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REPORT BY THE U.S.

General Accounting Office

Better Investment Decisions Can Save Money At GSA And FAA

The General Services Administration and the Federal Aviation Administration operate supply systems with hundreds of millions of dollars worth of inventory. As such, it is essential that managers make prudent decisions about "how much to buy" and "when to buy." Otherwise, out-of-stock situations can develop or inventory may be bought but never used. In either case, limited resources are not prudently utilized.

GAO found that the agencies could improve the effectiveness and efficiency of the supply systems by refining existing operating procedures and employing alternative management strategies. Such actions would make the systems more responsive to user needs and reduce inventory management costs--possibly by millions of dollars.

UNITED STATES GENERAL ACCOUNTING OFFICE

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,
AND READINESS DIVISION

B-202583

The Honorable Andrew L. Lewis, Jr.
The Secretary of Transportation

The Honorable Gerald P. Carmen
The Administrator of General Services

This report discusses the inventory investment decisions at the General Services Administration and the Federal Aviation Administration and suggests alternative management strategies that can save money.

General Services Administration and Federal Aviation Administration officials responsible for inventory management reviewed this report and generally concurred with the information contained in it. Their comments have been incorporated where appropriate.

This report contains recommendations to you on pages 9, 14, 22, and 29. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Chairmen, House Committee on Government Operations, Senate Committee on Governmental Affairs, and House and Senate Committees on Appropriations; the Director, Office of Management and Budget; and the Administrator, Federal Aviation Administration.

Donald J. Horan

Donald J. Horan
Director

REPORT BY THE U.S. GENERAL ACCOUNTING OFFICE

BETTER INVESTMENT DECISIONS CAN SAVE MONEY AT GSA AND FAA

D I G E S T

An effective and efficient logistics system is one which maintains sufficient, but not excessive, stocks on hand to meet users' needs. If the system cannot respond, and out-of-stock situations occur, costly actions, such as expedited procurements must be taken. Conversely, if the system has too much or an improper mix of stocks on hand, resources have been spent on inventories which may never be used. Thus, logistics managers must decide "when to buy" and "how much to buy." But, in order to make these decisions, managers need current and valid cost, demand, leadtime, and safety level data. As part of a continuing effort to evaluate the effectiveness and efficiency of supply systems in the Federal Government, GAO reviewed how the General Services Administration (GSA) and the Federal Aviation Administration (FAA) managers make these purchase decisions.

GAO found that even though the GSA National Capital Region and FAA were generally achieving their fill rate goals and had adequate stock turnover rates, the agencies could improve the effectiveness and efficiency of the supply systems by refining existing operating procedures and employing alternative management strategies. By doing so, the system would be more responsive to user needs and inventory management costs could be reduced. While GAO could only project some savings--$564,000 yearly at FAA and a one-time savings of $774,000 at GSA National Capital Region--the potential is much greater. GSA and FAA annually turn over stock valued at about $750 million and $75 million, respectively. GAO identified several areas where improvements were needed and believes that

--using updated data would reduce inventory management costs,

--recognizing and responding more rapidly to demand trends in GSA's demand forecasting would reduce purchases,

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--using more accurate leadtime data would reduce requirements, and

--revising the method for computing safety level stocks would reduce the safety level investment without adversely affecting supply responsiveness.

UPDATED COST DATA

Inventory managers compare the costs of carrying inventory to the costs of processing procurements to determine optimum reorder times and quantities. Although GSA and FAA have performed studies to update carrying and procurement costs, they were still using old data--FAA used 1973 and 1975 data and GSA, 1976. This increases their inventory management costs. For example, a 1980 FAA study showed that its carrying costs had decreased from 22.9 percent to 13.6 percent. At the same time, procurement costs increased from $134.96 to $259.56. Therefore, FAA should be making larger purchases less frequently. GAO projects that using the updated cost data would save FAA $259,000 a year.

In addition, GAO found that if FAA used an economic order quantity model that considered shortage costs and demand variability in addition to carrying and procurement costs, it could save another $305,000 a year.

BETTER DEMAND FORECASTING

GSA's demand forecasting, unlike FAA's, does not give more weight to the more recent months' demand data, therefore, it is less responsive to sudden demand changes. In times of decreasing demand, this can lead to unnecessary purchases and inventories greater than necessary.

While it is not possible to directly correlate demand forecasting techniques with long-supply situations, GAO and Department of Defense studies have determined it to be the major contributing factor to long supply. As of July 25, 1980, GAO noted that 30 percent (about $2.3 million) of GSA's National Capital Region's inventory was in long supply.

MORE ACCURATE LEADTIMES

Procurement leadtime--the period from initiation of procurement action to receipt of the item--is the prime factor that determines how much stock an agency needs to meet user demands, and as such, represents the largest part of an agency's total operating requirement.

The procurement leadtimes used by GSA, and to a lesser extent FAA, do not always reflect actual leadtime. For instance:

--GSA and FAA procurement leadtime includes avoidable delays after items are received at the stocking depot.

--GSA requested contractors to defer deliveries; however, the leadtime continued to accumulate during the deferral period.

--FAA added a rounding factor--0.77 month's leadtime demand--to an item's actual leadtime which is not realistic and inflates requirements.

MINIMIZING SAFETY LEVELS

Safety level stocks are maintained in addition to operating needs to protect against unanticipated demands. GSA had about $63.2 million of safety level stock requirements and FAA about $3.4 million.

Since safety level stocks are insurance-type items, investment in them should be minimized. To make the best use of limited funds, safety levels should only be provided for items whose characteristics require it. However, at GSA the number of items with safety levels varied based on funds available rather than the type of item. In addition, safety levels could be reduced about $774,000 if GSA calculated them on a systemwide basis rather than on a depot-by-depot basis. FAA's safety levels were fixed at 1 or 2 months' requirements based on the economic order quantity period rather than the type of item. The need for safety levels on many items was questionable given their low demand and replenishment infrequencies.

RECOMMENDATIONS

GAO recommends that the Administrator of GSA and the Secretary of Transportation:

--Implement updated inventory carrying and procurement costs as well as shortage costs and demand variability in their economic order quantity computations.

--Establish systems that relate the need for safety levels to item characteristics, including item essentiality to reduce safety level investments.

Other specific recommendations to the Administrator of GSA and the Secretary of Transportation are on pages 9, 14, 22, and 29.

GSA and FAA officials responsible for inventory management reviewed this report and generally concurred. Their comments have been incorporated in the report as appropriate.

Contents

ABBREVIATIONS

EOQ	economic order quantity
FAA	Federal Aviation Administration
GAO	General Accounting Office
GSA	General Services Administration
MPV	management policy variable

CHAPTER 1

INTRODUCTION

Logistics supply systems exist primarily to meet the valid and essential needs of their customers (users). How well the system meets these needs is an indication of whether it is effective. However, the fact that a system is effective does not mean that it is also efficient. An effective and efficient supply system is one that maintains sufficient, but not excessive, onhand stocks to meet users' demands. If a supply system cannot respond to a user's demands and out-of-stock situations occur, costly actions--such as expedited procurement and redistribution stock from other stocking locations--must be taken. Conversely, if the supply system has too much stock or the wrong mix of stock on hand, resources may be invested in inventory that may never be used, and stock excesses may result. These excesses may have to be purged from the system usually at a significant financial loss. Thus, the key decisions managers must make are "how much to buy" and "when to buy."

If resources are unlimited, the decisions of how much to buy and when to buy are easy, and managers could theoretically have sufficient stock available to meet customer needs. Obviously, resources are limited and managers must make important decisions to (1) minimize the number of instances where demands are not met and (2) optimize the cost tradeoff between carrying inventory for issue and repetitive procurements. This has led to the development of the economic order quantity (EOQ).

THE EOQ PRINCIPLE

The EOQ principle applies to consumable-type items, which are items that may also be referred to as expense, expendables, or stock-funded items. This distinguishes them from reparable-type items which are items that are recovered, repaired, and reissued.

All Federal agencies use the EOQ principle to determine replenishment quantities. However, the agencies have adopted different EOQ formulas or models to answer the how much to buy question. While some models are more sophisticated than others and take different factors into consideration, the objective of each is essentially the same--to order that quantity which will balance the cost of carrying inventory with the cost of repetitive procurements.

Another aspect which must be considered in conjunction with the EOQ is when to buy. Agencies have generally adopted the reorder point concept in which orders are placed when inventory levels fall below some predetermined amount. This is usually the amount of stock needed to meet demands that are estimated to occur during procurement leadtime--the time from when an order is placed until it is received and recordered as available for issue--plus an additional amount of stock (safety stock) to cover unanticipated demand surges and interruptions in deliveries.

As can be seen from the above, inventory management is a dynamic and somewhat complex business, and requires managers to constantly consider alternatives for optimizing the cost of carrying inventory versus the cost of repetitive procurements versus the cost of being out of stock.

For managers to be able to consider and implement alternative management strategies and achieve the EOQ objectives, they must have accurate and up-to-date cost, demand forecast, leadtime, and safety level data.

SCOPE, OBJECTIVES, AND METHODOLOGY

As part of a continuing effort to evaluate the effectiveness and efficiency of supply systems in Federal agencies, we reviewed how the General Services Administration (GSA) and the Federal Aviation Administration (FAA) determined how much to buy and when to buy.

GSA has 11 regions in addition to the National Furniture Center and the National Tools Center. One region does not have inventory management responsibilities. The 10 regions and centers manage a total of about 19,200 separate line items, with an inventory value of about $215 million. Most of the items are low cost, high demand frequency items. In fiscal year 1980, sales totalled $740 million. The National Capital Region, where our review was performed, manages about 2,300 active items--consisting of office-type items--with an inventory of about $14.5 million. In fiscal year 1980, the region had sales totalling $93.5 million.

GSA operates under the concept whereby a single manager has responsibility for one or more groups of stock items. The manager is responsible for (1) determining how much and when to buy, (2) directing that requisitions be filled from any depot that stocks the requested item, and (3) redistributing stock among the depots in order to balance inventory levels.

FAA manages about 200,000 line items valued at $155 million and supports over 18,000 National Airspace System ground facilities. The FAA supply system also supports 60 agency aircraft, ranging in age from pre-World War II DC-3s to modern jet and turbo-prop models.

Unlike GSA, which has multiple depots, FAA provides support to its customers primarily from a single depot. Most FAA-managed items are relatively low cost, low demand frequency items. On an annual basis, the depot makes about 425,000 issues, valued in the $75 to $80 million range. As discussed above, both GSA and FAA have a significant investment in inventory stock, and their respective supply systems are big business.

The objectives of our review were to determine whether the key data elements used by GSA and FAA in their requirements determination process were current, accurate, and based on the best information available. More specifically, we evaluated the following data elements--cost, demand, leadtime information, and safety levels.

We performed our evaluation at the FAA Aeronautical Center in Oklahoma City, Oklahoma, and the GSA National Capital Region and GSA Headquarters in Washington, D.C. In addition, we discussed the draft of this report with FAA Headquarters officials in the Office of Accounting, Logistics Services, and Material Management Division, and GSA Headquarters officials from the Office of Supply and Office of Inventory Management as well as the Director of Inventory Management from the GSA National Capital Region.

We reviewed pertinent agency regulations and studies and analyzed demand, leadtime, and safety level reports. Additionally, we randomly selected a statistical sample of items at GSA and FAA and verified the accuracy of the key data elements used to compute the items' requirements level. In chapter 6, we discuss the methodology used in selecting the sample and the types of analyses performed.

CHAPTER 2

CURRENT COST DATA NEEDED

TO OPTIMIZE STOCK LEVELS

AND REDUCE INVENTORY MANAGEMENT COSTS

Managers must have up-to-date and accurate data concerning the cost of carrying inventory and the cost of repetitive procurements in order to optimally determine when to buy and how much to buy. These are the driving factors in the EOQ models. Inventory carrying costs include the cost of money invested in inventory, storage costs, obsolescence costs, and shrinkage costs. Repetitive procurement costs include the costs of processing a procurement order, transporting the ordered items, and receiving and inspecting the items. When carrying costs increase at a greater rate than procurement costs, it is more advantageous to buy smaller quantities more frequently. Conversely, when repetitive procurement processing costs increase at a faster rate than carrying cost, it is more advantageous to buy larger quantities less frequently.

The cost factors being used by GSA National Capital Region and FAA are based on outdated cost information, and as a result, the stockage decisions provide no assurance that resources are being optimally utilized. We project that FAA could reduce its inventory management costs 1/ about $259,000 a year by utilizing updated cost information. GSA National Capital Region could also achieve similar benefits; however, the magnitude of reduced inventory management costs was not determined for all of the sample items because of prohibitive amount of time that would have been required to assemble the data in the necessary format.

In addition to using up-to-date cost information as a means of optimizing inventory levels and minimizing inventory management costs, additional opportunities exist for FAA to further reduce inventory management costs. This involves using an alternative EOQ model which considers shortage cost and demand variability in determining when to buy and how much to buy. Use of such a model could reduce FAA's annual inventory management costs 1/ about $305,000.

1/Inventory management costs consist of the cost of carrying inventory, repetitive procurement costs, and shortage cost. The model compares these costs and computes a more optimum reorder level which affects the frequency and amount of procurement--when to buy and how much to buy.

OUTDATED COST FACTORS USED TO DETERMINE STOCK LEVELS

FAA is required by regulation to update its cost factors every 2 years. Nevertheless, it is currently using carrying costs developed in 1973 and procurement processing costs based on 1975 data to determine its order quantity. GSA is also using outdated cost factors (1976 data) to determine stock levels. At both agencies, recent cost surveys showed that they should be buying larger quantities less frequently because repetitive procurement processing costs have increased at a faster rate than inventory carrying costs.

FAA cost factors

In 1977 FAA performed a cost survey which showed that since 1973 carrying costs had decreased from 22.9 percent of the total investment in inventory to 13.9 percent of the investment in inventory. The survey also showed that since 1975 procurement processing costs for each order had increased as follows:

Procurement methods	Procurement processing costs 1975	Procurement processing costs 1977	Percent increase or decrease (-)
Open market--$5,000 or less	$ 34.05	$ 45.31	33.10
Contract--more than $5,000	134.96	243.74	80.60
Defense Logistics Agency/GSA	20.27	19.29	-.05

However, the 1977 updated cost data was never used in determining optimal inventory levels. FAA officials stated that they did not know why the 1977 data was not implemented, and they could not find any indication that the survey results were ever sent to FAA Headquarters for review and approval.

In mid-1980, the Department of Transportation Inspector General completed a review which included determining the effect of not using the 1977 cost data as a basis for determining how much to buy and when to buy. The Inspector General estimated that FAA could have reduced inventory management costs about $80,000 a year if the 1977 cost data had been implemented.

FAA performed another cost survey in 1980 based on fiscal year 1979 cost data and, as shown below, found that carrying costs had remained about the same since the 1977 survey. However, procurement processing costs had continued to increase. At the time of our review, FAA had not decided whether to implement the results of the latest cost survey.

	Carrying and procurement processing costs		
	1973 & 1975	1977	1980
Carrying costs:	22.9%	13.9%	13.6%
Procurement processing costs:			
Open market	$ 34.05	$ 45.31	$ 55.05
Contract	134.96	243.74	259.56
Defense Logistics Agency/GSA	20.27	19.29	22.70

As illustrated above carrying costs have decreased and procurement processing costs have increased. Consequently, FAA should be buying larger quantities less frequently. We validated this by analyzing the sample items in our review and comparing the inventory management cost--using the latest carrying and procurement processing costs--to inventory management cost currently being used by FAA. By projecting our sample results to the universe of active items, our analysis showed that FAA could reduce its inventory management costs about $259,000 1/ a year if the updated cost factors were implemented and used to determine the frequency and quantity of procurements.

In discussing this matter with FAA Headquarters officials, we were told that the depot had requested approval to implement the updated cost data for determining stock levels. The officials said that they were considering the request and would make the changes if appropriate.

GSA cost factors

The cost factors used by GSA to determine optimum stock levels are based on outdated cost data. GSA, unlike FAA, does not have a requirement to update its cost factors at prescribed intervals. Nevertheless, the agency recognizes the importance of using current costs in determining inventory levels. The GSA's EOQ handbook provides that whenever any substantial change is indicated or suspected in the cost per order, the holding cost per dollar of inventory, or requirements value, a review of the estimated cost is necessary.

At present, GSA is using 1976 carrying and procurement processing costs to determine the optimal inventory levels. The agency recently updated the cost factors and found that the carrying costs have decreased and the procurement processing costs have increased as shown in the following table.

1/A projected cost reduction based on statistical projection at at 95-percent confidence level as shown in appendix I.

Cost factor	1976	1980
Carrying cost:	25.2%	22.7%
Procurement processing cost:		
Term contracts	$ 36.44	$ 80.81
Definite quantity contracts:		
$10,000 or less	102.81	190.12
More than $10,000	202.46	306.49

We did not compute what the reduced inventory management cost would be by using the most recent cost data for all sample items because of the time required to assemble the needed data elements in the proper format.

However, for 16 of the 50 sample items at the National Capital Region, we computed what effect the updated cost factors would have on the EOQ and frequency of replenishment. In each case, the use of updated cost factors would have increased the EOQ and decreased the frequency of replenishment as shown below.

Method of purchase	No. of sample items	EOQ increase		Decrease of replenishment frequency	
		Range	Average	Range	Average
		(percent)			
Term contract	6	20-23	21.5	14-18	17.0
Definite quantity contract:					
$10,000 or less	5	24-27	26.3	19-21	20.7
More than $10,000	5	12-16	13.0	10-14	11.6

GSA Headquarters and regional officials advised us that the survey results were being reviewed and that it is their intent to implement the revised cost factors as soon as the review is completed.

The recent cost surveys at GSA and FAA indicate that the agencies should be buying larger quantities less frequently in order to achieve optimal stock levels and reduced inventory management costs. To achieve these benefits, the agencies may have to make a one-time investment increase in operating stock levels. Nevertheless, over a given period of time, the total investment would be the same. For example, an agency might buy a year's requirement at one time instead of two incremental buys during the year. Obviously, when requirements for a certain period are bought at one time instead of on an incremental basis, the agency runs some risk of the items going into a long supply situation if demand decreases significantly. However, as discussed on pages 10 and 14, the risk can be reduced by an accurate demand forecasting technique which recognizes and quickly responds to indicated decreases in demand.

AN ALTERNATIVE EOQ MODEL

GSA's and FAA's EOQ models do not consider shortage costs and demand variability in the decisionmaking process, and as a result, opportunities to reduce inventory management costs are not being fully realized.

Considering shortage costs and demand variability as well as carrying and procurement costs in the requirements determination process results in a more complete picture of the inventory management costs.

Even though the agencies had not computed a shortage cost per se, the cost can be implied from the fill rate or service level objective the agencies have established. For example, a 90-percent fill rate objective means that a 10-percent stockout rate is accepted. This implicitly values the cost of maintaining one unit on backorder at nine times the cost of carrying one unit in inventory for the same length of time.

In our review, we used an EOQ model which recognizes shortage costs and demand variability in addition to the carrying costs and procurement costs which are a part of GSA's and FAA's EOQ models. We compared the inventory management costs using the agencies' EOQ models with the inventory management costs using the more refined model for the sample items. Based on this analysis, we estimate that FAA could reduce its management costs about $305,000 a year. (See app. II for a summary of this projection.) Reduced inventory management costs by using the alternative EOQ model at the GSA National Capital Region were not nearly as significant (about $3,300 a year) principally because the number of items managed by the region is considerably smaller than at FAA. Furthermore, another reason for the difference in the magnitude of reduced inventory management costs is the manner in which the agencies treat safety levels. At FAA, the safety level is a fixed amount, whereas, at GSA the safety level fluctuates based on demand frequency. Therefore, an item's total requirement and reorder level vary from period to period. The net effect is that GSA's approach to some extent recognizes demand variability as a result of changes to the safety level even though a variability of demand factor is not directly considered. Consequently, GSA's approach computes more optimum stockage decisions in terms of when to buy and how much to buy than if the safety level is a fixed amount.

The model used in our analysis is relatively simple and uses data elements already available at the agencies, except for the shortage cost factor, which, as previously discussed, can be implied from the fill rate goals established by the agencies. Therefore, no extensive reprograming effort would be required to achieve the benefits available.

CONCLUSIONS

The GSA National Capital Region and FAA have no assurance that the present method for determining how much to buy and when to buy results in optimizing inventory levels and minimizing inventory management costs because the cost factors used in making these decisions are outdated. As indicated by recently performed cost surveys, procurement costs have increased and inventory carrying costs have decreased. As a result, the agencies should be buying larger quantities less frequently in order to take advantage of the opportunities available to reduce operating costs.

Additionally, FAA could achieve additional reductions in its operating costs by refining its EOQ models to include a shortage cost factor which would give more nearly optimal answers, in terms of cost, to the question when to buy and how much to buy than does the agency's current model.

RECOMMENDATIONS

We recommend the Administrator of General Services direct the Commissioner of the Federal Supply Service and the Secretary of Transportation direct the Administrator of FAA to implement the recently revised cost factors and to take advantage of opportunities offered by recent EOQ modeling developments to optimize inventory levels and reduce inventory management costs.

CHAPTER 3

BETTER DEMAND FORECASTING COULD REDUCE

THE INCIDENCE OF LONG SUPPLY AT GSA

Accurate demand forecasting is an integral element in an efficient and effective supply system. Without accurate forecasting, needed items may not be bought in sufficient quantities to meet customer demands, or the quantity of items bought may eventually be greater than needed. In either case, valuable resources are not utilized in a prudent manner.

The demand forecasting techniques used by GSA and FAA are similar in that both use a smoothing formula which is equally sensitive to increasing and decreasing trends, that is, the same weighting factors are used regardless of whether the overall trend is increasing or decreasing. However, whereas GSA's technique gives more weight to past demand forecast data and less weight to the more recent demand data so that recent demand variations do not unduly influence the forecast, FAA's technique gives more weight to the recent data so that the forecast will more rapidly respond to demand variations.

The demand forecasting techniques used by GSA and FAA generally meet the needs of the respective agencies. However, GSA's forecasting technique should be refined to reduce the incidence of long supply 1/ caused by erratic demand patterns.

REFINEMENTS NEEDED TO IMPROVE GSA'S FORECASTING TECHNIQUE

GSA's forecasting technique gives more weight to the past forecast data (0.7) and less weight to the most recent month's demand data (0.3). Therefore, the forecast is less responsive to sudden increases and decreases in demand.

On a regionwide basis, 677, or about 30 percent, of the region's active items were in long supply as of July 25, 1980, and the value of the long supply inventory was about $2.3 million, which is about 16 percent of the region's annual inventory. As of the same date, 12, or 24 percent, of our 50 sample items were in long supply as shown in the following table.

1/Long supply is when an item's asset position exceeds its total requirements.

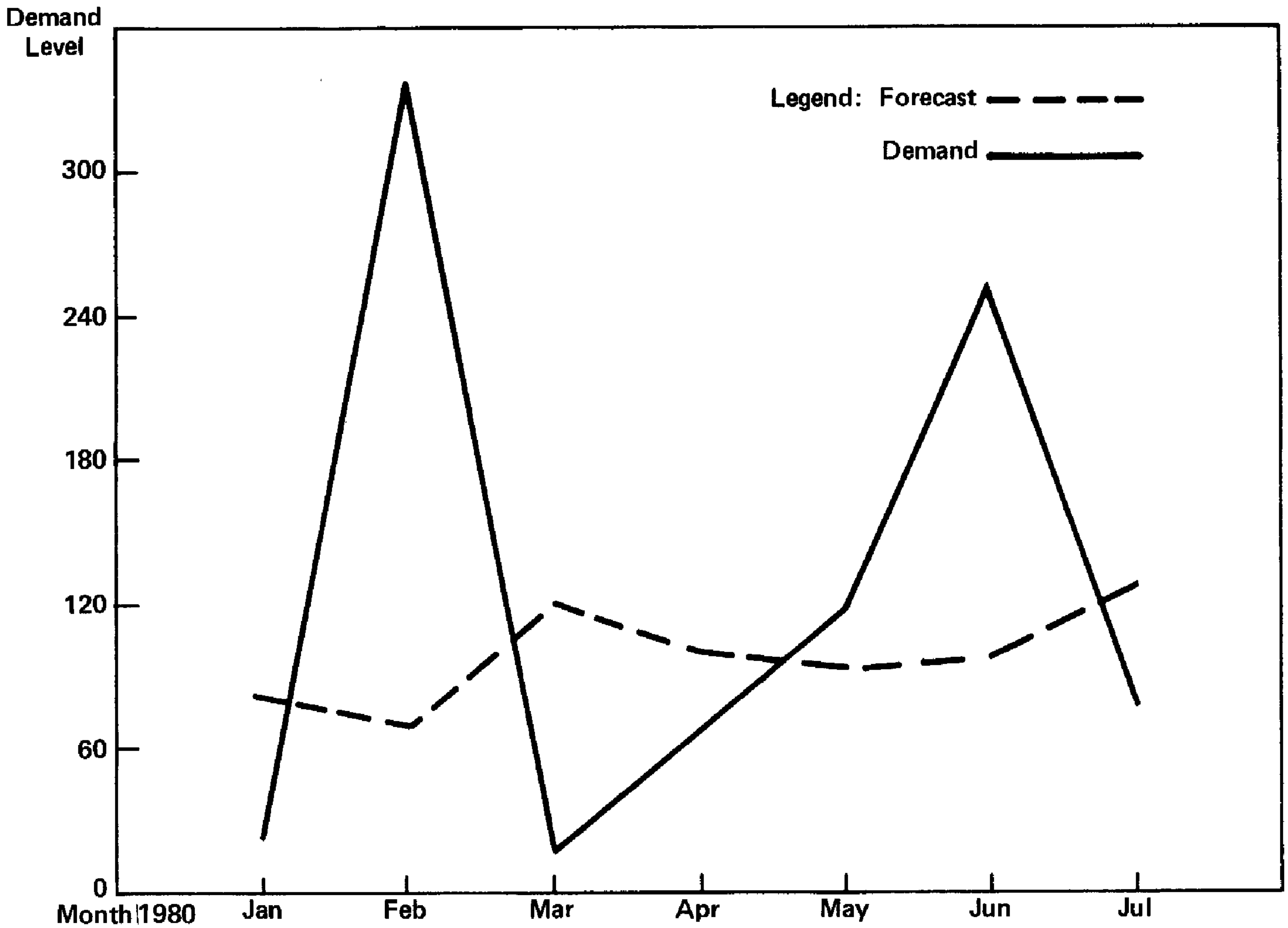
Item description	Item stock number	Value of inventory in long supply
Watercolor	7510-00-141-1523	$ 605
Pencil	7510-00-189-7873	188
Pencil	7510-00-286-5755	12,798
Washer	7510-00-286-6995	42
Rubber band	7510-00-059-4183	8,868
Form OF127	7540-00-138-9185	1,072
Form OF80	7540-00-139-4831	1,315
Form OF266	7540-00-149-0987	1,293
Form SF1179	7540-00-663-1396	10
Form SF512-A	7540-00-965-2503	180
Form OF274	7540-01-044-7185	3,931
Form SF403	7540-01-054-7239	200
Total		$30,502

It was not possible to quantify the extent that the forecasting technique contributed to the items' long supply position. However, according to Department of Defense studies and GAO reviews, inaccurate demand forecasting has been determined to be the major contributor. Furthermore, the fact that GSA's forecasting technique responds slowly to decreases in demand obviously contributes to such a situation. This is best illustrated by the following charts which graphically depict for two of the sample items in long supply as of July 25, 1980, how the forecast reacts when an item has erratic demands over a period of time.

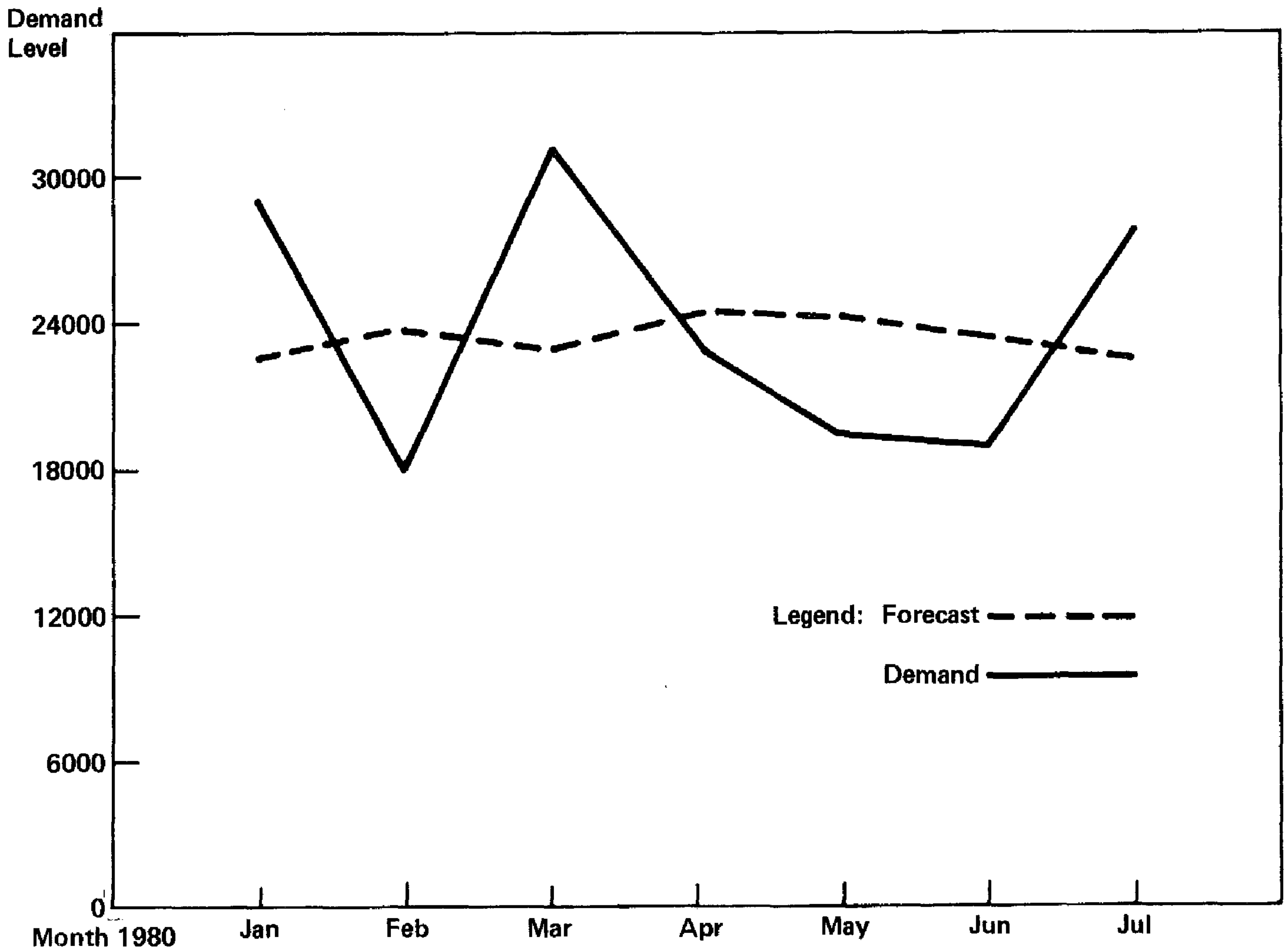
For example, as shown by the chart for rubber band, the item experienced a significant demand increase between January and February 1980; however, the forecast did not react to the increase until March. When demand decreased between February and March, the forecast did not fully respond to the decrease until May. Between March and June actual demand increased and this increase was reflected by the forecast between May and July. Between June and July the demand again decreased while the forecast continued to increase. The chart also shows that when the forecast does react to changes in demand, not only does it lag behind but the change in forecast is also much less severe than the actual change. To increase the forecast's response to decreasing demand GSA could increase the weight factor for the recent demand data.

GSA Headquarters and regional officials agreed that the present forecasting technique does not respond quickly to indicated trend decreases. They advised that they would test and evaluate the use of a system which responds more rapidly to trends in demand.

Forecast and Actual Demand
January to July 1980
Sample Item 7510-01-059-4183 (Rubber Band)



Forecast and Actual Demand
January to July 1980
Sample Item 7510-00-286-5755 (Pencil)



CONCLUSIONS

GSA's demand forecasting technique does not respond rapidly to indicated increasing and decreasing trends. As a result, wide variances often exist between the forecasted and actual demand on a month-to-month basis because of the erratic demand pattern of many of GSA's items.

We believe that GSA should reevaluate its current demand forecasting technique in view of the relatively high rate of items in a long supply position and consider adjusting its weighting factors to give more weight to the most recent demand data and less weight to the older data. This would allow the forecast to respond more quickly to decreasing demands and could reduce the incidence of long supply.

RECOMMENDATION

We recommend that the Administrator of General Services direct the Commissioner of the Federal Supply Service to reevaluate its forecasting technique with a view toward changing the weighting factors to give greater weight to the more recent demand data.

CHAPTER 4

OVERSTATED PROCUREMENT LEADTIME RESULTS

IN OVERSTATED OPERATING REQUIREMENTS

Procurement leadtime is the prime factor that determines how much stock is required to meet users' needs, and as such, represents the largest part of an agency's operating requirement. Leadtime refers to the period from initiation of procurement action to receipt of the procured item. Within this total period, there are two identifiable segments. The first one is administrative leadtime, which covers the time from initiation of procurement action to contract award. The second segment is production leadtime, which covers the period from contract award to receipt of the stock.

Leadtime is normally expressed in terms of months. However, it is also expressed quantitatively in terms of the number of items the agency expects to issue while awaiting receipt of the ordered items. Thus, the longer the leadtime, the greater the number of items an agency must stock to meet demands during the leadtime period.

Certain aspects of the leadtime period, such as contractor strikes and unexpected delays in deliveries, are not directly controllable by the agencies. Nevertheless, managers should periodically followup with contractors during the production leadtime period, when delays appear probable, in order that necessary actions can be taken to reduce delays. On the other hand, agencies can control other leadtime aspects, particularly during the administrative leadtime phase. For example, managers can ensure that:

--Asset position studies are promptly reviewed to determine if procurement action is needed.

--Requests for purchase orders or contracting are promptly forwarded to procurement for action.

--Leadtimes are not arbitrarily adjusted.

--Contract award procedures are expeditiously followed.

--Items are immediately available for issue upon receipt.

At GSA, and to a lesser extent at FAA, the procurement leadtimes used to compute requirements do not always reflect what the actual leadtime has been for an item. As a result, leadtime requirements are overstated and limited procurement funds are not being utilized in the most prudent manner. For example,

--Procurement leadtime at GSA and FAA includes unusually long delays between receipt of the items at the depot and when the items are posted as "available for issue."

--GSA at times requests that contractors defer deliveries. However, when this occurs, the leadtime continues to accumulate during the deferral period.

--FAA adds a rounding factor to an item's actual leadtime. If the factor increases the time to the next higher month, the higher figure is used, and thus overstates the leadtime requirements.

LEADTIME INCLUDES AVOIDABLE DELAYS AFTER RECEIPT AT DEPOTS

GSA National Capital Region does not terminate the leadtime on an item when it is received at the depot even though the item is put into stock and could be issued to satisfy a demand. Instead, leadtime is terminated after the information on the receiving report is posted to the master stock item record. Officials said there is normally about a 4-day delay between item receipt and termination of leadtime.

As presented below for five randomly selected receipts at one stocking location, the date the order was received varied from 4 to 10 days from the date the stock receipt was posted to the record as available for issue.

Item stock number	Date item received (note a)	Date item reported ready for issue	Difference (days)
7510-00-161-4237	10-25-79	10-29-79	4
7510-00-634-4127	2-01-80	2-11-80	10
7520-00-205-1784	1-22-80	1-28-80	6
7540-00-181-8025	3-13-80	3-17-80	4
6645-00-268-4042	11-02-79	11-06-79	4

a/Order place in stock and could have been issued to satisfy a demand.

GSA Headquarters and regional officials stated that leadtime should not be terminated when an item is received but should continue until the item has been inspected, if necessary, and posted to the master stock item record as available for issue.

As noted above, the sample items had been placed in stock; thus any required inspection must have already been performed. In our opinion, to inflate requirements to cover delays in posting the items as available for issue defeats the incentive to maintain sufficient but not excessive amount of onhand stock and results in less than optimal use of limited resources.

The fact that the leadtime for a particular item is overstated, for example by 10 days, does not equate to a 10-day overstatement of requirements because an item's leadtime is factored depending on the EOQ length. In computing an item's leadtime, GSA weights the leadtime using weighting factors ranging from 0.2 to 0.7, with the larger weighting factor used for items having an EOQ amount of 12 or more months demands. Their rationale is that items ordered less frequently have fewer receipts over a given period of time, and therefore, the greater weight should be given the most recent leadtime data.

For the five selected items mentioned above, the following table shows the effect on the requirement computations by overstating receipt times.

Item stock number	EOQ (months)	Weighting factor	X	Overstated receipt time (days)	=	Overstated requirement (note a)	No. of units overstated (note b)
7510-00-161-4237	3.45	0.3		4		1.2	907
7540-00-634-4127	2.77	.2		10		2.0	193
7520-00-205-1784	1.90	.2		6		1.2	2
7540-00-181-8025	(c)	-		4		-	-
6645-00-268-4042	2.99	.2		4		.8	48

a/Expressed in terms of number of days of requirements.

b/Number of days of overstated requirements multiplied by average daily demand.

c/Information not available because the item was not a part of our sample.

We did not project what the overall effect of the overstated leadtimes would be for our statistical sample of 50 items at the National Capital Region, because all the information needed to make the projection was not available at the stocking location. However, it could be substantial in view of the fact that the region buys about $84.6 million of items annually.

At FAA, an item's procurement leadtime is terminated when it has been received, inspected, and reported as ready for issue. In our review, we identifed several cases when the inspection date--the date leadtime is terminated--was considerably after the item was received at the depot.

For 28 of the 31 items in our sample, we compared the date the item was received at the depot, as shown on the transaction register, to the date of inspection. Information to make a comparison for the other three items was not available. For 15 of the 28 items, the receipt and leadtime termination date were in agreement. For eight other items, the receipt date was from 1 to 3 days before termination of the leadtime period; and for the remaining five sample items, as shown below, the leadtime was not terminated for a considerable period after the items were received.

Item	Receipt date	Termination of leadtime	No. of days between receipt and termination
1	5-13-80	7-15-80	63
2	3-09-79	5-19-79	71
3	2-01-79	3-28-79	55
4	7-16-79	7-27-79	11
5	6-08-78	6-17-78	9

We were not able to determine the specific reasons for the above delays; however, FAA stated that the need to inspect the items after receipt or a backlog of items awaiting inspection may have been the reason for the difference between the date of receipt and the date the leadtime was terminated. Headquarters officials agreed that leadtime should be terminated when the item is ready for issue. However, they were of the opinion that time spent inspecting an item or the time awaiting inspection should be included in the leadtime because the item cannot be issued until after the inspection has been performed.

We agree that it may be necessary to perform detailed inspections for certain items. However, for the items mentioned above, there was no indication that delays in inspecting the items was the reason for the difference between the date of receipt and the date the leadtime was terminated.

LEADTIME ON DEFERRED DELIVERIES INCLUDED IN LEADTIME HISTORY

In the fourth quarter of fiscal year 1980, GSA National Capital Region asked contractors to defer $238,000 of deliveries until October 1, 1980, because of funding constraints.

During the period that the deliveries were deferred, production leadtime continued to accummulate on the items. According to a region official, the majority of the items for which deliveries were deferred has a 2- to 3-month leadtime and were originally scheduled for delivery about September 10, 1980. Since most of the items were delivered about October 1, 1980, deferring delivery added about 3 weeks to the leadtime. The official said that the extended leadtime would not be deleted from the items' leadtime histories unless its inclusion would result in a new leadtime which was 25 percent greater than the previous leadtime.

Any time that a newly computed leadtime for an item exceeds the item's previous leadtime by 25 percent, the item manager receives a notice of exception. The item manager then reviews each case to determine the reason for the increased leadtime and makes an adjustment if necessary.

In the above mentioned cases, a 3-week extension of the leadtime would not result in a new leadtime which was 25 percent greater than the items' previous leadtime and therefore the leadtime history would not be adjusted. For example, an item which had a previous leadtime of 2 months would have a new computed leadtime of 2.15 months--a 7.5-percent increase--and an item which previously had a 3-month leadtime would have a new computed leadtime of 3.15 months--a 5-percent increase--as shown below.

(Receipt time a/ (months)	X	weighting b/ factor)	+	(1 - Weighting factor	X	Previous leadtime)	=	New leadtime (months)
(2.75		.2)		(.8		2)	=	2.15
(3.75		.2)		(.8		3)		3.15

a/Previous leadtime plus 3 week extension in leadtime caused by the deferred deliveries.

b/The weighting factor is based on the EOQ months of supply.

Because the increased leadtimes will not affect requirements until the items are bought the next time, the deferred deliveries have had no adverse impact at this time. However, when the items are next procured, the leadtime requirements will be overstated 7.5 percent and 5 percent, respectively.

GSA Headquarters and regional officials stated it was basically at the item managers' discretion as to whether the circumstances in a particular case merit an adjustment to the leadtime. They said that they would more closely monitor the leadtimes applicable to deliveries deferred at the agency's request to ensure that that portion of the leadtime was not included in the leadtime history.

DUE-INS FOR ITEMS CONTRACTED FROM SMALL BUSINESS ADMINISTRATION SECTION 8A CONTRACTORS NOT INCLUDED IN REQUIREMENTS COMPUTATIONS

GSA does not include due-ins from section 8A contractors in an item's requirements computation until the contractor has provided a firm delivery date or the item manager has other indications that deliveries will be made in accordance with the contract delivery schedule. Consequently, any requirements computation occurring between award of a section 8A contract and the confirmed delivery date may be overstated by the amount of due-ins from the section 8A contractor.

GSA officials said that since they cannot depend on section 8A contractors when an item's onhand stock drops below the reorder point and section 8A deliveries are not expected to arrive as scheduled, a replenishment contract may be awarded to an established source to meet the requirements. GSA officials told us that this can lead to long supply situations; however, one item manager told us that he adjusts the demand forecast in order to prevent long supply situations from occurring when section 8A deliveries arrive after another contract has been awarded. Another item manager stated that another alternative is to cancel or reduce deliveries from other non-section 8A contractors.

For example, in September 1979, GSA awarded a contract to a section 8A vendor for 40 percent of GSA's 1980 requirements for a binder with deliveries scheduled November 1979 through June 1980. Additionally, GSA awarded another contract to an established vendor for the other 60 percent of the total requirement to cover the period from July 1980 to November 1980. However, the due-ins from the section 8A contractor were not received during the period November 1979 to June 1980 and in this case the item manager reduced the amount that it had ordered from the other vendor in order to accommodate the past November deliveries from the section 8A contractor.

The lack of separate information on section 8A contractors precluded us from determining the extent that GSA adjusted the demand forecast or reduced the contract quantities when section 8A contractors were unable to deliver. A separate data base showing this information would allow the agency to determine the magnitude of the problem with section 8A contractors and enable the agency to include due-ins in an item's requirements determination, and therefore, more correctly determine its true requirements.

FAA'S METHOD OF COMPUTATION RESULTS IN OVERSTATED LEADTIME

FAA recomputes the procurement leadtime semiannually for all items which have had a receipt during the previous 6 months. The leadtime recomputation for these items considers all receipts during the previous 12 months. To compute the leadtime, FAA divides the total number of receipt days by the number of receipts to arrive at the average number of days for each receipt. The quotient is then divided by 30 in order to express the leadtime in terms of months. FAA then adds a rounding factor of 0.77 to the quotient. If adding the rounding factor increases the leadtime to the next higher month, the larger monthly figure is used. Otherwise the rounding factor is disregarded and the lower monthly figure is used. For example, if the quotient of the average number of days for each receipt divided by 30 is 4.25, FAA would add 0.77 and the leadtime would be 5 months. On the other hand, if the average months for each receipt was 4.15 the rounding factor would not increase it to the next higher month. In this case the leadtime would be 4 months.

Because our selected sample items did not have sufficient receipt activity to determine the effect of adding the rounding factor or project the results to the universe of items managed, we selected another sample of 10 active items. For nine of the items, we computed the leadtime requirements, excluding the rounding factor, and compared it to the leadtime requirements computed by FAA. Information was not available for the other item to allow us to make a similar computation. As shown below, including the rounding factor resulted in increased leadtime requirements, totaling about 260 units, for the 9 items.

	Not considering rounding factor					Considering rounding factor					
Item number	Leadtime	X	Average monthly demand	=	Leadtime requirements	Leadtime	X	Average monthly demand	=	Leadtime requirements	Difference
1	2.03		31.75		64.45	a/3		31.75		a/63.50	a/0.95
2	4.25		7.25		30.81	5		7.25		36.25	5.44
3	2.58		6.66		17.18	3		6.66		19.98	2.80
4	1.53		473.41		724.30	2		473.41		946.82	222.52
5	6.50		12.41		80.67	a/8		12.41		a/86.87	a/6.21
6	6.07		1.16		7.04	a/7		1.16		a/6.96	a/.08
7	4.67		4.41		20.59	5		4.41		22.05	1.46
8	9.07		8.16		74.01	9		8.16		73.44	-.57
9	4.87		181.08		881.86	5		181.08		905.40	23.54
Total					1,900.91					2,161.27	260.53

a/Using FAA's rounding technique, the leadtimes should have been 2, 7, and 6 months, respectively. FAA officials were not able to explain the differences; therefore, the leadtime requirements and differences were based on 2, 7, and 6 months, respectively.

FAA depot officials were unable to explain the basis or rationale for the rounding factor or how a factor of 0.77 was determined. Headquarters FAA officials were also unable to explain the rationale for the rounding factor. They agreed that the factor should not be included and stated that it would be eliminated from the leadtime computation.

CONCLUSIONS

Procurement leadtime requirements account for the vast majority of an agency's total operating requirement. Therefore, any action the agency can take to reduce the total leadtime reduces the operating stock requirement and frees procurement funds for other priority needs.

We believe that opportunities exist for GSA and FAA to reduce their operating requirements by more accurately and consistently computing procurement leadtime as it relates to (1) reducing the time lag between item receipt and posting the receipt to the records, (2) deferring deliveries from contractors, (3) awarding contracts to Small Business Administration section 8A contractors, and (4) using actual versus adjusted leadtimes in the requirements determination process.

RECOMMENDATIONS

We recommend that the Administrator of General Services direct the Commissioner of the Federal Supply Service to:

--Eliminate the delays between receipt of items at the depot and their posting to the records.

--Exclude leadtime attributable to the period that deliveries are deferred at the agency's request from the item's leadtime history.

--Establish a separate leadtime data base for Small Business Administration section 8A contractors and include section 8A due-ins in the requirements determination process.

We also recommend that the Secretary of Transportation direct the Administrator of FAA to:

--Emphasize the need for timely processing of received items into the warehouse.

--Use an item's actual leadtime rather than the leadtime adjusted by a rounding factor to compute requirements.

CHAPTER 5

SAFETY LEVEL REQUIREMENTS

CAN BE REDUCED

Safety level stock is that quantity of material maintained in addition to operating level stock which permits continuous operations in the event of interruptions of normal replenishment or unpredictable increases in demands. In other words, safety level stock is added protection against the unanticipated. Investment in such protection stock should be made in such a manner that offers the maximum benefit for funds invested.

The added protection offered by safety level stock is costly. For GSA the safety level requirement amounts to about $63.2 million and for the National Capital Region, about $6.6 million. For FAA, the safety level requirement totals $3.4 million.

At the GSA National Capital Region and FAA's depot, the method of computing safety level requirements does not optimize the use of limited resources or best meet the intended purposes of a safety level requirement.

At GSA,

--the extent of safety level stock varies from time to time based on stock funds available for investment rather than essentiality and

--the safety level requirement could be reduced about $774,000 by computing the requirement on an agencywide basis instead of on a depot-by-depot basis.

At FAA,

--an item's safety level requirement is fixed at 1 or 2 months, depending on the length of the economic order quantity period rather than the characteristics of the individual item and

--the need for safety level for many of the items is questionable in view of the low demand and infrequency of replenishment.

SAFETY LEVELS BASED ON FUNDS AVAILABLE FOR INVESTMENT

At GSA, a prime factor in determining the extent of safety level stock is the funds available for investment rather than whether safety levels are needed--item essentiality.

Even though GSA considers variation in demand, the economic order quantity size, and leadtime in determining the amount of an item's safety level requirement, the controlling factor is the management policy variable (MPV) which represents the number of times a year the agency is willing to accept a stockout situation. Thus, as additional funds become available for investment, GSA lowers the MPV--reducing the number of stockouts the agency is willing to accept--and increases the safety level investment to reduce the possibility of a stockout. Conversely, in times of restricted funding, GSA raises the MPV--increasing the number of stockouts the agency is willing to accept--and reduces its investment in safety level stock. At the time of our review, GSA had set the MPV at 1--meaning the agency was willing to accept one stockout per year.

The rationale for using MPV as the controlling factor for determining the safety level investment was that the agency believed that by increasing the inventory investment through safety level stocks, the fill rate would also increase. However, based on a June 1980 study, GSA determined that there is no direct correlation between increased inventory investment, increased safety stock levels, and increased fill rates. Compounding the problem of using the MPV as a means to control the safety level investment is the fact that GSA can assign an MPV to each Federal supply class based upon those items in the class that are most sensitive to the factors in the safety level formula. Thus, all items in a class have the same MPV regardless of the item's individual characteristics. This means that all the items in a class are considered equally essential in terms of the number of stockouts the agency is willing to accept. Consequently, an item may not be essential but would have a safety level just because it happened to be in the same Federal supply class as essential items.

Because GSA had not established a coding system to show which items are more essential than others, we could not determine whether only the more essential items are afforded the added protection of a safety level. However, the nature of the items managed by the National Capital Region--office supply items--makes it questionable as to whether the agency should invest limited resources to provide an added level of stock to reduce the chance of a stockout for these type items. For example, in the sample items selected for review, such type items as alarm clocks, award binders, stamp pads, and envelopes had safety level stock. It is difficult to imagine what adverse effect would occur to the Government's operation if such items were out of stock. One obvious benefit that accrues to GSA by having a safety level is that it aids the agency in achieving a high requisition fill rate. Nevertheless, the more important concern should be--is a safety level for these type items a prudent use of limited resources?

GSA officials are considering a strategy to base safety levels on item criticality/essentiality. They said that although the items have an assigned essentiality code, it is not used to determine safety levels, but that they would explore ways to link the coding to the need for a safety level, recognizing that they must respond to the needs identified by the various agencies which they serve.

SAFETY LEVEL INVESTMENT CAN BE REDUCED WITHOUT DECREASING SUPPLY RESPONSIVENESS

GSA National Capital Region can reduce its investment in safety level stocks about $774,000 (see app. III) by computing the requirement on a systemwide basis as opposed to a depot-by-depot basis.

The items managed by the region are stored at various depots throughout the country. Demand for an item is recorded at the issuing depot, and a safety level is computed for each item at each depot. This procedure is unlike Department of Defense activities which also store and issue items from its various stocking depots but computes a systemwide safety level requirement. The theory behind a systemwide safety level is that an item has a systemwide demand base, and the amount of the safety level is not a function of the number of storing locations, but rather a function of the systemwide demands. Therefore, computing safety levels on a systemwide basis while reducing the total requirement would not affect supply responsiveness.

Of the 2,268 active line items managed by the National Capital Region, about 1,800, or about 79 percent, have a safety level requirement totalling about $6.6 million.

For each of the items, we computed the systemwide safety level, using GSA's safety level formula, and compared the results to the safety level computed on a depot-by-depot basis for the 17 items with a safety level requirement, stored at more than one location as shown below. In all of our computations, we used 12 months demand data and the average procurement leadtime.

Item stock number	GAO computed systemwide safety level	Sum of individual depot safety levels	Difference	Increased or decreased (-) safety level investment (note a)
6545-00-526-1903	76	81	5	-$ 100
6645-00-268-4042	777	1,263	486	-2,114
6680-00-641-3206	224	283	59	-441
7510-00-157-8618	1,554	18,14	224	-373
7510-00-161-4237	14,349	9,638	-4,711	942
7510-00-233-7685	331	349	18	-36
7510-00-272-9805	5,134	5,129	-5	1
7510-00-281-6177	398	325	-73	119
7510-00-286-5755	14,407	14,681	274	-118
7510-00-550-7127	307	94	-213	211
7510-00-801-0482	297	275	-22	67
7510-00-823-7873	652	212	-440	200
7510-00-965-2445	2,375	3,570	1,195	-14,376
7520-00-543-7149	2,468	2,578	210	-512
7520-00-205-1784	25	25	0	0
7520-00-290-6445	3,865	4,881	1,016	-1,585
7520-00-972-1061	16,010	24,434	8,424	-918
Total				-$19,033

a/Difference multiplied by unit cost.

As shown above, some of the items would have a larger safety level if computed on a systemwide basis rather than on the sum of the individual depot safety level basis. This was due principally to the wide demand variation on a month-to-month basis and the way GSA's model treats such variations. Obviously, if the safety levels were sufficient on a depot-by-depot basis, there would be no need to increase it under a systemwide basis.

We projected the results shown above to the universe of items in the National Capital Region which had a safety level. The projection was made at a 95-percent confidence level and showed that the region could reduce its safety level investment about $774,000. Although we did not project the reduction in safety level investment for all GSA regions, we believe that since the other regions follow the same procedure for computing safety levels the regions could achieve substantial reductions in their safety level investment.

GSA officials commented that at one time safety level requirements were computed on a zone basis. Under a zone basis, all depots which stocked a particular item were grouped together for replenishment purposes. The concept was discontinued in October 1978 because one of the problems experienced was in allocating safety stock among the depots. The officials said that when the safety level requirement on a zone basis was less than the total requirement for individual depots, the stock was allocated in proportion to actual demand and that individual depots frequently stocked out of particular items. As a result, stock had to be transferred from one depot to another to satisfy out-of-stock situations.

GSA may have overreacted to the problem. Since safety levels come into play only when there is a disruption in deliveries or wide fluctuations in demand, the need to dip into safety level stocks should not be frequent. Further, when it is required, it should not be that difficult to fill the order from another depot as is done now.

GSA Headquarters and region officials said that they would review and test the effect of computing safety level requirements on a systemwide basis.

SAFETY LEVELS AT FAA NOT RELATED TO ITEM CHARACTERISTICS

A 1977 report by a Department of Transportation inventory management evaluation team recommended that FAA adopt the variable safety level concept which would consider the individual characteristics of an item--such as its leadtime and demand variations--in determining the safety level amount. Additionally, a report soon to be released by Department of Transportation Inspector General also recommends that FAA adopt the variable safety level concept.

In our opinion, it is questionable whether many of the FAA-managed items even require a safety level as evidenced by the fact that of the approximately 67,000 active items, 63,000 items have a very low demand frequency and are reordered anywhere from just over once a year to once every 3 years (a 1-month safety level requirement). The other 4,000 items have a 2-month safety level requirement and are reordered anywhere from 2 to 12 times a year.

As of June 30, 1979--the latest information available--FAA's safety level stock was valued at $3.4 million. FAA determines the amount of the safety level based on an item's order frequency. The rationale is that items ordered more frequently--less EOQ--require a larger safety level because items with less EOQ involve larger dollar buys and must be procured competitively. This, in turn, lengthens the leadtime which increases the chance of encountering delays in deliveries.

The fact that FAA bases the safety level on the EOQ amount (in terms of months) ignores the basic characteristics of the individual item. Thus, no recognition is given to the purposes for which a safety level was developed--variation in demand and leadtime. Thus, there is no assurance that items needing a safety level have one and vice versa. As shown below, our analysis of

10 items not included in our statistical sample of 50 items 1/ did not support FAA's contention that items with less EOQ have longer leadtimes and thus require a larger safety level--2 months.

Sample item No.	EOQ	Leadtime	Safety level
	-----------	(months)	-----------
5962-00-148-2858	4	7	2
5961-01-011-2086	6	7	2
5905-00-831-6502	6	9	2
5905-00-504-6076	36	9	1
5961-01-082-6228	4	7	2
6240-00-155-7773	2	2	2
5945-00-027-6032	6	6	2
5950-01-069-1111	6	3	2
6625-00-925-4118	4	5	2
7025-00-484-7647	6	3	2

As shown above, there is no direct correlation between length of EOQ and length of leadtime. For example, sample item 6240-00-155-7773 has the smallest EOQ and shortest leadtime. Additionally, sample items 7025-00-484-7647 and 5905-00-831-6502 have the same EOQ; however, the leadtimes range from 3 to 9 months, respectively.

FAA Headquarters officials stated the safety level requirement should be based on the individual item characteristics, and that use of a variable safety level formula would be explored.

CONCLUSIONS

Safety level stock represents a sizeable investment in stock that may never be used. Therefore, when such an investment is made, managers should ensure that it is not excessive but, at the same time, sufficient to meet the purposes for which it was intended--a guard against stockouts caused by unanticipated demand surges and interruption of deliveries.

The methods used by GSA National Capital Region and FAA to determine the amount of safety level stock do not provide these assurances. We believe that the safety level investment by both agencies could be reduced without adversely affecting supply responsiveness by restricting safety levels to only essential items and refining the safety level formulas to include leadtime variation as well as demand variation. Also, GSA could reduce its safety level investment by computing the requirement based on systemwide demands, rather than each stocking location.

1/We selected the 10 items, on a random basis, from a group of active items, because many of the statistical sample items were relatively inactive, and the leadtime, EOQ, and safety level data was not current.

RECOMMENDATIONS

We recommend that the Administrator of General Services direct the Commissioner of the Federal Supply Service to:

- --Develop a system which relates the need for and amount of safety level to item essentiality.
- --Use leadtime variation, rather than the length of leadtime, in the computation of safety level requirements.
- --Compute an item's safety level requirement on a systemwide basis, rather than on a depot-by-depot basis.

We recommend that the Secretary of Transportation direct the Administrator of the Federal Aviation Administration to adopt a variable safety level concept which considers the individual characteristics of an item--including item essentiality and demand and leadtime variations--in determining safety level requirements.

CHAPTER 6

SAMPLING METHODOLOGY

Our sample at the GSA National Capital Region consisted of 50 items (see app. IV), selected from a universe of 2,268 items managed by the region as listed in the November 1, 1979, GSA National Stock Index and Pricelist. The sample universe excluded items no longer stocked by GSA and items reassigned to the Defense Logistics Agency. Although centrally managed by the region, the items are stored at and issued by numerous GSA depots throughout the country.

At FAA, we selected 90 1/ expendable items from a universe of 60,614 items as of July 24, 1980. Our initial sampling effort involved a total universe of 188,765 items as of June 28, 1980. From the total universe, we excluded:

--62,290 direct ship items. These are items requisitioned by the user directly from the source of supply--GSA or the Defense Logistics Agency.

--4,724 non-EOQ items, such as forms and instruction booklets.

--33,254 potential excess items. Since our objective was to test certain attributes, such as demand forecast and leadtime, it was necessary to limit the universe to active items.

--27,267 insurance items, which are non-EOQ items.

After excluding the above category of items, our sampling universe was reduced to 61,230 active expendable items. However, in performing our reliability assessment, we noted that items which should have been excluded were not, and items that should have been included were excluded. We learned that the reason for the erroneous sampling universe was that at the time our random sample was being selected, the agency was updating its master data file. Therefore, we selected another sample on July 24, 1980, from a universe which did not include direct ship and non-EOQ items. From this universe, we excluded potential excess and insurance items resulting in a sampling universe of 60,614 active expendable items which we determined to be reliable.

1/Of the initially selected 90 items, 59 were not reviewed because the items were inactive. Therefore, the data needed to test such attributes as demand forecasting and leadtime was either not current or readily available. As a result, our sample items were reduced to 31. (See app. V.)

For the sample items at GSA and FAA, we:

--Compared the forecasted demand with actual demand and determined how the agencies' forecasting techniques treated increasing and decreasing demand trends of a random and cyclical nature.

--Determined whether the agencies' methods for computing procurement leadtime were reasonable and accurate by comparing the leadtime factor used in the requirements computation process with the historical leadtime data maintained on each item.

--Compared the safety level requirement for selected items with the item's transaction history to determine whether a safety level was required to avoid out-of-stock situations. At GSA, we also determined what the safety level requirement would be for the item if the requirement was computed on a systemwide basis, as opposed to GSA's method of computing a separate level for each depot where the item is stocked.

--Determined whether the agencies used current cost data to compute the EOQ and the reorder point. We also recomputed the EOQ and reorder point using another model which considers shortage cost--a factor not considered by GSA and FAA in their present models--which is more optimal in terms of balancing the cost of carrying inventory with the cost of repetitive procurements.

PROJECTION OF REDUCED INVENTORY MANAGEMENT COST BASED ON COMPARISON OF CURRENT AND OUTDATED COST DATA AT FAA

	Range (note a) Low	Range (note a) High	Projection (note a)
Number of items for which current cost data was not available	32,776	46,206	39,491
Number of items for which comparison of current versus outdated cost data showed no change in management costs	2	2,922	1,102
Number of items for which comparison of current versus outdated cost data showed management costs were overstated.	9,580	22,012	15,796
Number of items for which comparison of current versus outdated cost data showed management costs were understated	697	7,753	4,225
Total			60,614
Monthly overstated management costs	$ 27.05	$ 44,682.01	$ 22,306.22
Monthly understated management costs	101.99	1,400.75	751.37
Net monthly overstated (understated) management costs as a result of agency using outdated cost data	-868.11	43,977.81	21,554.85
Annual reduction of inventory management costs	-$10,417.32	$527,733.72	$258,658.20

a/The projection and range were based on a 95-percent confidence level.

PROJECTION OF REDUCED INVENTORY MANAGEMENT COSTS AT FAA USING AN ALTERNATIVE EOQ MODEL WHICH CONSIDERS SHORTAGE COST IN COMPUTING OPTIMUM STOCKAGE LEVELS

	Range (note a)		Projection
	Low	High	(note a)
Number of items for which data was not available	32,776	46,206	39,491
Number of items for which alternative EOQ model would not affect management costs	4	3,351	1,470
Number of items for which alternative EOQ model would result in reduced management costs	12,018	25,084	18,551
Number of items for which alternative EOQ model would result in increased management costs	3	4,547	2,020
Total			61,532
Monthly decreased inventory management costs	$ 3,208.19	$ 49,511.39	$ 26,359.79
Monthly increased inventory management costs.	1.07	2,376.55	909.14
Net monthly decreased inventory management costs resulting from use of alternative EOQ model	2,188.70	48,712.60	25,450.65
Annual decreased (increased) inventory management costs resulting from use of alternative EOQ model	$26,264.40	$584,551.20	$305,407.80

a/The projection and range were based on a 95-percent confidence level.

PROJECTION OF REDUCED SAFETY LEVEL INVESTMENT AT GSA NATIONAL CAPITAL REGION BY COMPUTING THE SAFETY LEVEL ON A SYSTEMWIDE BASIS AS OPPOSED TO A DEPOT-BY-DEPOT BASIS

	Range (note a)		Projection
	Low	High	(note a)
Number of items in the universe			2,268
Items excluded from projection:			
Number of items for which no information was available (note b)	184	893	409
Number of items with a zero safety level	238	760	499
Number of items with a safety level at only one stocking location	276	814	545
Decrease of safety level units by computing requirements on a systemwide basis	$ 11,852.00	$1,295,595.00	$538,081.00
Increase of safety level units by computing requirements on a systemwide basis	4,967.00	626,680.00	225,502.00
Net (decrease) increase of safety level units by computing requirements on a systemwide basis	-1,180,794.00	555,636.00	-312,579.00
Net (savings) increase resulting from computing safety level requirements on a systemwide basis	-$2,069,560.33	$ 521,112.51	-$774,223.91

a/The projection and range were based on a 95-percent confidence level.

b/Includes items for which information was not available or no demand was recorded for the item.

LIST OF 50 RANDOMLY SELECTED SAMPLE

ITEMS AT GSA NATIONAL CAPITAL REGION

Sample number	Item stock number	Item description
1)	6545-00-526-1903	First aid kit
2)	6645-00-268-4042	Clock, alarm
3)	6675-00-514-3535	Curve, drafting
4)	6675-00-514-4769	Pen, lettering
5)	6675-00-866-0108	Triangle
6)	6680-00-641-3206	Counter
7)	7510-00-141-1523	Watercolor
8)	7510-00-157-8618	Binder, awards
9)	7510-00-161-4237	Ink, stamp pad
10)	7510-00-164-8917	Pencil
11)	7510-00-189-7873	Pencil
12)	7510-00-194-7890	Ribbon
13)	7510-00-224-7242	Shield, erasing
14)	7510-00-226-5401	Julian calendar
15)	7510-00-233-7685	Protector
16)	7510-00-257-3411	Cloth, tracing
17)	7510-00-269-8769	Ink, printing
18)	7510-00-272-9805	Envelope
19)	7510-00-281-6177	Binder
20)	7510-00-265-2510	Ink, printing
21)	7510-00-286-1727	Crayon
22)	7510-00-286-5755	Pencil
23)	7510-00-286-6995	Washer
24)	7510-00-286-9685	Insert
25)	7510-00-470-0095	Numbering kit
26)	7510-00-550-7127	Tape, pressure
27)	7510-00-663-9052	Tape
28)	7510-00-801-0482	Tape, pressure
29)	7510-00-823-7873	Finger pad
30)	7510-00-965-2445	Ribbon
31)	7510-00-059-4183	Band, rubber
32)	7520-00-205-1784	Machine
33)	7520-00-290-6445	Holder
34)	7520-00-543-7149	Ballpoint pen
35)	7520-00-634-6720	Case
36)	7520-00-728-5137	Rubber stamp
37)	7520-00-973-1061	Marker
38)	7540-00-138-9185	OF 127
39)	7540-00-139-4832	OF 80
40)	7540-00-149-0575	SF 420
41)	7540-00-149-0828	OF 186
42)	7540-00-149-0987	OF 266
43)	7540-00-634-3968	SF 14
44)	7540-00-634-4127	SF 513
45)	7540-00-663-1396	SF 1179
46)	7540-00-753-4601	SF 540
47)	7540-00-965-2503	SF 512-A

Sample number	Item stock number	Item description
48)	7540-01-016-5432	SF 270
49)	7540-01-044-7185	OF 274
50)	7540-01-054-7239	SF 403

LIST OF 31 RANDOMLY SELECTED SAMPLE ITEMS AT FAA

	Sample number	Item stock number	Item description
General:	1	3120 01 035 6064	Bushing actuator
	2	5825 01 046 4193	Detector
	4	6625 01 047 3273	Voltmeter
	6	5961 01 068 8246	Rectifier
	9	6210 01 007 1738	Lens
	11	9059 00 617 1198	Led light
	18	4920 00 009 4942	THRM Strip
	22	6140 01 021 4861	Battery pack
	23	9058 00 406 3024	Oscillator
	26	5815 01 035 7927	Character clip assembly
	40	5955 01 077 1086	Quartz crystal
	45	6210 01 009 5797	Lens
	49	5935 00 386 8902	Connector
	51	5310 00 865 9727	Washer
	52	5955 00 868 4701	Crystal unit
	53	3110 01 068 0521	Bearing
	55	7510 00 584 2711	Green inked-ribbon
	56	5826 00 020 1625	Washer
	57	9070 00 251 1436	Red ribbon
	59	6240 00 088 9041	Mercury vapor lamp
	60	6625 00 318 6218	Circuit card assembly
Aviation:	5	5915 01 047 9514	Filter
	6	5330 00 808 0794	Packing
	9	4720 00 966 5741	Hose assembly
	12	8010 00 562 3389	Sealant
	13	5330 00 421 3638	Gasket
	18	1660 00 569 2044	Heat vent coupling
	21	6210 00 061 8114	Lens
	24	3120 01 055 7839	Bearing
	26	2620 00 288 0247	Inner Tube
	29	5330 00 846 1956	Packing

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