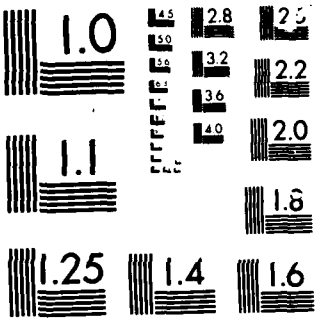
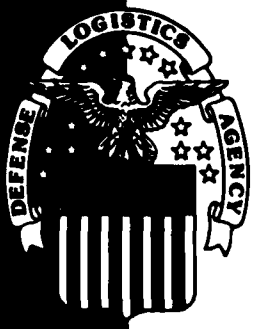
AD-A166 751 ANALYSIS OF A DEMAND RECORDING ANOMALLY(U) DEFENSE 1/1
LOGISTICS AGENCY ALEXANDRIA VA OPERATIONS RESEARCH AND
ECONOMIC ANALYSIS OFFICE J J HOBSON SEP 85

UNCLASSIFIED F/G 15/5 NL



MICROCOPY CHART



DEPARTMENT OF DEFENSE

DEFENSE LOGISTICS AGENCY

Cameron Station,
Alexandria, Virginia 22304-6100

REPORT ON ANALYSIS OF A DEMAND RECORDING ANOMALLY

September 1985

ANALYSIS OF A DEMAND RECORDING ANOMALY

September 1985

RE: Distribution Statement
Approved for Public Release. Distribution Unlimited.
Per Ms. Cleo Ridgeway, Defense Logistics Agency/LO

Captain Jeffrey J. Hobson, USAF
Operations Research and Economic Analysis Office
Headquarters, Defense Logistics Agency
Cameron Station, Alexandria, Virginia 22304-6100

DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

DLA-LO

Sep 1985

FOREWORD

This report presents an analysis of a Standard Automated Materiel Management System (SAMMS) inconsistency between the distribution and requirements subsystems. The purpose of this analysis was to determine the urgency of implementing SAMMS System Change Request USDOH033 to correct a current deficiency which may lead to malpositioned stock and increased transportation costs.

This analysis estimates the extent of misrecorded demand and suggests that a follow-on study to calculate the increased transportation costs is unnecessary. First, a data file of Materiel Release Order (MROs) for the general commodity for FY84 was constructed. Then the misrecorded demand was calculated, and the situations that caused the misrecording were examined. Approximately four percent of the total weight shipped was found to be recorded incorrectly.

The results of this study indicate that the system change request should be completed, but there is no compelling reason to increase the priority of the implementation. The percentage of stock misrecorded is small and the amount that could be malpositioned would not be located at a depot that is much further from the customer than the optimal storage depot would be. In addition, the excess transportation costs associated with the misrecording need not be estimated. The expected benefits received from the analysis would be insufficient to justify the costs of performing it.

ROGER C. ROY
Acting Assistant Director,
Policy and Plans

CONTENTS

I. INTRODUCTION

A. Source Preference Table

A DLA supply center under the Standard Automated Materiel Management System (SAMMS) uses a Source Preference Table (SPT) to determine which depot stock will be shipped from in order to satisfy a requisition. The SPT for a customer is a list of supply depots ordered by increasing approximate distance from the customer. Each customer is assigned a Geographical Area Code (GAC) signifying its DLA assigned geographical region. The full SPT contains source preference lists for all GACs. The SPT also includes attrition sites which are locations having residual stock on hand following a DLA supply management decision stopping the replenishment of an item at that depot. This listing is also independent of the item being requisitioned. In other words, the depot listing of the SPT includes all depots and not just the depots that stock a particular item.

When a requisition is received, the customer's GAC is determined by searching a file that contains the customers' identification codes and assigned GACs. The SPT listing for this GAC is then searched depot by depot and compared with the Supply Control File (SCF). The SCF contains a list of all depots assigned to stock the item being requisitioned. By comparing the SPT and the SCF, the closest depot with available stock can be determined. This stocking depot then becomes the shipping depot for this requisition.

B. Storage Mission Code. Unlike the distribution process in SAMMS, the requirements process uses Storage Mission Code (SMC) tables. Every item is assigned a SMC that describes its storage pattern (list of depots stocking the item) and also how demand will be rolled to calculate the Proportion Recurring Demand Allocable (PRDA) for restocking purposes. When a requisition is received, the demand for the item is recorded at the first primary depot (not an attrition site) in the SPT. This recording depot is not necessarily the location from which the item is shipped, nor is it necessarily a location that stocks the item. If the demand is recorded at a nonstocking depot as defined by the SMC, then the demand must be rolled to a stocking depot. This rolling is accomplished using the SMC table since each nonstocking depot is assigned a stocking depot. The demand from the nonstocking depots is then aggregrated at the stocking depots for the purpose of calculating the PRDA.

C. System Conflicts

Since the distribution process and the requirements process use different procedures for determining the shipping and recording (rolled to) depots, the possibility for misallocation of stock exists in SAMMS. This misallocation can occur if the shipping depot and the rolled-to depot are not the same. One depot would ship an item, but the rolled-to depot would be restocked instead of the shipping depot during the reordering process. The following example will highlight how this misallocation could occur.

A requisition for an item with a SMC of 'PA' is received from a customer in GAC 17. The stocking depots for this SMC are as follows: Mechanicsburg, Tracy, Ogden, Memphis, and Richmond. The distribution process would scan the SPT listing for GAC 17 until the first stocking depot was found. If this depot has the stock on hand, the depot would ship the item; however, if the depot were out of stock, the process would continue until stock was located. In this case, the first stocking depot for this item is Richmond. Therefore, Richmond would ship the item to the customer to

satisfy the requisition. However, the requirements process would determine that Warner-Robins AFB was the first non-attrition site in the SPT and record the demand to it. The demand would then be rolled to a stocking depot based on the SMC 'PA'. For this situation, the demand recorded at Warner-Robins would be rolled to Memphis. When the item was restocked, the PRDA for Memphis would be overstated and, hence, stock that was shipped from Richmond would be replaced with stock sent to Memphis.

This example demonstrates that a potential problem exists if this misrecording of demand occurs frequently. Transportation costs could be much higher than they needed to be since the actual shipping depot could run out of stock after a reorder period. This would cause another depot to fill the requisition and this other depot would be a greater distance away from the customer. However, it should be noted that this misrecording of demand does not guarantee higher system transportation costs or stockouts since it is possible the rolled-to depot may experience greater than average demand after restocking the item. The rolled-to depot would have the stock on hand for this situation because of the misallocation. If the misallocation had not occurred, an out-of-area shipment at a possibly greater cost would be necessary to satisfy the demand.

This recording problem was realized in 1980, and on 14 March 1980, System Change Request USDOH033 was initiated to correct this process inconsistency. This system change was revised twice; the final revision removed any discrepancy between the shipping depot and the rolled-to depot. However, this change would require substantial manhours to accomplish and the project has been on backlog. The Directorate of Supply Operations, Transportation Division, requested in December 1984 that a study be undertaken to determine the extent of mispositioned stock in order to evaluate the urgency of this backlogged system change.

D. Objectives

1. Determine the amount of misallocated stock due to the SAMMS deficiency.

2. Develop methodology to estimate the annual excess transportation costs that result from this deficiency.

3. Determine if a follow-up study is necessary to estimate the excess transportation costs.

E. Scope. This study will be limited to calculating the amount of misallocated stock for a single commodity (General) and a single year (FY84). A methodology of calculating the excess transportation costs associated with this misallocation will be developed but no actual cost figures will be derived.

II. METHODOLOGY

A. Assumptions

In order to model the system to calculate the extent of mispositioned stock, some assumptions had to be made. The primary assumption was that the closest stocking depot to the customer would always have the required stock to satisfy a requisition. This implies that there would never be a stockout situation or a situation where backordering was necessary. This assumption was necessary for two reasons. First, stockouts may presently occur because stock is being mispositioned from the recording

problem. Since the purpose of this study was to determine the extent of misallocated stock, stockouts would give a biased view of the situation. Second, backorders were not allowed since the depot that ultimately ships a backordered item may not be the optimal shipping depot based on the SPT. This occurs since a backorder is filled by the first depot receiving stock during the restocking period. Therefore, if an item is backordered and the rolled-to depot were the first to receive stock, the rolled-to depot would fill the requisition and become the shipping depot. This would not be listed as a misallocation situation since the shipping depot is the same as the rolled-to depot. However, the closest stocking depot should have been the shipping depot so a misallocation of stock does actually occur but is dynamically "corrected" by coincidence.

Another assumption was that the extent of the misallocation of stock was approximately the same for all commodities. This allowed the study to be performed using a single commodity. The final assumption was that the demand pattern for the items did not change over time. If this assumption were not made, the demand pattern for each item would have to be analyzed to determine if buying stock back to the non-shipping depot would actually result in misallocation.

B. Database

To calculate the amount of misallocated stock, MROs for the General commodity for FY84 were used as a foundation. The MRO data file contains actual shipments that took place and the locations of the customers. The information used from this file was item number, storage mission code, unit price, unit weight, and quantity shipped. In addition to this information, the customer's GAC was determined and added to the file. Of the total MROs in the file, less than five percent were not used because of invalid SMCs or uncertain GACs. The end result was a database with over 2.5 million MRO records.

In addition to the database, two tables were constructed. These tables were built to yield the shipping depot and the rolled to depot for any combination of customer's GAC and item's SMC. The tables used the assumption that the first stocking depot in the SPT had the stock on hand. An assumption was also made that the attrition sites would not have the stock demanded. For example, the shipping depot and the rolled-to depot could be read from the two tables given that the customer is from GAC 17 and the SMC of the item is 'PA' without having to reference the SPT and the SMC constantly.

C. Calculating Misallocation

The variable used to determine the extent of misallocation of stock is the total weight of items shipped from one depot with demand rolled-to another. This variable was chosen since it would give the most relevant figure for this analysis. This total weight of misallocated stock could then be divided by the total weight shipped to determine the percentage of all shipped stock that may be mispositioned due to the SAMMS deficiency. Items that did not have a weight in the file were excluded from the remainder of the analysis. Deleting these items did bias the total weight of misallocated stock downward. However, assuming the items with no weight were divided proportionally between the correctly stocked and mispositioned items, the percent of stock mispositioned should not be affected.

To calculate the total misallocated weight, each MRO record was examined and the GAC of the customer, the SMC of the item, and the weight shipped were extracted. The

shipping depot and the rolled-to depot were then determined from the tables mentioned earlier. If the two depots differed, the weight of the shipment was added to the misallocated total. The weight of all shipments was also totalled to calculate a grand total. In addition, two other analyses were performed. The first of these was to determine the amount of stock that was misallocated by depot. This was accomplished by constructing a matrix of shipping and rolled-to depots. Then as the two depots were determined, the proper cell in the matrix was incremented by the shipment weight. The matrix allows examination of the misallocation of stock to determine if the problem were widespread or limited to specific depots.

Net misallocation was also calculated to remove the effect of cross-misallocation. This would occur if the shipping depot for one customer became the rolled-to depot for a second customer, whereas the rolled-to depot for the first became the shipping depot for the second. This reversal of rolls would tend to reduce the amount of mispositioned stock. The net misallocation of stock by depot was calculated in the same manner as above, except that the weights were accumulated for each item and then a net weight amount was determined.

III. ANALYSIS

A. Misallocation Extent

The 2.5 million MRO records yielded a total shipping weight of approximately 476 million pounds of material. This weight figure is biased on the low side since four percent of the MROs had no weights recorded. Of the total records, 193,046 (7.6%) MROs and approximately 23 million pounds (4.8%) of material were shipped from one depot and rolled to another. When cross-misallocation was considered, the final result was approximately 21 million pounds (4.2% of the total weight) restocked at the incorrect depot.

The breakdown of the weight shipped according to shipping depot and rolled-to depot for the six DLA depots is shown in Table 1. Examination of this table reveals that 96% of the total weight misallocated occurs in four situations. The four situations and the misallocation due to each are listed below:

Shipped From	Rolled To	Weight (million pounds)	Number MROs
Richmond	Memphis	14.4	96,427
Ogden	Memphis	6.5	41,853
Memphis	Richmond	1.4	4,920
Ogden	Tracy	0.5	13,028

It can be noted from the list above that in each of the four situations the shipping depot and the rolled-to depot are geographically adjacent (no other DLA depot between them). From this fact, the geographical area of the customers for each situation was determined. Appendix A contains maps that are shaded to reflect the area where customers are located for each situation. The maps show that the rolled-to depot is not much further from the customer area than the shipping depot. This is a significant fact since any excess transportation costs would be the result of the extra distance from the depot to the customer.

Table 1

WEIGHT SHIPPED BY SHIPPED-FROM DEPOT AND ROLLED-TO DEPOT
FOR DLA SUPPLY DEPOTS (IN POUNDS)

	Shipped From					
Rolled To	DDMP	DDTC	DCSC	DDMT	DGSC	DDOU
DDMP	35,024,578	250		56,211	19,469	142,642
DDTC	20	39,088,032		1,204		477,212
DCSC			4,120,073	30,331		41,020
DDMT	160,398			87,781,793	14,416,486	6,494,656
DGSC	30,112			1,391,642	168,029,380	242,815
DDOU						100,168,928

B. Transportation Cost Calculation

Calculating the excess transportation costs associated with this recording anomaly is very difficult for several reasons. First, it is not known if the demand pattern for an item remains constant over time. If the demand distribution geographically changes over time, then a misallocation due to a recording deficiency may not increase costs. Rather, the misallocation may be placing the stock in the correct locations for future demand. Second, if the shipping depot that is not restocked correctly runs out of stock, it cannot be assumed the customer whose demand was recorded incorrectly will be the customer that will requisition an item and that the item will be shipped from the second best stocking depot. The third problem with calculating the excess cost occurs if shipments are consolidated to decrease the shipping cost per pound. A misallocated item may be consolidated with other items at the rolled-to depot and then shipped for a lower cost even though the distance was greater. Finally, total demand for items fluctuates over time and there are no assurances that the misallocated goods would be demanded in quantities that would deplete the onhand stock at any depot.

Given the problems mentioned above, any attempt to calculate the excess transportation costs would require extensive background analysis to determine the effects of each situation. A simulation model would be the best technique to analyze the situation, due to the uncertain nature of demand. To develop this model, geographical and quantitative demand patterns for items would have to be determined. These demand patterns could then be used as the foundation for the simulation model. Any deterministic technique used to calculate the excess costs incurred due to the recording anomaly would yield an unreliable estimate of the actual value.

IV. CONCLUSIONS

The extent of the mispositioned stock was calculated for the General commodity for FY84. Of the total weight shipped during this period, less than five percent was misallocated and approximately four percent would be mispositioned when cross-misallocation was considered. Ninety-six percent of this misallocation was attributable to four situations and in each of these cases, the two storage depots are geographically adjacent and the two depots are approximately equidistant from the customers.

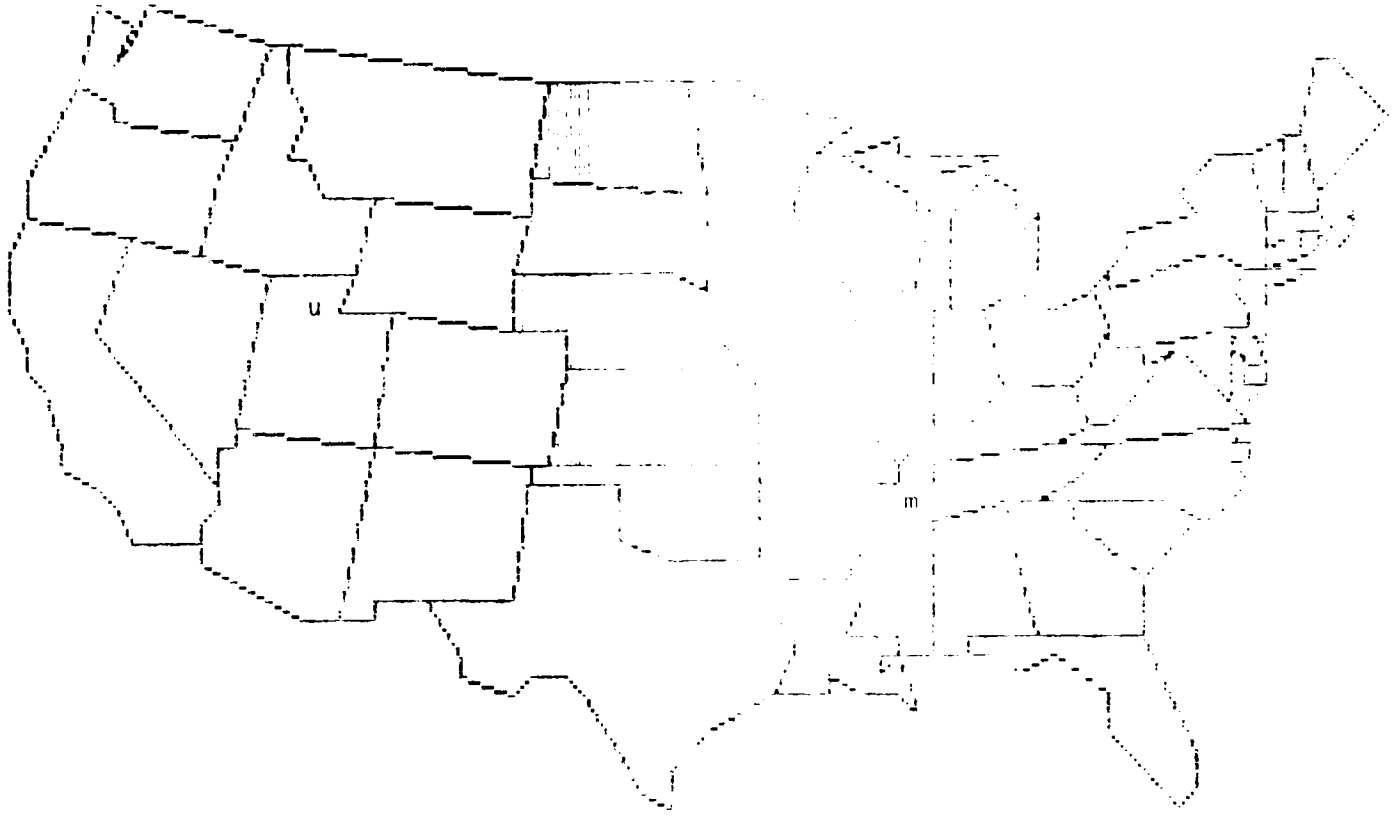
A calculation of the excess transportation costs resulting from this misallocation would be difficult for several reasons. Uncertainty in the geographical demand pattern, consolidation of shipments, and customer location are all problems in calculating this excess cost. A simulation model would be the best technique to calculate an approximate cost. However, building this model would require extensive research to address the problems mentioned above and may have a manpower cost near that of solving the problem directly.

V. RECOMMENDATIONS. The SAMMS System Change Request USDOH033 to correct the recording deficiency should be completed whenever possible. However, the results of this analysis do not support increasing the priority of that request. The extent of misrecorded demand is approximately four percent, and the stock that is mispositioned is not located much further from the customer than it would be if it were restocked correctly. A follow-on study to calculate the excess transportation costs due to the misallocation should not be undertaken since the results of this study show the probable excess costs being low and extremely uncertain. The additional benefit derived by performing a detailed cost analysis would probably not be justified.

APPENDIX A

Maps

Location of Customers with Possible
Incorrect Recording of Demand

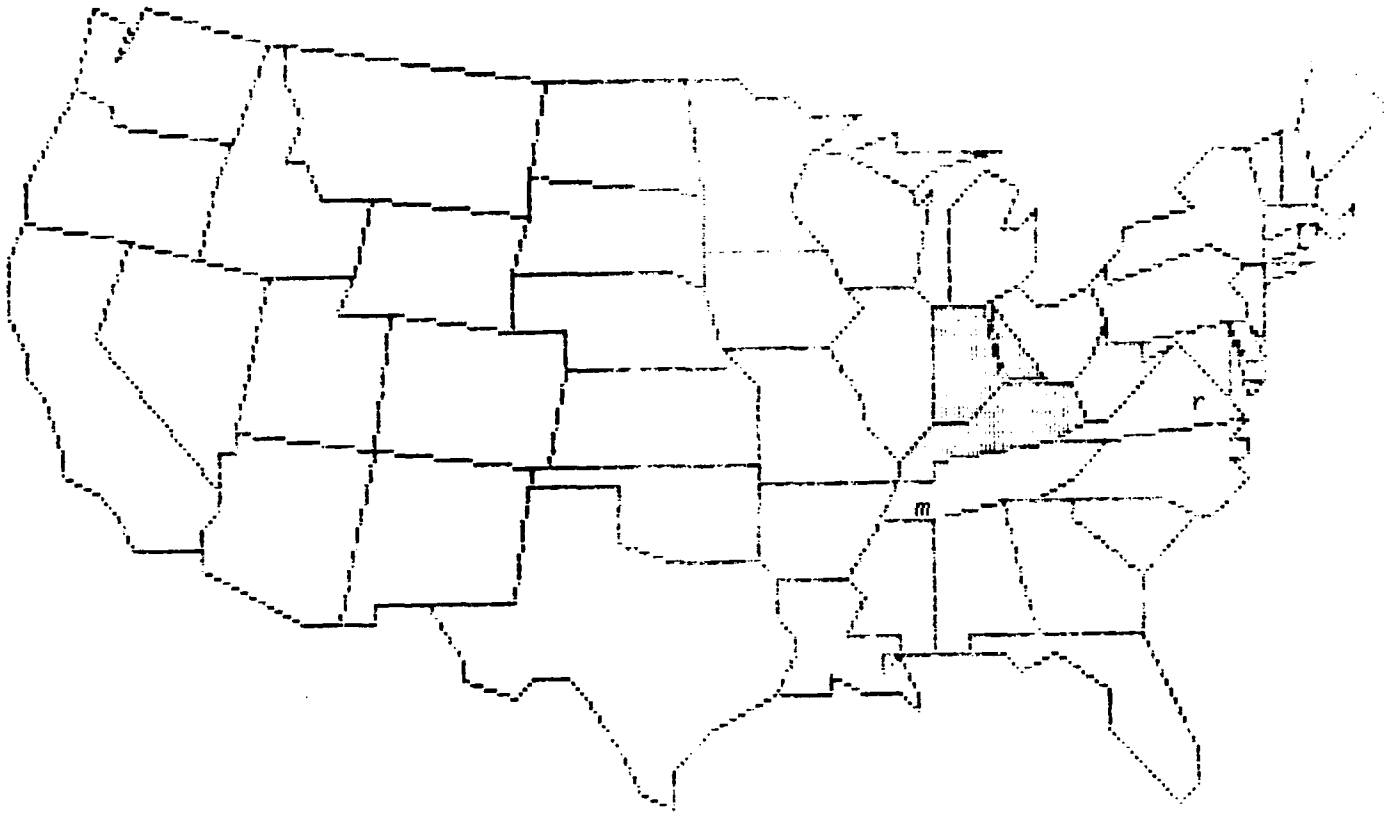


Location of customers

u Ogden - Shipping depot

m Memphis - Rolled-to depot

Location of Customers with Possible
Incorrect Recording of Demand

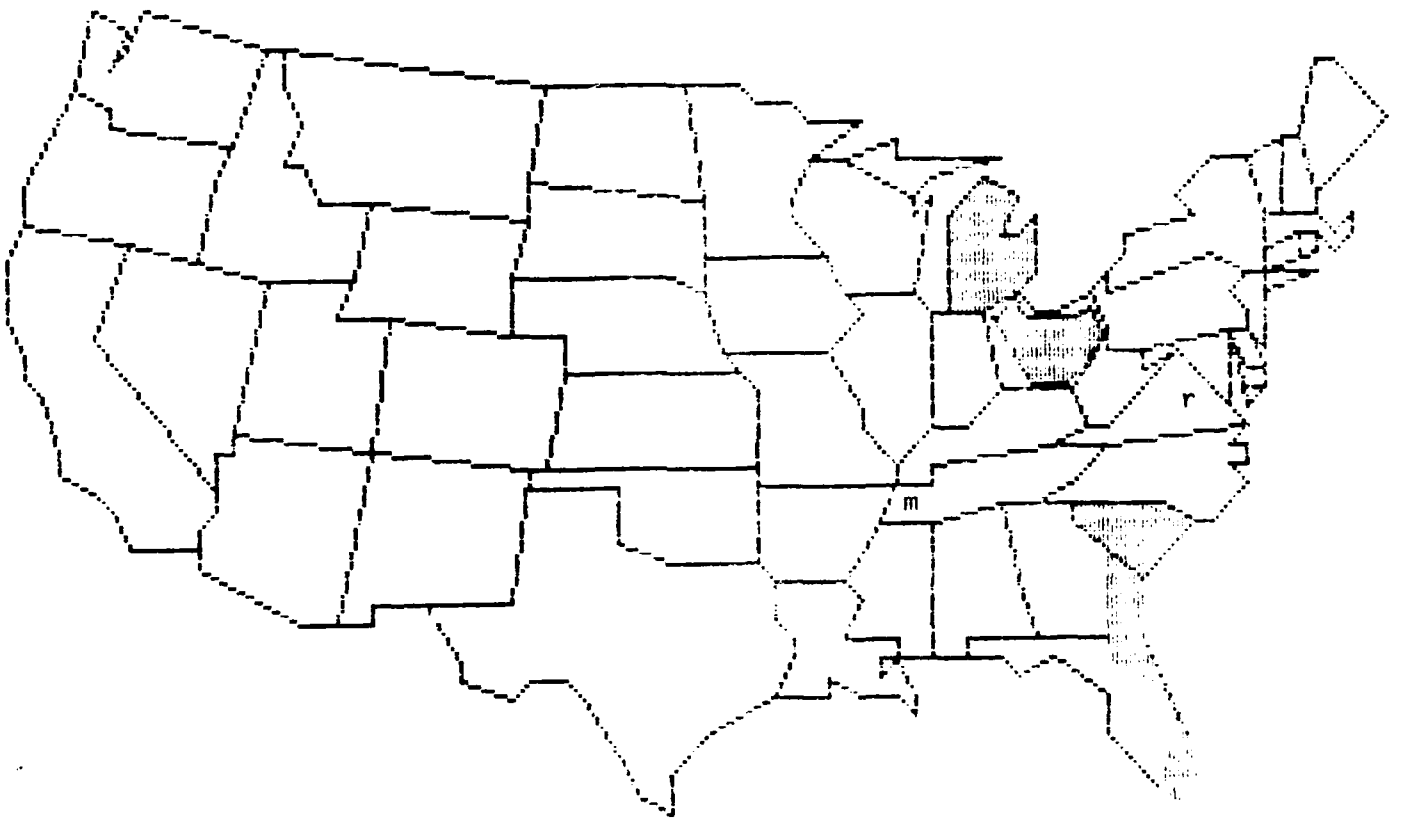


Location of customers

m Memphis - Shipping depot

r Richmond - Rolled-to depot

Location of Customers with Possible
Incorrect Recording of Demand

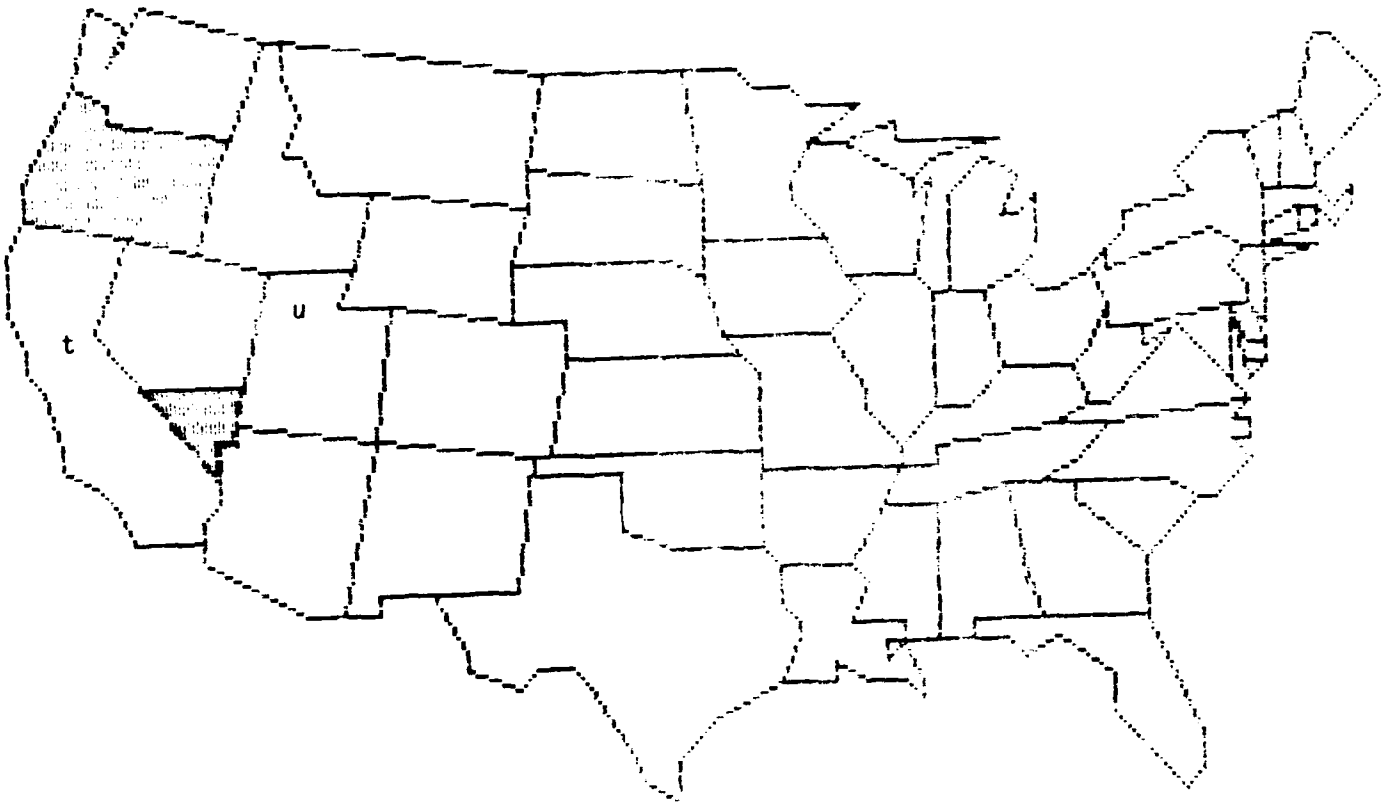


Location of customers

r Richmond - Shipping depot

m Memphis - Rolled-to depot

Location of Customers with Possible
Incorrect Recording of Demand



Location of customers

u Ogden - Shipping depot

t Tracy - Rolled-to depot

END

FILMED

5-86

DTIC