material moves in considerable volume on CONTRUCK, it is only used as filler. As a consequence, CONTRUCK is not looked at as an operation whose freight costs should be minimized by maximum consolidation. Trucks depart on a rigorous schedule whether they are full or not to meet the transportation priority-one on cross-country transit time of 4 days.

While the currently envisioned Advanced Receiving may not benefit from the inclusion of NSC-to-NSC freight, an expanded system might. We found that CONTRUCK now operates at approximately 50 percent of capacity because of its demanding scheduling requirements. If Advanced Receiving is expanded to include more freight that travels in the direction of CONTRUCK movements (primarily east to west, west to east), much of the expansion material could travel with little increase in overall cost by taking advantage of the excess CONTRUCK capacity.

Future Transportation Savings

Advanced Receiving could produce even greater transportation savings if it is expanded to include such other sources of material for NSCs as non-RFI (ready for issue) repairable material from the Navy's Advanced Traceability and Control (ATAC) repairables processing hubs, receipts from GSA depots, and commercial-vendor shipments. The scope of this study did not include those three sources of material but further analysis is patently warranted.

ATAC Shipments. NAVSUP presently pays premium freight rates to move ATAC repairable material with a 2-day transit time and a high degree of control. In view of the very expensive, very valuable nature of this material, such costs can be reasonably justified. NAVSUP is now exploring the use of Advanced Receiving source processing time by circumventing central receiving operations.

We believe NAVSUP can realize significant transportation savings, however, by diverting much of the ATAC repairable material to less-expensive, but slower, truck shipments. Although some repairable components are so scarce that they are immediately inducted upon receipt at a Depot Supply Point (DSP), many go onto the shelf and are not inducted until some time later. If ATAC material were receipt-processed at the source, those two categories of repairable material could be differentiated before they were transported and shipment mode could be determined on the basis of induction priority.

We recommend two courses of action: First, when hub processing identifies a component as a high-priority, short-supply asset that will likely be inducted upon receipt at the DSP, the Navy should ship it by high-priority means. To avoid delays, it should be delivered to the induction processing location at the NSC and not to a direct-delivery storage point. Since such material would be shown on the NSC inventory after hub processing, induction processing could be completed while the material is still in transit.

Second, we recommend that the remainder of ATAC material – lower-priority material that would normally be stored at the DSP – be handled under standard Advanced Receiving consolidation and transportation procedures. Because of the high value of repairable material, it is often argued that the faster it gets to a DSP, the shorter the Navy pipeline and the lower the procurement costs will be. That condition is, in fact, true for shipment *to* the ATAC hub (faster transit *will* reduce

pipelines); however, because of receipt processing at the hub, some delay of shipment is possible without affecting pipeline costs since Navy UADPS-SP software uses a fixed 5-day in-house receipt take-up time (time from receipt to storage) when it calculates reorder levels. The repairable material will have been receipt-processed into UADPS at the hub, and the 5-day take-up time can be used for consolidation, transportation, and delivery with absolutely no impact on current repairables management procedures.

The proportion of ATAC material that is currently inducted upon receipt is not immediately apparent; thus, it is not possible to project transportation savings that would result from our recommendation. We know, however, that Advanced Receiving material control procedures will provide the degree of control and traceability that is needed for managing ATAC material (a primary reason for the premium handling that ATAC uses now). By diverting lower-priority repairable material into Advanced Receiving, transportation costs will be reduced and control and traceability will be maintained.

GSA Material. Advanced Receiving should probably include material that is shipped from GSA depots to NSCs. We originally intended to include such material in our analysis, but difficulties in obtaining data from GSA made that impossible. We were able to obtain some information on the number of line items issued to the Navy from GSA facilities in California and Georgia, and we conclude that there are large amounts of freight near potential Advanced Receiving hubs that could be used to increase system volume. We recommend that NAVSUP pursue the identification of GSA-to-Navy freight volumes and rerun the Advanced Receiving model to analyze their effect.

Commercial Vendor Material. We believe that very large transportation savings, perhaps even larger than the $4.1 million already forecasted, can be realized by including material from commercial vendors into the Advanced Receiving system. We examined a NAVSUP data base of contract awards (the DD Form 350 contracting data base for FY86) and identified the locations of contracting activity for all supply contracts greater than $25,000. We found large numbers of contracts within 250 miles of DLA depots, an indication that such material could be included in the Advanced Receiving transportation network to increase freight volume and reduce per-CWT cost.

Because of weaknesses in the DD Form 350 data base, however, it can be used only as an indicator of potential volume. It shows only the number of contracts by location (not the number of shipments), and it does not show the weight of material shipped from contract sites. The data base, however, identifies contract numbers, which could be used to produce weight information with considerable manipulation of data.

Many Navy supply contracts call for title of material to be transferred to the Navy at the NSC rather than the factory, and prices are quoted at Free On Board (FOB) Destination, not FOB Origin. In an FOB Destination contract, the supplier pays for transportation, and higher overall system transportation costs can be expected since freight must often be shipped in smaller units at expensive rates. Navy contracting officers are instructed to consider transportation costs when awarding contracts and to specify the approach (FOB Destination or FOB Origin) that produces the lowest cost to the Navy. The contracting officers make these least-cost decisions one contract at a time, and they often choose FOB Destination when the volume of freight from other contracts in the region might easily justify FOB Origin.

With Advanced Receiving, the hub receives material for all contracts in a specific region and other forms of transportation are used for local movement only (from the factory to the hub). Commercial companies that have multiple sources of demand have found that FOB Origin transportation is far less expensive when consolidation of LTL freight into truckload shipments is done for particular regions of the country. The Navy should experience similar results.

We recommend that NAVSUP continue to collect and analyze data on contract shipments and include such material in the Advanced Receiving. This material will not only reduce the transportation rates, but it will offer improved control and visibility with less damage and loss.

Consolidation Approaches. If ATAC and GSA material and direct contractor deliveries are incorporated into Advanced Receiving, the additional volume will permit material to be consolidated more quickly into larger, less-expensive truckloads.

The extent of transportation savings will depend on NAVSUP's consolidation policy. As an example, consider an NSC that receives one 20,000-pound truckload

shipment (50 percent full) each week from a given Advanced Receiving hub. If, ATAC, GSA, or commercial vendor material were included, in that shipment, the volume might increase to 40,000 pounds a week. NAVSUP consolidation policy must then deal with two basic options: shipping the 40,000 pounds once a week in one truckload for maximum transportation savings or shipping it twice a week in two 20,000-pound truckloads to reduce order and shipment time (OST).

Present DLA consolidation policy emphasizes transportation savings. When DLA ships by truck, it effectively consolidates material into economical truckload quantities. As detailed in Appendix D, 68 percent of all such DLA material is shipped in truckloads of more than 20,000 pounds. We recommend that NAVSUP treat that DLA policy as a goal in establishing its Advanced Receiving hub consolidation policy. Decisions to consolidate to less than the 68 percent level must be taken advisedly to avoid incurring additional transportation costs.

Order and Shipping Time Will Be Reduced

We found that Advanced Receiving will reduce actual OST times for Navy requisitions. It will also create potential stock-out problems because of the fixed five-day receipt take-up time used by UADPS-SP. To the degree that OST is reduced, a one-time savings in inventory holding costs could exceed several million dollars systemwide. In Appendix C, we present an example of the inventory savings that could be realized if OST were reduced between 1 and 17 days at NSC Jacksonville and NSC Norfolk.

How OST Will Be Reduced

Under Advanced Receiving, OST will be reduced by shipping full truckloads faster and by streamlining the receiving process to combine or eliminate steps. In Chapter 2, we noted that distribution managers at DLA depots review the accumulated issues and organize issue-production runs for customers in a geographic area when sufficient volume exists to make issue personnel productive. As a consequence, the computer may hold up accumulated truckloads until sufficient volume is reached to produce good issue productivity. In Advanced Receiving, freight will still be consolidated, but with a free-flow of material from DLA. Receipts will be processed and consolidated simultaneously, combining what now requires two steps. At the hub, once the volume of freight for a given NSC accumulates to the point established by NAVSUP in its consolidation policy, a truckload shipment can

be quickly moved. The net result is that material will arrive at its storage location at the NSC more quickly than it does now.

How UADPS-SP Modifications Will Affect OST

Source receipt processing of Advanced Receiving material may create stock-out problems for the Navy unless receiving software is modified. In calculating reorder levels, UADPS-SP software uses a fixed 5-day receipt take-up time after receipt processing. Since Advanced Receiving begins processing material at the hub during consolidation and before shipment, the computer will register only 5 days for a period that previously had included consolidation at DLA, shipment to the NSC, and in-house processing.

It is difficult to estimate the impact of this UADPS-SP procedure. Incoming receipts could be receipt-processed, sorted, consolidated, trucked directly to an NSC delivery point, and put on the shelf within 5 days, but those activities will likely take longer. Perpetuation of the automatic 5-day take-up time could lead to incorrect stock reorder calculations, which could adversely affect NAVSUP's support to the Fleet.

We recommend that the UADPS-SP receipt processing routine be quickly modified to avoid problems. Until it is modified, Navy inventory managers may have to manually intervene in computer calculations of reorder levels using more realistic data based on samples of actual receipt take-up times under Advanced Receiving. Correction of this problem is also consistent with the recommendation that UADPS-SP software be modified to record in-transit and in-process receipt time.

Labor and Material Handling Costs Will Be Reduced

The costs of the labor needed to process Navy receipts and of the consumable material for packaging will be reduced if requisitions from DLA are processed under Advanced Receiving. Many features of Advanced Receiving contribute to these cost reductions. The labor-intensive steps of packing at the source and unpacking at the destination will be considerably streamlined by the introduction of reusable shipping containers. At the hub, fewer steps and less handling will be needed to process material and send it immediately to its consolidation location. Material discrepancies can be identified and resolved at the source without having to resort to

the very expensive Report of Discrepancy (ROD) process that is currently used. At the NSC, deliveries of smaller loads to multiple locations and the use of automatic identification for accountability transfer will reduce the cost of material delivery by eliminating present tailgate operations. Advanced Receiving eliminates much of the administrative burden that is now necessary to ship and receive issues to the Navy.

We were unable to use the results of NAVSUP's 1986 Advanced Receiving test to quantify labor reductions because the te· , configuration was not the same as the Advanced Receiving system NAVSUP desires and because test data needed as input to our cost model were not collected. In place of the test data, we used cost figures from other sources.

For the cost of in-house receiving operations by NAVSUP, we used detailed labor and material handling costs collected by the ATAC repairables processing hub at NSC Norfolk. Those data and the weight of material processed gave us the cost ($3.51/CWT) for processing receipts under the current, or baseline, system (Scenario 1) and for Central Receiving in Scenarios 3 and 5 (for CONTRUCK freight) and 8 and 10. The ATAC data are for the month of June 1986, the only month for which such data are available. (See Appendix E for Calculation Details).

For a contractor-operated hub, we used a processing cost of $1.15/CWT. That cost was extracted from a data base belonging to Herbert W. Davis and Company that contains the results of its annual survey of physical distribution operating costs in the private sector. That cost was used in Scenarios 4, 5, 6, 7, 9, and 11.

For the cost of Advanced Receiving by DLA (Scenarios 2 and 3), we used a figure of $0.16/CWT. That is the incremental cost of data entry for receipt processing and manifest preparation only, without any allowance for packaging or material handling. It is simply an estimate of the cost of receipt processing by DLA at its shipping dock.

Finally, for the cost of consolidating LTL shipments by a carrier at Richmond for material from several DLA depots (Scenarios 6 and 7), we used a figure of $1.25/CWT, also extracted from the Davis data base.

Using those costs, we established potential savings of up to $1.8 million per year in material handling costs for the volume of material being shipped by DLA to the NSCs. In the scenario that produced these cost savings, Scenario 2, DLA

processed Navy receipts and continued to ship using its current methods. That scenario does not produce transportation savings nor would it reduce OST. Scenario 9, the option with the lowest overall cost (both transportation and material handling), produced a material handling savings of $1.3 million per year over the baseline.

We are not certain of the validity of the in-house receipt-processing cost that we used for the baseline. At $3.51/CWT, that cost is nearly three times the cost of contracted processing and nine times the cost of DLA processing. We questioned the ATAC hub transportation agent, Emery Air Freight, and were reassured that the data were valid. Even a substantially lower baseline processing cost would not change the final ranking of the scenarios because material handling costs are simply a reflection of the number of material handling steps in each scenario. A sensitivity analysis indicated that the selection of Scenario 9 as the most attractive alternative would remain unchanged even if the baseline processing cost was reduced by as much as 67 percent.

AREAS OF CONCERN

Both NAVSUP's test of Advanced Receiving and our analysis of important features of Advanced Receiving have identified areas that will require careful consideration before the system is implemented on a large scale.

Quality

Because Advanced Receiving will bypass the Central Receiving function at the NSC and because it adds a third party (the contractor) to the receipt process, more opportunities will exist for material to be improperly accounted for, lost, or misappropriated. The current system has procedural safeguards against these problems. Whether those safeguards are worth their cost and whether less costly methods could produce the same level of confidence are key points that the designers of Advanced Receiving must address.

In the 1986 Advanced Receiving test, a NAVSUP employee performed receipt processing of NSC Jacksonville's material at DGSC Richmond. Of the 1924 issues from DGSC that were processed in the 1-month test, that employee identified 40 discrepancies (2 percent of the issues) and returned the issues to DGSC for correction. A statistical sample at the NSC, however, indicated an accuracy rate of

96 to 97 percent even after those corrections had been made. The NAVSUP standard is 99 percent.

How well a contractor employee will perform the receipt processing will depend on the design of accountability transfer techniques and quality assurance measures and the degree of freedom given the contractor. We have recommended the use of statistical process control (SPC) for accountability transfer from the contractor to the NSC. We also believe that SPC is important in the transfer of material from DLA to the contractor.

If a discrepancy is found at the NSC in material delivered by the Advanced Receiving contractor, it will be attributable to an error either by the contractor or by DLA. While SPC offers a statistically valid means of determining whether the contractor correctly accounts for material, a procedure must be established to ensure that he receives from DLA the correct item and quantity that it intended to issue. Without valid proof that the contractor receives the correct material from DLA, he cannot be held accountable through the material receipt and delivery process. We believe that an SPC procedure at the DLA depot would provide such proof.

Another important quality factor is the cost-saving feature of Advanced Receiving that allows incorrectly issued material to be returned to DLA before being transported to the NSC without the expense of preparing an ROD. While this feature will undoubtedly save money, DLA will require verification, particularly when the contractor identifies shortages or returns a mistaken issue of material that is of lower value than the material called for in the requisition. Again, SPC at the DLA depot should provide such verification by showing, in a statistically significant manner, the quality of issues that DLA made. Once SPC is shown to work, DLA must be encouraged to accept the contractor's hub manager as the Navy's representative for issue returns.

Time is required to design and introduce SPC, particularly in a new process. We recommend that NAVSUP request DLA to institute SPC for its issues to the Navy as soon as possible so that it will be accepted before Advanced Receiving is implemented. For the contractor's operation, we recommend on-site inspection when Advanced Receiving is initiated and continuing until on-site inspection results and contractor SPC results agree. Afterward, periodic audits of the contractor's operation should be sufficient.

Finally, the Advanced Receiving contract should very clearly show the importance of high levels of quality by incorporating incentives for high quality (considering the value of materials processed in the system) and penalties for quality levels below NAVSUP's standards. If the contractor cannot demonstrate a high level of quality from the start, NSC Commanding Officers will be unwilling to eliminate their quality checks in Central Receiving.

Productivity

Advanced Receiving must be designed with productivity in mind. Changing accountability from a "per carton" to a "per line item" basis is clearly an added workload and will cost more than the present system unless labor-saving methods are used. The 1986 Advanced Receiving test was unable to evaluate material manifesting procedures, a feature of the new system that must be highly productive and accurate. Both the creation of manifests at the hub and the clearing of manifests at the destination (acknowledgment that material has changed from "in-transit" to "in-process") must be designed to be fast and accurate. Manual manifesting procedures will be time consuming and error prone, and manually checking of each line item at the delivery point will delay the truck and driver at each delivery location, making the delivery process slow and expensive.

Earlier in this chapter we recommended use of an automated manifest preparation system and a material delivery/manifest checkoff system that uses automatic identification. We strongly urge that both be in place when Advanced Receiving is initiated.

Training

Contractors that process NSC receipts must understand DLA issue documentation, UADPS-SP receiving procedures, and MMDs. The head of receipt processing at NSC Jacksonville indicated that it takes between 1 and 6 months to train an employee to use UADPS-SP Application B Enhanced (ABE) effectively. Employees with supply backgrounds required less training. Other NSCs, while differing on the specific times, indicated that the ABE training would require several months.

Since ABE gives the operator direct access to the NSC's inventory management system, NAVSUP should insist that Advanced Receiving contractors rigorously

train receiving personnel in ABE usage. NSC Commanding Officers should be assured that their inventory accuracy will not be endangered by data entry errors.

NAVSUP should take two actions to reduce errors and make the contractor's task easier. The first, modification of location numbers on the MMD to make them easier to understand, has been discussed. The other involves requiring the NSCs to report monthly on the number of receipts processed with no Master Stock Inventory Record (MSIR) or no Due-In Record on file at time of receipt. These transactions result when the NSC Inventory Control Department does not establish due-in times or a preliminary MSIR at the time it orders stock. Such failures can confuse the ABE operator and cause delays in receipt processing.

Direct Delivery Limitations

The level of direct delivery service that will be economical under Advanced Receiving has limitations. While the volume of material required by large customers such as an aviation depot, a shipyard, or an aircraft carrier is sufficient for the NSCs to make regular deliveries, the economies of direct delivery to smaller or distant customers should be considered early in the design of each NSC Advanced Receiving system.

Packaging

The 1986 Advanced Receiving test showed that packing labor and material could be saved by using reusable shipping containers. In a letter to NAVSUP summarizing his analysis of the test, the head of Physical Distribution at DGSC indicated that his total estimated annual savings would exceed $30,000 if material going to NSC Jacksonville were not packed.

From the same test, we also concluded that the design of the reusable shipping containers was critical to the protection of Navy material. In 3 of the 12 truck shipments during the test, material arrived sprawled on the floor of the delivery truck, partially because of carrier negligence and partially because of improper shipping container design. Fortunately, no damage occurred, but these three shipments clearly demonstrate that material must be better protected.

While substantial packaging savings are possible under Advanced Receiving, the type of reusable containers is an important factor in preventing damage that will offset those savings. Careful consideration should be given to this feature.

Some types of material will still need to be packaged, even under Advanced Receiving. It will be important to identify those materials before the system is implemented.

Reusable Shipping Containers

In addition to protecting the material, reusable shipping containers can provide other benefits that NAVSUP should consider. With transportation being the highest cost component of Advanced Receiving, maximum use of cubic capacity in shipping trailers is important for cost control. In the 1986 Advanced Receiving test, the containers were only 5 feet tall and were not constructed to be stacked. The top 3 feet of the 8-foot-high trailer (or 37 percent of the available space) could not be used. In addition, the containers were not designed to be disassembled for their return to DGSC. Because the test involved only small material and because maximum use of trailer volume was not a goal of the test, the unused volume was not of concern. In the full system, however, it will be.

The test taught us other lessons about containers. Test containers were not lockable. This was not a problem during the test when dedicated trucks were sealed at Richmond and checked for intrusion at Jacksonville. In a full-scale Advanced Receiving distribution network, however, lockable containers might be considered for preventing material loss.

Reusable shipping containers are increasingly being used by the automobile industry because it, like NAVSUP, feels that such containers can save money. That industry has found, however, that considerable effort is still spent ensuring that sufficient containers are available at shipment sites. We recommend that NAVSUP require Advanced Receiving contractors to provide and manage shipping containers. We believe such a requirement would free Navy managers from a constant and demanding task, would avoid the problems of plant property accounting, and would avoid claims from the contractor that lack of containers prevented his meeting performance standards.

With proper selection and management of reusable shipping containers, substantial packaging savings should be achieved over present methods.

CHAPTER 5

SUMMARY OF RECOMMENDATIONS

In this chapter, we summarize the recommendations made throughout the text. In addition to those specific recommendations on quality, productivity, transportation, packaging, software, and long-term issues, we have two general recommendations:

- NAVSUP should implement Advanced Receiving for all material received from DLA depots. Our projections show that Advanced Receiving will produce significant savings in transportation (primarily by reducing small parcel shipments and improving freight rates), material handling, and inventory pipeline costs. At the same time, it will improve the traceability and control of material being shipped to NSCs.

- NAVSUP should use a commercial contractor to operate Advanced Receiving. Athough DLA could provide receipt processing services at a lower unit cost than a contractor, it would not offer NAVSUP the flexibilty that may be necessary in the formative stages of Advanced Receiving. Should Advanced Receiving be expanded to include GSA receipts, repairable returns, or commercial vendor receipts, a contractor-run operation could be quickly adjusted to absorb the new workload. However, NAVSUP should keep in mind that a contract of such scope requires sophisticated control and oversight.

QUALITY

The contract for operating Advanced Receiving must contain provisions to assure that quality levels remain high. It should include incentives for meeting quality standards and penalties for failing to do so. If the quality of receipts deteriorates, the NSC Commanding Officers, who are held accountable for the accuracy of NSC inventories, could quickly lose confidence in Advanced Receiving. Quality problems would virtually ensure the continuation of double counting of material and dependence on Central Receiving. Our recommendations for maintaining or improving the control of quality are given in the following sections.

Statistical Process Control of Contractor Performance

Statistical process control (SPC) will provide the NSC managers the assurance they need to accept material without extensive and costly checking. The NSCs should randomly sample their receipts to ensure that the contractor's control charts are correct and that contract standards are being met. Sample sizes should be limited to the minimal number necessary to demonstrate statistical significance, and provisions should be made to change the sample sizes as the quality of deliveries increases or decreases. When Advanced Receiving is introduced, NAVSUP should inspect the contractor's on-site operation and should conduct periodic on-site audits after control systems are established.

Statistical Process Control Of DLA Issues

NAVSUP should request DLA to develop an SPC program as early as possible for issues to Navy customers in order to establish a quality baseline against which the Advanced Receiving contractor can be measured. If SPC can measure contractor performace at the destination, it can also be used at the source to show that the contractor has received the correct type and quantity of material from DLA.

Data Collection at Advanced Receiving Hubs

The contractor should collect data on each receipt processed at the hub and provide it to the NSCs for traceability and control. Since those data must be quickly available, the contractor should telecommunicate each day's data overnight to the appropriate NSC for processing on a microcomputer. In addition, the contractor should provide the NAVSUP Advanced Receiving manager with summaries of the data on a monthly basis. Those data will be used to measure contractor performance.

In the contract for Advanced Receiving operation NAVSUP should include:

- A provision for the development of microcomputer software that will produce the appropriate management information at the NSCs
- Contract incentives and performance criteria that clearly indicate the importance of such data.

PRODUCTIVITY

Advanced Receiving is a viable process now that technologies are available for collecting and transmitting large amounts of data. We strongly recommend the

following productivity enhancements to ensure that Advanced Receiving realizes its anticipated savings.

Automated Manifest Preparation

NAVSUP should develop a microcomputer-based manifest-preparation system before it implements Advanced Receiving; the manifests should show the receipt control number, location number, and document number for each receipt. A line-item manifest will provide the traceability and control and the capabilty to bypass Central Receiving that are critical to the success of Advanced Receiving. If such a manifest were prepared manually, it would require an extensive amount of extra labor.

Material Movement Document Modifications

NAVSUP should modify the MMD to include bar codes for the storage location number and document number of material. These changes will enable the NSC to quickly accept material from the contractor. NAVSUP should also require plain-language delivery locations to be printed on the MMD so that contractor employees can more easily consolidate by delivery location.

Automatic Identification To Confirm Delivery

The Navy representatives at the delivery locations should scan the MMDs with bar code readers and compare them with electronic manifests (that have been telecommunicated from the hub) to confirm that shipments have been delivered. With manifests that list each line item in a load, traditional delivery procedures would require the contractor to expend an inordinate amount of labor to provide NAVSUP with proof that deliveries had been made.

Return of Incorrect Issues to DLA

NAVSUP should request DLA to accept returns from the contractor, acting as NAVSUP's agent, in the interest of reducing the cost impact of issue discrepancies. Advanced Receiving should appeal to both NAVSUP and DLA since it can identify and correct issue discrepancies before the material is shipped to the NSCs.

TRANSPORTATION

After Advanced Receiving is operational, NAVSUP should incorporate materials other than those from DLA (GSA receipts, repairable returns, and receipts from vendors). We believe that such an extension of Advanced Receiving will produce even greater transportation savings even though quantifying those other materials was beyond the scope of this evaluation.

NAVSUP should target its consolidation policy to ensure that at least 68 percent (by weight) of all material is shipped at truckload rates. While faster delivery of material would reduce pipeline costs, it would increase the amount of material being shipped at the more expensive transportation rates. NAVSUP consolidation policy must address this cost tradeoff.

PACKAGING

Before implementing Advanced Receiving, NAVSUP should identify the types of material that must be packaged even though reusable containers should work for most material.

NAVSUP should task the Advanced Receiving contractor to provide reusable containers that are stackable and collapsible to make best use of trailer volume in both directions. The contractor must also develop a system for ensuring that sufficient reusable containers are available when needed.

UADPS-SP MODIFICATIONS

We have avoided recommending modifications to UADPS-SP software because current changes have saturated NAVSUP's programming capabilities. NAVSUP should, however, make one change now: the constant 5-day material take-up time for receipts at the NSCs is unrealistic under Advanced Receiving and could result in stock outages when reorder points are computed. NAVSUP should modify the UADPS-SP software to change the take-up time to reflect those take-up times expected under Advanced Receiving.

Equally important but less immediate, NAVSUP should modify UADPS-SP receiving software to track in-transit and in-process segments of a receipt's movement toward final storage. Process control will be provided by the microcomputer-based data management procedures recommended for "Data

Collection at Advanced Receiving Hubs," but that procedure will be awkward. The change to UADPS-SP will streamline the control of material in both receipt segments.

LONG-TERM RECOMMENDATIONS

NAVSUP should take the initiative now to begin a dialog with DLA as the first step in planning for the electronic interchange of data between their two inventory management systems. Advanced Receiving will make use of recent improvements in telecommunications, transportation services, and material control to reduce the cost of processing Navy receipts and increase their visibility. While that will represent an improvement over current methods, Advanced Receiving will still require an operator to key into one computer data that were produced on another computer. The private sector has made significant recent advances in this area and DoD has a great opportunity to take advantage of those advances.

APPENDIX A

SOURCES OF DATA

Data were obtained from a number of sources for use in our analysis of transportation costs of the current system and the 10 alternative Advanced Receiving scenarios. The information sought was the volume of freight moved from Defense Logistic Agency (DLA) to Naval Supply Center (NSCs) and NSCs to NSCs and backhaul volume from NSCs to DLA. Specific data sources were:

- An extract of all weight shipped on Government Bills of Lading (GBLs) between DLA depots and NSCs, NSCs back to DLA depots, and NSCs to NSCs from the Military Traffic Management Command's Freight Information System (FINS) data base. Data from January 1985 through June 1986 were used and interpolated into annual amounts.

- All listing of the number of mail and small-parcel shipments made by NSCs to DLA depots and between NSCs for the months of August and September 1986. This was converted to 12-month weights using sampled weights for mail and small-parcel United Parcel Service, (UPS) shipments from Issue Groups Two and Three material. Data were provided by each NSC.

- An extract of the weight and number of mail and small-parcel shipments from DLA depots to NSCs for the months of June and July 1986 from a data base maintained by DLA Operations Research Office (DORO) at Richmond, VA. These data were extrapolated over a 12-month period.

- An extract of ATAC repairable shipments and weight shipped from NSC Norfolk to other NSCs during the month of June 1986 from a data base maintained by the ATAC hub operator, Emery Air Freight. These data were extrapolated over a 12-month period. Labor cost data were provided by Mr. William Andrews, NSC Norfolk.

APPENDIX B

SCENARIO DESCRIPTIONS AND MODEL RESULTS

The scenarios that were tested in our analysis of Advanced Receiving are listed in Table 4-1. This appendix describes each scenario and presents the model input and model result for each. Where appropriate, diagrams have been added to illustrate the scenario.

SCENARIO 1: BASELINE

1. DESCRIPTION

The baseline run duplicates the current mix of transportation and handling costs to move product from the six Defense Logistics Agency (DLA) locations to the 13 Naval Supply Centers (NSCs) and outports.

2. MODEL INPUT

A. All freight is motor carrier classification 50.

B. 13 percent of the weight must be received by the Navy with 13 days and 87 percent within 21 days of the requisition date.

C. The weight can be shipped by four different modes:

1) United Postal Service (UPS)

2) Parcel Post

3) Defense Logistics Agency (DLA) carrier

4) Common carrier discount rates for Class 50 with a 20 percent discount.

D. The handling cost per hundredweight (CWT) for Central Receiving is $3.51. This cost is applied to 50 percent of the total weight shipped. It is assumed that the other 50 percent circumvents Central Receiving now and will continue to do so.

E. The total weight shipped for a 12-month period from DLA to the Navy is 112,150,000 pounds.

3. MODEL RESULT

Freight:	$7,364,572
Handling:	1,968,233
Total:	$9,332,805

SCENARIO 2

1. DESCRIPTION

DLA processes Navy receipts at each of its depots so that all trucks can bypass NSC Central Receiving. DLA continues to ship via its negotiated rates (see Figure B-1).

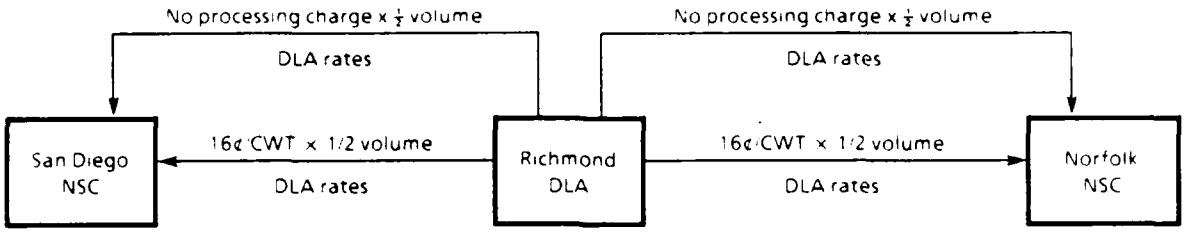

FIG. B-1. DIAGRAM OF SCENARIO 2

2. MODEL INPUT

A. All the assumptions made in Scenario 1 apply to Scenario 2, except the cost of receipt processing.

B. The projected charge for DLA to check Navy shipments was based on:

1) Terminal connect time and other computer charges at $10/truckload.

2) One-half hour of clerical time per truckload to produce the manifest; cost: $15/hour.

3) Clerk's time and computer time computed on an assumed 10 line items per truckload.

4) One hour of DLA clerical time to check each outbound truck, at $15/hour.

5) An average truckload (TL) shipment size of 200 CWT.

6) A cost of $32.40, or 16¢/CWT, to check a shipment.

3. MODEL RESULT

Freight:	$7,364,572	
Handling:	89,720	(16¢/CWT × 0.5 × 1,121,500 CWT)
Total:	$7,454,292	

SCENARIO 3

1. DESCRIPTION

DLA continues to process receipts and ship them directly to the Navy. The exception is that Less-Than-Truckload (LTL) movements from eastern DLAs to western NSCs are consolidated at Norfolk and then travel by CONTRUCK to Long Beach, San Diego, and Oakland. Western DLA depots consolidate their eastern-bound LTLs at San Diego prior to shipping them truckload to the eastern NSCs (see Figure B-2)

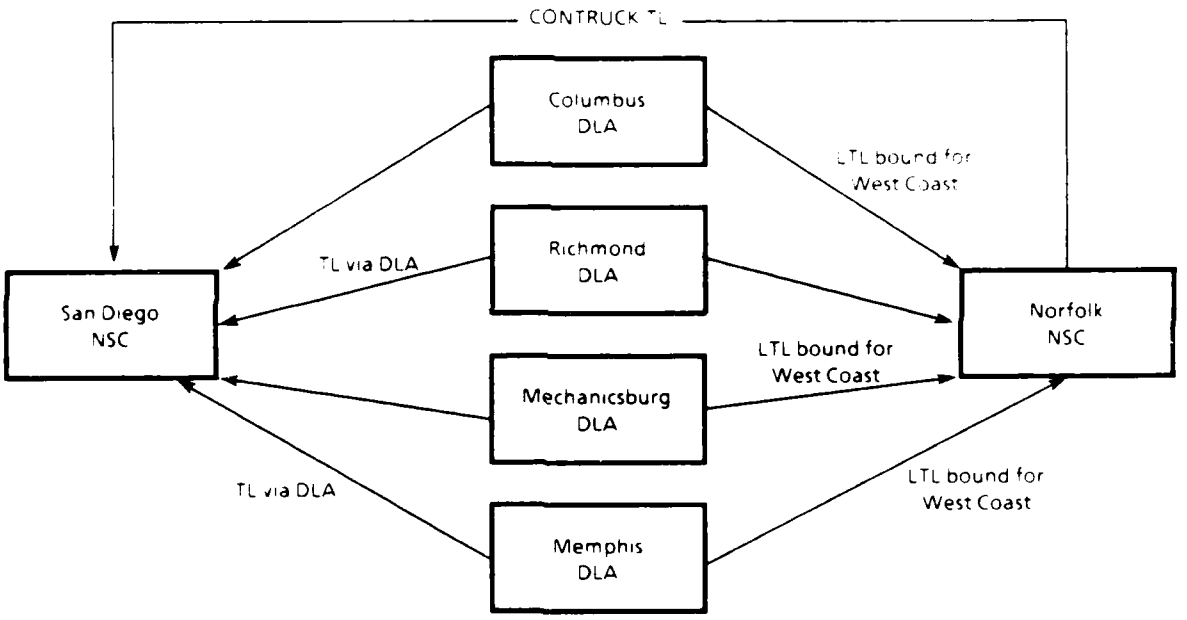

FIG. B-2. DIAGRAM OF SCENARIO 3

2. MODEL INPUT

A. Same assumptions as made in Scenario 2.

B. Assume average LTL inbound weight is 5,000 pounds and the average outbound weight on CONTRUCK is 30,000 pounds.

C. Ogden does not participate in this program.

D. Only existing CONTRUCK routes are available.

MODEL RESULTS

Freight:	$7,358,510	
DLA Handling:	89,720	
NSC handling:	141,102	($3.51/CWT × 40,200 CWT)
Total:	$7,589,332	

SCENARIO 4

1. DESCRIPTION

A common carrier located close to each DLA depot processes receipts and ships 50 percent of the weight bound for the Navy. The other 50 percent is still shipped by DLA since it already bypasses Central Receiving at the NSC (see Figure B-3).

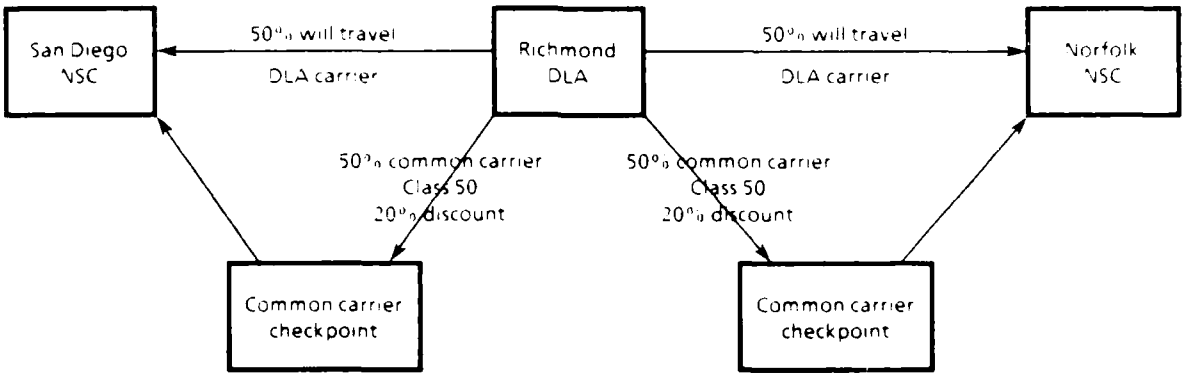

FIG. B-3. DIAGRAM OF SCENARIO 4

2. MODEL INPUT

A. 13 percent of the weight must be received by the NSC within 13 days and 87 percent within 21 days of the requisition date.

B. The weight can be shipped by five different modes:

1) UPS

2) Parcel Post

3) DLA carriers

4) Common carrier rates Class 50 with a 20 percent discount

5) Truckload rates of $1.20/mile.

C. The common carrier has to perform four tasks to process the receipt:

1) Unload the truck.

2) Use a computer to communicate.

3) Print the manifest.

4) Reload the truck.

- The cost for unloading and loading a truck ranges from 50¢/CWT to $1.50/CWT. We use $1/CWT for these tasks.
- The computer communications are $10/shipment at DLA; thus, we expect to pay 50 percent more when profit and equipment costs are added for the common carrier.
- The half-hour processing time per truckload is also increased by 50 percent for profit and equipment costs, making the cost $15/shipment.
- The average truckload weighs 20,000 pounds.
- The total receipt processing cost is $1.15/CWT.

D. For a 12-month period, the total weight shipped from DLA to the Navy is 112,150,000 pounds.

MODEL RESULTS

Freight:	$7,006,260	(DLA plus common carrier)
Handling:	644,863	($1.15/CWT × 0.5 × 1,121,500 CWT))
Total:	$7,651,113	

SCENARIO 5

1. DESCRIPTION

A common carrier processes receipts and ships directly to the Navy. The difference from Scenario 4 is that the LTL movements from eastern DLA depots to western NSCs go to Norfolk first and then travel on CONTRUCK to San Diego, Long Beach, and San Francisco. Western DLA depots ship east-bound LTL movements via CONTRUCK (see Figure B-4).

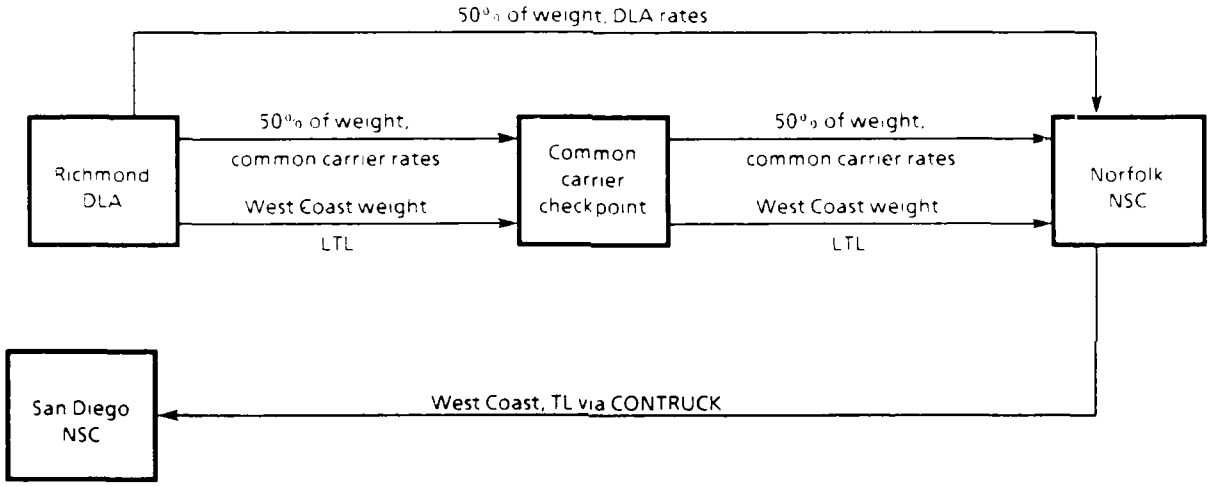

FIG. B-4. DIAGRAM OF SCENARIO 5 (ONLY WEST-BOUND DELIVERIES SHOWN)

2. MODEL INPUT

A. The LTL volume considered is weight for shipment sizes under 20,000 pounds. It is not part of the parcel post weight.

B. The average outbound CONTRUCK will weight 30,000 pounds.

3. MODEL RESULTS

Freight:	$6,930,191	
Common carrier handling:	644,863	
NSC handling:	141,102	($3.51/CWT × 40,200 CWT)
Total:	$7,716,146	

SCENARIO 6

1. DESCRIPTION

The eastern DLA depots located in Richmond, Columbus, and Mechanicsburg consolidate their LTL volume at a common carrier facility in Richmond. This allows the LTL volume to travel in TL quantities. DLA depots in Ogden, Tracy, and Memphis continue to ship via DLA modes to the Navy. DLA processes receipts at Ogden, Tracy, and Memphis (see Figure B-5).

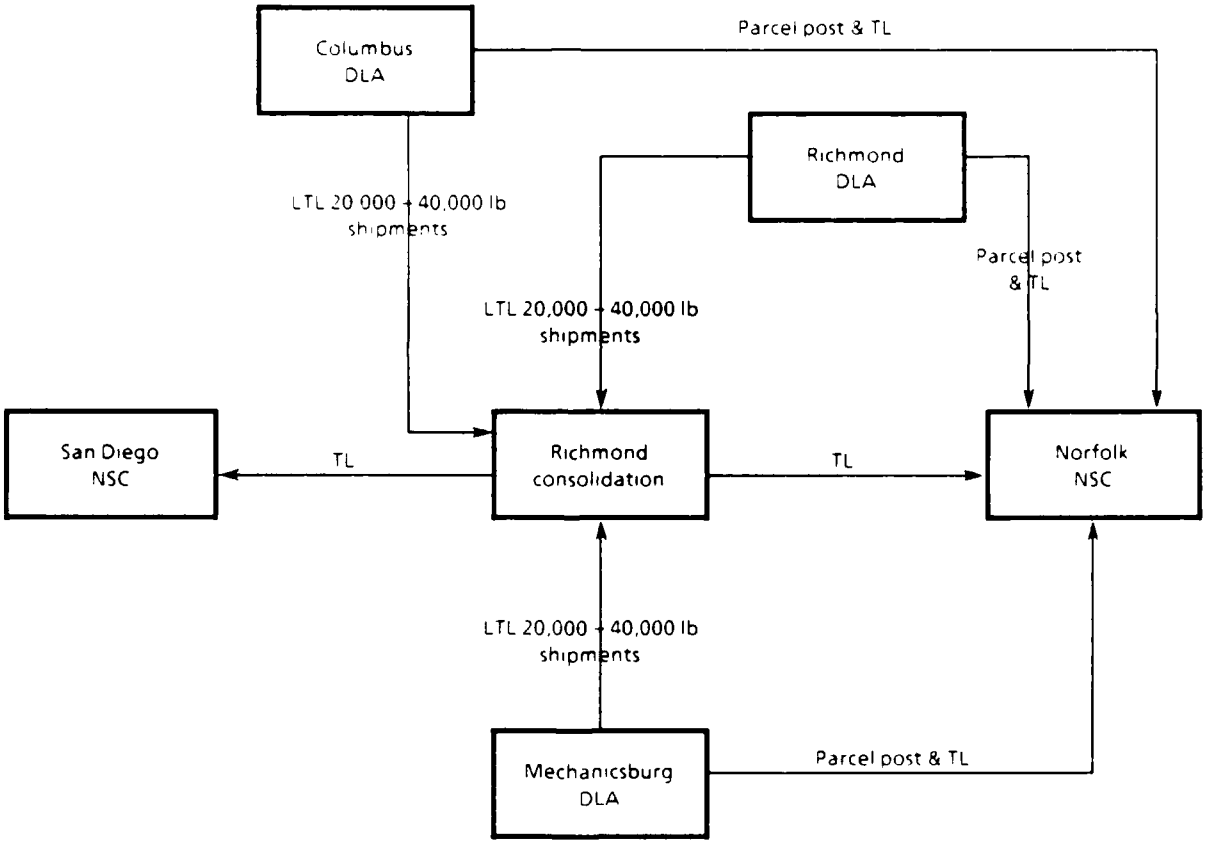

FIG. B-5. DIAGRAM OF SCENARIO 6

2. MODEL INPUT

A. All material from Richmond, Columbus, and Mechanicsburg that is not parcel post and is under the 40,000 pounds shipment size category is considered available for consolidation.

B. Memphis, San Diego, and Ogden are too far from the NSCs to be considered for a consolidation.

C. The participating DLA depots consolidate their LTL material bound for all NSCs and ship it to the Richmond consolidation point in a truckload. The Richmond consolidation point ships to the NSCs in truckloads averaging 30,000 pounds.

D. The truckload cost is $1.20/mile.

E. The storage and handling cost for the consolidation point was computed as follows:

1) A truckload contains 40 pallets.

2) The consolidation facility ships to all 13 Navy destinations.

3) The consolidation facility has space to store 80 pallets for each NSC, a total of 880 pallet positions.

4) The storage cost/pallet/month is $3.60, or $38,019 per year.

5) The weight available for consolidation is 372,100 CWT.

6) The storage cost per year/CWT = $38,076 per year/372,100 CWT = 10¢/CWT/year.

7) The handling cost (loading, unloading, and checking) is $1.15/CWT/year.

8) The total storage and handling cost is $1.25/CWT/year.

3. MODEL RESULTS

Freight:	$7,106,072	
Consolidation handling:	465,125	(372,100 CWT × $1.25/CWT/year)
Other handling:	430,848	(749,300 CWT × 0.5 × $1.15/CWT)
Total:	$8,002,045	

SCENARIO 7

1. DESCRIPTION

The eastern DLA depots in Richmond, Columbus, and Mechanicsburg consolidate their LTL volumes at a common carrier facility in Richmond. This allows the LTL volumes to travel in TL quantities. Truckloads moving from Richmond to the western NSCs use CONTRUCK. DLA processes receipts and ships from other DLA locations using DLA-negotiated rates (see Figure B-6).

2. MODEL INPUT

Same as Scenario 6.

3. MODEL RESULT

Freight:	$6,979,190	
Consolidation handling:	465,125	(372,100 CWT × $1.25/CWT)
Other handling:	430,848	(749,300 CWT × 0.5 × $1.15/CWT)
Total:	$7,875,163	

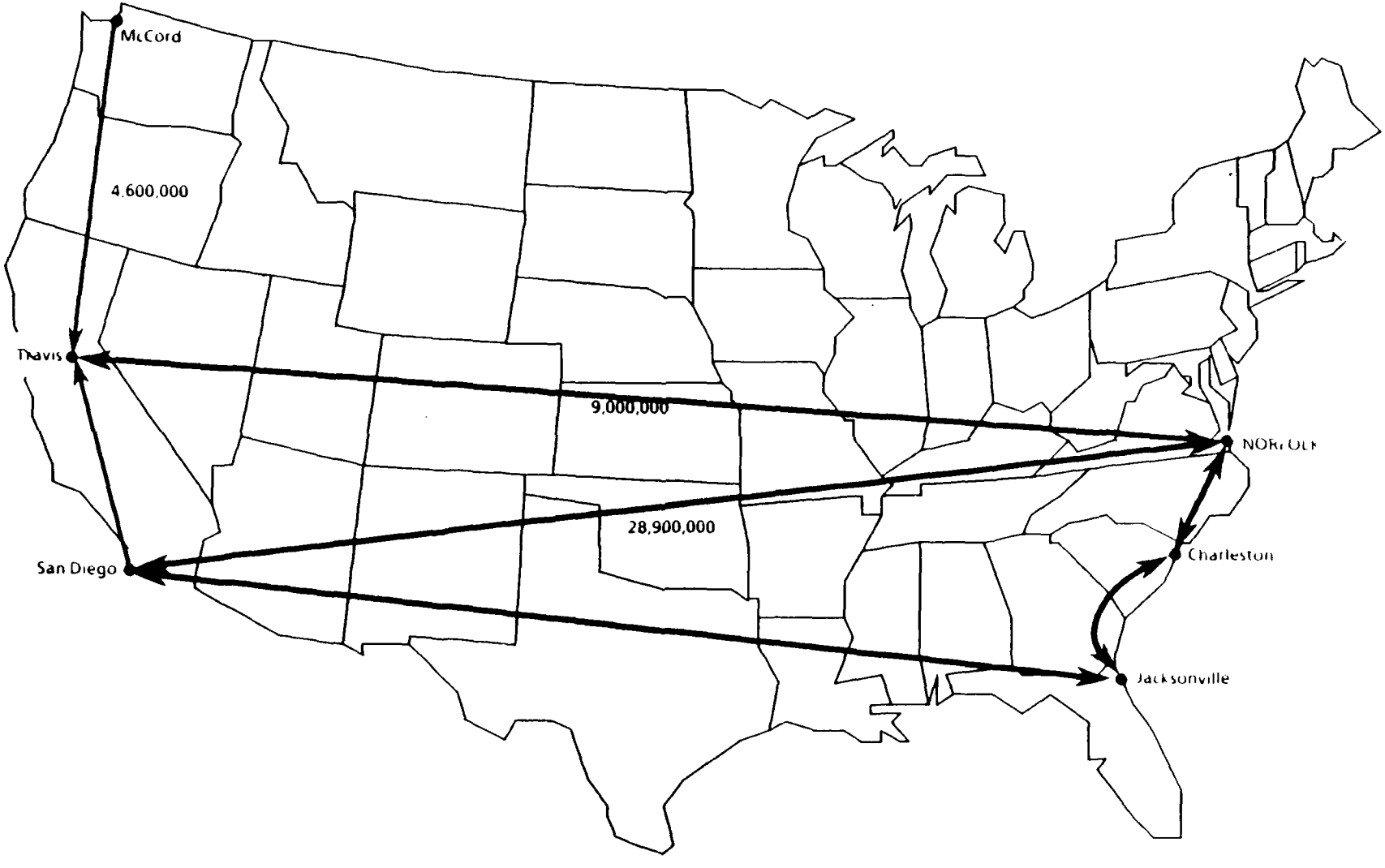

FIG. B-6. CONTRUCK WEIGHT – COLLECTION/DISTRIBUTION POINTS AND ROUTE MAP

SCENARIO 8

1. DESCRIPTION

NAVSUP controls all transportation by using a common carrier to pick up freight at the DLA depots. The freight is shipped at a 30 percent discount off Class 50 rates for LTL and $1.20/mile for truckload shipments over 20,000 pounds. Receipt processing is done by Central Receiving at each NSC.

2. MODEL INPUT

The handling cost assumptions are the same as those used in Scenario 1.

3. MODEL RESULT

Freight:	$6,454,372	
Handling:	1,968,233	($3.51/CWT × 0.5 × 1,121,500 CWT)
Total:	$8,422,605	

SCENARIO 9

1. DESCRIPTION

NAVSUP controls the transportation as in Scenario 8, but the common carrier processes receipts to by-pass Navy Central Receiving.

2. MODEL INPUT

The handling cost assumptions are the same as those in Scenario 4.

3. MODEL RESULT

Freight:	$6,454,372	
Handling:	644,863	($1.15/CWT × 0.5 × 1,121,500 CWT)
Total:	$7,099,235	

SCENARIO 10

1. DESCRIPTION

NAVSUP controls all the transportation by picking up at DLA depots and shipping via common carrier at a 20 percent discount off Class 50 rates. Receipt processing is done by Central Receiving at the NSCs.

2. MODEL INPUT

The handling cost assumptions are the same as those in Scenario 1.

3. MODEL RESULT

Freight:	$6,656,272	
Handling:	1,968,233	($3.51/CWT × 0.5 × 1,121,500 CWT)
Total:	$8,624,509	

SCENARIO 11

1. DESCRIPTION

NAVSUP controls the transportation as in Scenario 10, but the common carrier processes receipts to by-pass Central Receiving at the NSCs.

2. MODEL INPUT

The handling cost assumptions are the same as those in Scenario 4.

3. MODEL RESULT

Freight:	$6,656,272	
Handling:	644,863	($1.15/CWT × 0.5 × 1,121,500 CWT)
Total:	$7,301,135	

APPENDIX C

EFFECT OF ORDER AND SHIPPING TIME REDUCTIONS

This appendix presents an analysis of the expected impact on the inventory investment levels at NSC Jacksonville and NSC Norfolk if the replenishment lead time from DLA depots is reduced. The analysis uses April 1986 Management Criteria Listing data and focuses on DLA "technical" Cogs, 9C, 9G, 9N, and 9Z. Only that portion of the inventory managed by the Variable Operating and Safety Level (VOSL) system was examined. The results of the analysis are presented in Tables C-1 and C-2, followed by definitions of the terms and a description of the calculations used.

RESULTS

Tables C-1 and C-2 present the results of the analysis for NSC Jacksonville and NSC Norfolk, respectively. Column (1) in each table shows hypothetical reductions in lead time from DLA depots ranging from 1 to 17 days. Columns (2), (3), and (4) reflect the reductions in the value of inventory requirements for safety level, leadtime, and reorder point respectively. Columns (5) and (6) present the values of the reductions of the costs to hold and store materiel. These terms are defined after the tables.

TABLE C-1

NSC JACKSONVILLE INVENTORY IMPACT OF DLA LEADTIME REDUCTION

(1) Lead time reduction (days)	(2) Safety level reduction ($000s)	(3) Lead time requirement reduction ($000s)	(4) Reorder point reduction ($000s)	(5) Holding "cost" reduction ($000s)	(6) Storage "cost" reduction ($000s)
1	75 70	133.92	209.61	29.29	0.76
2	152.34	267.83	420.17	58.77	1.52
3	229.97	401.75	631.72	88.47	2.30
4	308.63	535.66	844.29	118.38	3.09
5	388.35	669.58	1,057.93	148.51	3.88
6	469.19	803.50	1,272.68	178.88	4.69
7	551.19	937.41	1,488.60	209.49	5.51
8	634.41	1,071.33	1,705.73	240.36	6.34
9	718.90	1,205.24	1,924.14	271.49	7.19
10	804.73	1,339.16	2,143.89	302.91	8.05
11	891.97	1,473.07	2,365.05	334.62	8.92
12	980.70	1,606.99	2,587.69	366.65	9.81
13	1,070.98	1,740.91	2,811.89	399.00	10.71
14	1,162.92	1,874.82	3,037.74	431.70	11.63
15	1,256.61	2,008.74	3,265.35	464.76	12.57
16	1,352.17	2,142.65	3,494.82	498.22	13.52
17	1,449.71	2,276.57	3,726.28	532.10	14.50

TABLE C-2

NSC NORFOLK INVENTORY IMPACT OF DLA LEADTIME REDUCTION

(1) Lead time reduction (days)	(2) Safety level reduction ($000s)	(3) Lead time requirement reduction ($000s)	(4) Reorder point reduction ($000s)	(5) Holding "cost" reduction ($000s)	(6) Storage "cost" reduction ($000s)
1	165.76	291.81	457.58	63.99	1.66
2	333.19	583.63	916.82	128.33	3.33
3	502.33	875.44	1,377.77	193.03	5.02
4	673.24	1,167.25	1,840.49	258.11	6.73
5	845.98	1,459.07	2,305.05	323.56	8.46
6	1,020.62	1,750.88	2,771.49	389.42	10.21
7	1,197.21	2,042.69	3,239.90	455.68	11.97
8	1,375.82	2,334.51	3,710.33	522.37	13.76
9	1,556.54	2,626.32	4,182.86	589.51	15.57
10	1,739.44	2,918.13	4,657.58	657.10	17.39
11	1,924.61	3,209.95	5,134.55	725.16	19.25
12	2,112.13	3,501.76	5,613.89	793.72	21.12
13	2,302.11	3,793.57	6,095.68	862.80	23.02
14	2,494.64	4,085.38	6,580.02	932.41	24.95
15	2,689.84	4,377.20	7,067.04	1,002.59	26.90
16	2,887.83	4,669.01	7,556.84	1,073.35	28.88
17	3,088.75	4,960.82	8,049.57	1,144.72	30.89

DEFINITIONS

Leadtime Reduction

The reduction in the number of days, on average, to receive and process materiel from DLA depots. This includes the Supply Center's receipt take-up time, which means that improvements in average receipt take-up time must be reflected in inventory requirements policy. At present, leadtime levels at CONUS retail activities include a fixed 5-day receipt take-up time.

Safety Level

The value of stock levels maintained to provide "stockout protection" against the variability of leadtime demand.

Leadtime Requirement

The value of stock levels maintained to satisfy demands that occur during the average shipping and receipt take-up time for stock replenishment.

Reorder Point

The sum of the safety level and leadtime requirement.

Holding Cost

The imputed cost to hold inventory. The holding cost consists of capital costs (reflecting the time value of money), obsolescence costs, and storage costs. Holding costs are not explicitly incurred but are used in inventory policy to capture the "hidden" costs of inventory.

Storage Cost

The costs associated with warehouse operations and inventory loss factors. Storage costs represent a small portion of holding costs and are estimated based upon the average value of on-hand inventory instead of actual expenses incurred in storage facilities.

CALCULATIONS

The inventory and lead time data used to calculate the values in Tables C-1 and C-2 are from April 1986 Management Criteria Listings. A special report on CY85

transactions prepared by DLA was used to determine the percent of receipts from different DLA depots. The logic of the VOSL inventory model is documented in the D-UB39 Data Processing Guide. The calculations described below were done separately by Cog (9C, 9G, 9N, and 9Z), and the totals are displayed in Tables C-1 and C-2.

Leadtime Reduction (Days)

The values for reductions in replenishment leadtime cover the range of realistic possibilities for leadtime improvement.

Safety Level Reduction

If changes in leadtime are being evaluated, with demand and protection levels unchanged, then the VOSL safety level can be considered proportional to the square root of leadtime (measured in months). That is, the safety level is equal to a constant, K, multiplied by the square root of leadtime. The value of reduction in safety level is the new safety level subtracted from the old safety level, with the new safety level equal to K multiplied by the square root of the new leadtime. The "new leadtime" is the current leadtime less a factored leadtime reduction, which is "leadtime reduction" multiplied by the percent of receipts directly from DLA depots. Thus, if leadtime reduction is 8 days and 75 percent of receipts are from DLA depots, then the "new leadtime," for the purpose of calculating new levels, is the current leadtime less 6 days.

Leadtime Requirement Reduction

The reduction in the leadtime inventory level created by, the new leadtime level is computed by multiplying the value of average monthly demand by the new leadtime in months. The new leadtime is the current leadtime minus the factored leadtime reduction, as described in the paragraph on Safety Level Reduction.

Reorder Point Reduction

The reorder point reduction is the sum of the safety level reduction and leadtime requirement reduction.

Holding Cost Reduction

The holding cost reduction is the safety level reduction multiplied by 21 percent *plus* the leadtime requirement multiplied by 10 percent. The 21 percent factor reflects the Navy policy for inventory holding costs and consists of three annual loss rates: 10 percent obsolescence cost, 10 percent capital cost, and 1 percent storage cost. Holding cost is further increased by applying the 10 percent obsolescence loss rate to the value of the leadtime inventory.

Storage Cost Reduction

Navy policy defines storage costs, for planning purposes, as 1 percent of the value of the on-hand inventory. Accordingly, the change in storage cost is defined as 1 percent of the change in safety level.

APPENDIX D

FREIGHT VOLUME DATA

This appendix presents information on the volume of freight that moves between the 19 Navy and Defense Logistics Agency (DLA) points identified on Table 1-1 of the main text. In order to be used in the Advanced Receiving model, freight volumes had to be reduced to a common denominator – weight – and the results of that process are shown in the following tables. Tables D-1 through D-3 show the weight of movements from DLA depots to Naval Supply Center (NSCs) and outports, from NSCs to DLA depots, and from NSCs and outports, to other NSCs and outports respectively. NSC Puget Sound and the outport at Seattle were combined as a single point called Bremerton. Similarly, weights for the NSC and outport at Oakland were combined.

Tables D-4 and D-5 show the current shipment-size breakdown for DLA and NSC outbound freight.

TABLE D-1

DLA-TO-NSC WEIGHT

(KWT)

Destination	Origin						Total
	Mechanicsburg	Richmond	Memphis	Columbus	Ogden	Tracy	
Norfolk	9,440	18,520	6,020	5,740	2,920	1,250	43,890
Charleston	2,770	6,800	2,250	910	640	270	13,640
Jacksonville	280	2,970	6,050	260	200	230	9,990
Pensacola	70	660	2,470	260	170	80	3,710
Long Beach	0	60	0	80	170	190	500
San Diego	650	2,440	1,410	550	6,210	12,820	24,080
Oakland	180	300	130	110	1,020	240	1,980
Bremerton	100	390	420	250	3,760	9,300	14,220
Cape Canaveral	0	0	0	0	0	0	0
Bayonne	0	0	0	0	0	0	0
New Orleans	0	0	0	0	0	0	0
TOTAL	13,490	32,140	18,750	8,160	15,090	24,380	112,010

TABLE D-2

NSC-TO-DLA WEIGHT

(KWT)

Origin	Destination						Total
	Mechanicsburg	Richmond	Memphis	Columbus	Ogden	Tracy	
Norfolk	3,630	0	1,140	1,600	890	30	7,290
Charleston	170	560	40	110	0	180	1,060
Jacksonville	0	20	150	0	0	0	170
Pensacola	0	160	0	20	0	0	180
Long Beach	0	70	0	0	0	190	260
San Diego	40	390	70	0	390	1,290	2,180
Oakland	0	230	50	10	60	140	490
Bremerton	90	180	0	0	750	0	1,020
Cape Canaveral	0	0	0	0	0	0	0
Bayonne	0	0	0	0	0	0	0
New Orleans	0	0	0	0	0	0	0
TOTAL	3,930	1,610	1,450	1,740	2,090	1,830	12,650

TABLE D-3

NSC-TO-NSC WEIGHT

(KWT)

Destination	Origin											Total
	Norfolk	Charleston	Jacksonville	Cape C	Pensacola	Bayonne	New Orleans	Long Beach	San Diego	Oakland	Bremerton	
Norfolk	0	3,080	1,620	0	10	480	40	270	2,050	1,750	490	9,790
Charleston	3,250	0	160	0	0	10	0	30	140	360	40	3,990
Jacksonville	5,050	190	0	0	10	20	10	0	210	130	0	5,620
Cape Canaveral	100	1,840	30	0	10	120	10	0	0	30	0	2,140
Pensacola	690	0	250	0	0	0	0	0	280	90	0	1,310
Bayonne	740	30	0	0	0	0	140	0	40	70	0	1,020
New Orleans	40	10	0	0	0	10	0	0	40	220	0	320
Long Beach	770	310	20	0	10	0	60	0	23,390	670	390	30,620
San Diego	1,850	60	170	0	280	0	0	500	0	8,910	2,050	13,820
Oakland	1,950	290	60	0	40	0	0	260	710	0	350	3,660
Bremerton	200	30	0	0	0	10	0	0	170	1,780	0	2,190
TOTAL	14,640	5,840	2,310	0	360	650	260	1,060	32,030	14,010	3,320	74,480

Note: Total Weight 74,480

Total Weight Eastern NSC To Eastern NSC 17,950

Total Weight Western NSC To Western NSC 44,180

Total Weight Eastern NSC To Western NSC 6,110

Total Weight Western NSC To Eastern NSC 6,240

TABLE D-4

SHIPMENT SIZE BREAKDOWN – DLA

(Percent of Weight)

Product	DLA	Shipment Size Categories (Pounds)												Total %	Total KWT
		1-10	11-20	21-50	51-150	151-500	501-1,000	1,001-2,000	2,001-5,000	5,001-10,000	10,001-20,000	20,001-40,000	40,001 +		
2	Mechanicsburg		2%					1%	4%	10%	17%	29%	37%	100	13,480
18	New Cumberland		100%											100	10
3	Richmond		5%						1%	2%	13%	50%	29%	100	32,310
8	Memphis		3%						7%	9%	16%	40%	25%	100	18,770
9	Columbus		9%					1%	6%	8%	30%	43%	3%	100	8,160
11	Ogden		9%					2%	8%	12%	17%	31%	23%	100	15,120
16	Tracy		4%					1%	3%	4%	%	46%	26%	100	24,590
	TOTAL		5%					1%	4%	6%	16%	42%	26%	100%	112,400

TABLE D-5

SHIPMENT SIZE BREAKDOWN – NSCs

(Percent of Weight)

Product	NSC/ Outport	Shipment Size Categories (Pounds)												Total %	Total KWT
		1-10	11-20	21-50	51-150	151-500	501-1,000	1,001-2,000	2,001-5,000	5,001-10,000	10,001-20,000	20,001-40,000	40,001 +		
4	Norfolk		1%		1%	1%			1%	3%	8%	56%	28%	100	21,930
5	Charleston		1%						5%	11%	20%	50%	13%	100	6,900
6	Jacksonville								1%	2%	9%	10%	78%	100	2,480
7	Pensacola							1%	17%	27%	27%	17%	11%	100	720
13	Long Beach							1%	2%	11%	12%	25%	48%	100	1,320
14	San Diego		1%		1%			2%	1%	2%	6%	3%	83%	100	34,590
15	Oakland	2%	5%					1%	5%	9%	22%	42%	15%	100	14,500
17	Bremerton							1%	6%	4%	13%	15%	60%	100	4,340
1	Bayonne							1%	8%	21%	3%	5%	62%	100	650
10	New Orleans							6%	37%	33%	9%	15%		100	260
	TOTAL		1%		1%			1%	2%	4%	10%	32%	48%	100	87,690

APPENDIX E

CALCULATION OF NSC RECEIVING RATE

To compare the cost of the eleven scenarios in the Advanced Receiving Model, we needed to obtain processing costs that could be related to the weight of material processed. For contractor operations, such costs were available in a commercial database. For Defense Logistics Agency (DLA) receipt processing, we were able to identify and estimate the cost of work tasks using commercially available labor standards. In-house receiving operations at NSCs required more extensive investigation.

To link processing cost and weight, it was necessary to identify an in-house Navy receiving operation that kept records of the weight of receipts processed as well as the cost to process them. We found one: the Advance Traceability and Control (ATAC) repairables processing hub at NSC Norfolk. We obtained the weight of material processed during the month of June 1986 (supplied by Emery Air Freight, the ATAC freight agent at that time) and the labor charges for handling and data input (supplied by the NSC repairables department). The ATAC hub performs some processing steps not found in Central Receiving. Labor costs for those nonapplicable functions were excluded from our calculations.

Table E-1 shows how our cost of $3.51 for in-house receipt processing was calculated using the data:

TABLE E-1

CALCULATION OF BASELINE RATE FOR NSC CENTRAL RECEIVING

Labor Costs	
Material Handling	$14,452
Data Entry	11,178
	25,630
Indirect (32%)	8,202
Total	$33,832
Weight Processed	9,633
Baseline Cost Per Hundred Weight	$3.51/CWT