

January 1988

NAVY SUPPLY

Economic Order Quantity and Item Essentiality Need More Consideration





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

National Security and
International Affairs Division

B-229167

January 6, 1988

The Honorable James H. Webb
The Secretary of the Navy

Dear Mr. Secretary:

This report addresses the economic order quantity and safety level aspects of the requirements determination process for material. We found that improvements in the process could reduce the potential for increases in stocks beyond current needs and minimize the costs of ordering and holding inventory.

The report contains recommendations to you on pages 17 and 22. As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs no 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 and on Armed Services; the Secretary of Defense; and the Director, Office of Management and Budget.

Sincerely yours,

A handwritten signature in cursive script that reads 'Frank C. Conahan'.

Frank C. Conahan
Assistant Comptroller General

The Navy's inventory of stock exceeding requirements by a 24-or 30-month supply has shown dramatic increases in recent years and is expected to rise to \$14 billion in fiscal year 1988. The policy of ordering a year's supply of material rather than the economic order quantity (when it is less than 1 year) is increasing the risk of overbuying material with a resultant potential for increasing its stocks beyond current needs.

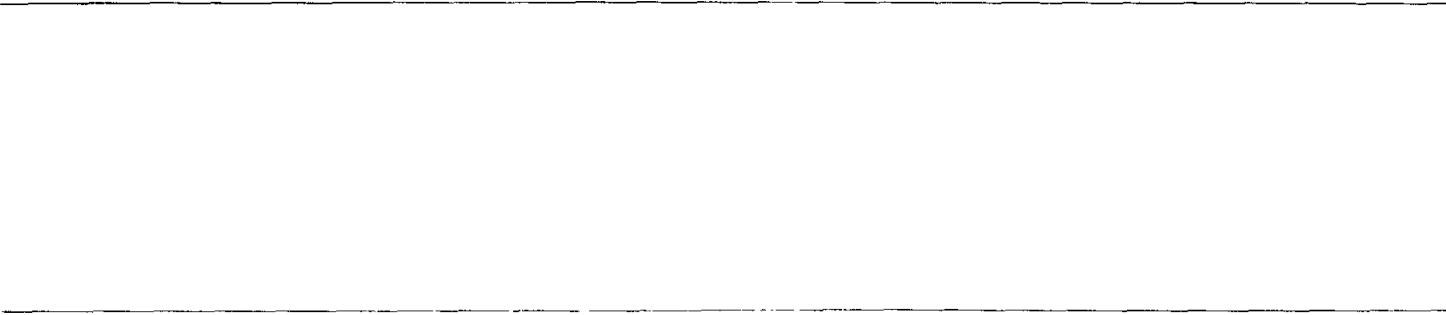
Decisions on when and how much to buy must take into account the variable costs of ordering and holding material and an implied shortage cost of running out of material. Ordering more than the economic order quantity decreases ordering and shortage costs but the increased holding costs of larger inventories more than offset these decreases. Several Navy studies have concluded that it was not cost effective to order a year's supply of material rather than a lesser quantity.

Risk and Essentiality Need to Be Recognized

To compute safety levels, the Navy uses a set of mathematical formulas that considers such factors as demand variation, item cost, shortage cost, and acceptable risk of stockout. However, if the computed risk does not trigger a safety level requirement, the Navy lowers the degree of acceptable risk so that almost every item has a safety level. On the procurement actions evaluated by GAO, the Aviation Supply Office increased safety level requirements by an estimated \$80.6 million by lowering the acceptable risk of stockout.

The Navy has developed an item essentiality coding system at the Ships Parts Control Center and is in the process of doing so at the Aviation Supply Office. Items are coded into five categories ranging from those that have no impact on the mission capability of a weapon system to those that could cause a total loss of mission capability.

The Navy's requirement computation formulas include an item essentiality factor that, if used properly, would vary depending upon the essentiality of an item. However, in practice both activities assign equal essentiality to all items. As a result, safety levels are provided for almost all items, even though a lack of some items would have no impact on mission capability. On the procurement actions evaluated by GAO, the Aviation Supply Office provided safety level requirements of \$11.1 million for some items, even though the aircraft using these items could perform their missions without them.



prompted both the Department of Defense (DOD) and the Navy Comptroller to cut the Navy's wholesale replenishment obligation authority for fiscal years 1986 and 1987.

Between February 1986 and June 1987 we held discussions and collected information at Navy headquarters, the Naval Supply Systems Command, ASO, SPCC, the Fleet Material Support Office, the Naval Air Development Center, and the Willow Grove Naval Air Station. We reviewed the Navy's systems and related policies for determining replenishment inventory requirements for EOQ and safety levels. We did not review leadtime requirements because they were being studied by the Logistics Management Institute.

To evaluate whether the Navy's replenishment requirement determination systems and related policies could lead to inflated procurements with a potential for a growth in long supply assets or unnecessary costs, we sampled and analyzed automated requirement computations and available asset records maintained by ASO. We then recomputed requirements using different supply management principles and determined the differences. Although we did not sample and analyze records maintained by SPCC, we determined that, at the time of our field work, SPCC's requirement determination system and related policies were substantially the same as ASO's.

At ASO we sampled 100 consumable items where item managers had accepted automated procurement recommendations either in whole or in part and had initiated purchase action to buy the items. We obtained needed data on 64 items. Data on the other 36 consumable items were not readily available. We also sampled 165 repairable items with automated procurement recommendations. We obtained needed data on 65 items. Of the other 100 items, purchase recommendations on 50 were not accepted by ASO inventory managers and data on 50 were not readily available.

Since we only had data on 64 of 100 consumable items in our sample, we could only project to 64 percent of the total recommendations accepted for procurement. Also, because we only had data on 65 of the 165 repairable items in our sample, we could only project to 39 percent of the automated purchase recommendations.

We used the same computer programs, reports, records, and statistics the Navy uses to manage inventories, make decisions, and determine requirements. We did not independently determine their reliability.

EOQ Principle Not Followed

To reduce the purchase workload, the Navy adopted a policy in fiscal year 1985 that overrode the use of EOQ formulas and required a minimum of 1 year's supply on all items. At the same time, the Navy's inventory of long supply stock showed dramatic increases, and it has continued to increase. We evaluated the results of two periodic reviews in which ASO compared material requirements with available assets and recommended procurements. We found that:

- ASO had initiated procurements for \$133.7 million in material that exceeded the EOQ.
- ASO had incurred additional costs of \$10.5 million on this material because the increased holding costs of the larger inventories more than offset the decreases in ordering and shortage costs.

Although we did not perform a similar analysis at SPCC, we determined that SPCC's reordering policy at the time of our field work was substantially the same as that of ASO's. Subsequently, SPCC revised its reordering policy in a way that potentially will worsen the situation for some items while improving it for others. The revised policy affects procurements initiated after June 1987.

The Navy could reduce the potential for increases in long supply and minimize the costs of ordering and holding inventory by buying the EOQ rather than a minimum of 1 year's supply.

Navy Policy Overrides EOQ

The EOQ principle is a mathematical technique for determining the purchase quantity that will result in the lowest total costs for ordering and holding inventory to meet expected supply requirements. We reviewed two fiscal year 1986 periodic reviews in which ASO compared requirements to assets and initiated procurements. We found ASO had initiated procurements for \$133.7 million of material in excess of the EOQ. ASO took this action to reduce its purchase workload.

DOD requires the services normally to use a minimum order quantity of 3 months' supply and a maximum of 3 years' supply. Deviations from these limits are permitted if particular commodity characteristics (shelf life, seasonal buys, etc.) or industry procurement practices (quantity discounts, etc.) dictate otherwise. DOD set the minimum at 3 months to avoid uneconomic, repetitive procurements of high-dollar/demand items. Similarly, DOD set the 3-year maximum to recognize that economic, technological, and political events influence requirements and could affect future needs.

Table 2.1: Effect of 1-Year Policy on Procurements

Dollars in millions			
	Consumables	Repairables	Total
Total procurements initiated	\$597.5	\$429.6	\$1,027.1
Portion in excess of EOQ	124.0	9.7	133.7 ^a

^aThe projected value of material purchased over the computed EOQ is based on the actual EOQ even when it is less than DOD's minimum 3-month criterion. If the 3-month criterion is applied, the projected value of material purchased over the computed EOQ amounts to \$115.4 million for consumables and \$9.1 million for repairables, or \$124.5 million in total.

The following examples are illustrative of procurements where orders exceeded the EOQ.

- ASO initiated a purchase for 1,615 consumable switch assemblies (NSN-5930-01-225-3243), costing \$274 each. Of the 1,615 switch assemblies, 406 were applicable to the minimum ordering quantity of 1 year and 1,209 were needed to bring the stock position up to the reorder level. The EOQ called for the purchase of 131 switch assemblies, or about 4 months' supply. The 1-year policy increased the procurement by 275 switch assemblies, at a total cost of \$75,350. Within a month of the procurement, 214 of these assemblies were categorized as long supply.
- ASO initiated a purchase for 48 consumable slip ring assemblies (NSN-1615-00-945-4293), costing \$747 each. Of the 48 ring assemblies, 31 were applicable to the minimum ordering quantity of 1 year and 17 were needed to bring the stock position up to the reorder level. The EOQ called for the purchase of 13 assemblies, or about 5 months' supply. The 1-year policy increased the procurement by 18 slip ring assemblies, at a total cost of \$13,436.
- ASO initiated a purchase for six repairable transmitters (NSN-6610-01-079-8804), costing \$5,217 each. All six transmitters were applicable to the minimum ordering quantity of 1 year. The EOQ called for the purchase of three transmitters, or 6 months' supply. The 1-year policy increased the procurement by three transmitters, at a total cost of \$15,651.

Variable Costs Are Not Minimized

According to DOD, operating an inventory control point involves the variable costs of ordering and holding material and an implied shortage cost of running out of material. Ordering costs are associated with determining requirements, processing purchase requests, and taking other contract actions until orders are received. Holding costs are associated with the interest that could have been earned on an alternative investment

- ASO incurred variable costs of \$3,074 on its purchase of consumable slip ring assemblies. If ASO had ordered the EOQ instead of 1 year's supply, variable costs would have been \$2,409, or \$665 less.
- ASO incurred variable costs of \$4,243 on its purchase of repairable transmitters. If ASO had ordered the EOQ instead of 1 year's supply, variable costs would have been \$3,136, or \$1,107 less.

Several Fleet Material Support Office studies of various groupings of items managed by ASO and SPCC have provided cost/benefit analyses of the impact on variable costs by increasing the DOD ordering minimum from 3 months to 1 year. The studies concluded that it was not cost effective to increase the minimum ordering quantity to a 1-year supply because increases in holding costs outweighed decreases in ordering and shortage costs.

Long Supply Assets Have Been Growing

The Navy's inventory of long supply assets has been growing since the 1-year minimum order policy took effect. Long supply is a condition in which the assets on hand and on order exceed the requirements for the assets by either a 24- or 30-month supply, depending on when the requirements determination is made. Table 2.3 shows the Navy's estimated long supply assets at the end of fiscal years 1986, 1987, and 1988. The estimates reflect inventory values in excess of 30 months of supply of individual items.

Table 2.3: Estimated Long Supply Assets

Type of material	Fiscal year		
	1986	1987	1988
Air consumable	\$1,525.8	\$2,169.9	\$2,466.1
Ship consumable	757.9	1,158.9	1,239.6
Air repairable	1,993.1	1,470.2	6,270.1 ^a
Ship repairable	3,731.2	3,941.1	4,018.2
Total	\$8,008.0	\$8,740.1	\$13,994.0

^aThe principal reason for the projected increase in long supply assets in fiscal year 1988 for aviation repairables is that outdated prices were indexed to show current values. This was brought about by the change from appropriation funding to stock funding for these repairables.

The growth in long supply assets has been of continuing concern to DOD and the Navy. During a recent budget review, DOD noted that between fiscal years 1984 and 1986 the Navy spent \$2.4 billion for spares for which there was no support requirement after the parts were delivered. As a result, DOD cut the Navy's request for stock fund obligational

SPCC recently revised its minimum order procedures. However, these procedures continue to override the EOQ for items having stable or increasing demand trends. As a result, variable costs will not be minimized and the potential for long supply to increase will exist.

Recommendation

We recommend that the Secretary of the Navy direct the Commander, Naval Supply Systems Command, to not routinely buy more than the EOQ under DOD's overall ordering parameters of the 3-month minimum and the 3-year maximum, unless it can be shown that larger procurements will result in quantity discounts that more than offset the additional holding costs.

Agency Comments and Our Evaluation

DOD did not agree with our recommendation. DOD stated that the Navy is continuing to refine its ordering policy at SPCC and, after further testing, plans to apply a similar policy at ASO. This policy places supply items in one of three categories, depending upon their demand stability. Category I, for items with a very stable demand, has a minimum order quantity of 8 or 10 quarters; Category II, for items with a stable demand, has a minimum order quantity of 4 quarters; and Category III, for items with no well established demand pattern, has a normal EOQ.

To the extent that the above policy reinstates the EOQ for Category III items, it is a step in the right direction. However, for Category I and II items, we believe that the Navy needs to clearly demonstrate that the larger procurements will result in quantity discounts on individual items that more than offset the additional costs of holding the larger inventories. Otherwise, costs will not be minimized.

DOD stated that we did not consider all of the relevant costs and benefits of the 1-year policy. According to DOD, this policy is a reflection of changes in the contracting environment and the DOD policy to increase competition through reliance on larger buy quantities. The changes in contracting environment DOD referred to primarily relate to increases in workload at the inventory control points and increases in administrative leadtime. DOD stated that these factors could result in stock replenishment orders being placed weekly and as many as four buys being in process for the same item at the same time.

We do not agree that these arguments justify a 1-year minimum order rule for stable or increasing demand items. First, purchase workload

Safety Levels Do Not Adequately Consider Risk and Essentiality

The Navy's policies on acceptable stockout risk and mission essentiality enable almost every wholesale inventory item to have a safety level of stock to protect against unexpected demands or delivery delays by contractors. We evaluated the results of two periodic procurement reviews by ASO and found that ASO had added safety level requirements of \$80.6 million for certain items because it had lowered what previously had been considered the acceptable risk of running out of stock for these items. In addition, safety levels were provided for almost all wholesale items, even though a lack of some items would have no impact on mission capability. For example, ASO provided safety level requirements of \$11.1 million for some items, even though the aircraft using these items could perform their missions without them.

The Navy could reduce the potential for increases in long supply assets by not lowering what it previously considered to be the acceptable stockout risk and by eliminating or reducing safety level stocks for items that are not essential to aircraft mission capability.

Almost All Items Have a Safety Level

A safety level of stock acts as a buffer against unexpected increases in demand or delays in delivery from a contractor. The quantity of this stock is driven by the assumed degree of acceptable risk of being out of stock on a given item.

DOD requires the Navy to maintain a wholesale safety level of stock geared toward filling 85 percent of all requisitions received. To compute safety levels, the Navy uses a set of complex mathematical formulas that consider such factors as demand variation, item cost, shortage cost, and acceptable risk of stockout. If the computed risk does not trigger a safety level requirement, the Navy lowers (constrains) the degree of acceptable risk so that almost every item has a safety level. For example, the computed safety level for consumable switch assemblies (NSN-5930-01-225-3243) was zero, based on an acceptable risk of 80 percent. ASO lowered the risk to 40 percent, and a safety level requirement of 122 units valued at \$33,428 was computed for the assemblies.

The Navy allows safety levels on virtually all items in order to maximize the requisition fill rate, which is the primary measure of wholesale inventory management effectiveness. Also, the Navy spreads the safety level over all weapons systems so that one system does not have an overly high fill rate at the expense of another.

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Safety Levels Do Not Adequately Consider
Risk and Essentiality

items. According to Navy officials, the use of variable item mission essentiality coding in computing wholesale safety level requirements needs further study and, therefore, is still several years away from implementation.

Although the Navy is several years away from implementing essentiality coding in the requirements computations, we were able to obtain preliminary data from ASO on the essentiality of some of the items in our samples. The codes for the items have not been formally approved; however, ASO officials stated that they do not anticipate any changes to the codes. We found that 13 of the 129 items in our samples had no impact on the mission capability of an aircraft. On the basis of our sample, we estimate that 621 items, valued at \$11.1 million, in the sample universe had no impact on mission capability. Table 3.2 shows the projected safety level value and essentiality of all items in our universe.

Table 3.2: Safety Levels by Essentiality Category

Code/category	Consumables		Repairables		Total	
	Number	Value	Number	Value	Number	Value
1 Optimum Performance Capable: capable of all missions	530	\$5.7	91	\$5.4	621	\$11.1
2 Fully Mission Capable: loss of a secondary mission	151	1.8	0	0	151	1.8
3 Partially Mission Capable: degradation of aircraft	0	0	107	3.0	107	3.0
4 Partially Mission Capable: loss of one primary mission	379	5.4	107	16.6	486	22.0
5 Not Mission Capable: not safely flyable	1,742	52.0	381	37.6	2,123	89.6
0 Essentiality not determined	2,045	23.1	305	18.3	2,350	41.4
Total	4,847	\$88.0	991	\$80.9	5,838	\$168.9

The following are examples of instances where ASO could have eliminated safety level requirements if it had been in a position to implement essentiality coding in the requirement computations and had considered item mission essentiality in determining requirements. In these instances, the Navy aircraft could perform all their missions without the item. In addition to not considering mission essentiality on these items, ASO lowered the acceptable risk of stockout, thereby triggering a safety level requirement.

In one instance, ASO initiated the purchase of 12 consumable valve housings (NSN-2915-00-822-3563), costing \$2,011 each, to be used on the P-3 aircraft. ASO assigned mission essentiality code 1 to the housing because a 3-year history of maintenance data showed no impact on the operational readiness of the aircraft without the item. Under this code, there

Agency Comments and Our Evaluation

DOD agreed with our recommendations and stated that the Navy intends to use item essentiality for both initial provisioning and replenishment stocks. DOD stated that SPCC already uses mission essentiality codes to a limited extent and that ASO will use these codes when (1) the current review of the reasonableness of the codes is complete and (2) modernization efforts to allow for the direct utilization of the codes in determining requirements are complete. DOD indicated that full capability to use essentiality within the Navy will be available when automated data processing modernization efforts are completed in the 1990 time frame.

Although agreeing with our recommendations, DOD questioned some of the information in our findings. DOD stated that (1) risk is not changed on a line item basis in order to create a safety level requirement and (2) not all items managed by ASO and SPCC have a safety level. We agree that safety level requirements are driven by groups of items and that some items, such as insurance items and very low demand items, do not have safety levels. Our review universe centered on orders that were placed as a result of selected procurement reviews at ASO. All of the 129 randomly selected items in our samples had a safety level and 59 of them had safety level requirements because the acceptable risk of stockout was constrained.

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GAO DRAFT REPORT - DATED JULY 20, 1987
(GAO CODE 394103) OSD CASE 7355

"NAVY SUPPLY: ECONOMIC ORDER QUANTITY AND ITEM
ESSENTIALITY NEED MORE CONSIDERATION"

DEPARTMENT OF DEFENSE COMMENTS

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FINDINGS

FINDING A: Navy Supply Management. The GAO observed that the Navy maintains wholesale inventories of consumables and reparable at various stockpoints to fill requisitions for customers worldwide. The GAO further observed that the Naval Supply Systems Command administers the Navy supply system, providing supply management policies and procedures to its inventory control points, such as the Aviation Supply Office (ASO) and the Ships Parts Control Center (SPCC), and those activities determine the wholesale requirements for aviation and ship materiel. The GAO observed that the ASO and the SPCC use distinct requirements determination processes for initial provisioning stock, mobilization stock and replenishment or peacetime operating stock. The GAO commented that, in determining replenishment inventory needs, the Navy considers:

- the economic order quantity (EOQ), which is the amount needed to meet demand between successive replenishment orders and is equal to the replenishment quantity when assets reach the reorder level--i.e., it is the quantity that results in the lowest total cost for ordering and holding stock;
- the leadtime level, which is the amount needed to meet normal demand during the time required to order and receive delivery of stock; and
- the safety level, which is the amount needed to meet fluctuations in demand and leadtime.

The GAO reported that, in FY 1987, the Navy budgeted almost \$3 billion to purchase and replenish materiel for peacetime operating stocks. (p. 2, pp. 8-11/GAO Draft Report)

DoD POSITION: Concur.

FINDING B: Navy Overrides Economic Order Quantity (EOQ) Principle. The GAO observed that the EOQ principle is a mathematical technique for determining the purchase quantity,

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3-years demand. These constraints recognize that the model results can be unrealistic, from a management standpoint, even though the results are optimal in terms of order and holding costs. Based on today's environment, the same logic led to the Navy decision to initially use a 12-month constraint on order quantity.

The 12-month EOQ was intended by the Navy to compensate for weaknesses in the EOQ model. For example, the model assumes an unlimited procurement capacity and, left unconstrained, would place stock replenishment orders weekly if the holding costs were high enough. Also, when DoDI 4140.39 was written in 1970, the average administrative lead time was 90 days. In today's operating environment, administrative lead time is approximately 400 days. It is not practical to procure an EOQ that is less than administrative lead time demand, since this could result in as many as four buys being in process for the same item at the same time. Because the EOQ model does not consider the number of procurements that can be processed by an ICP in a year and the operating environment that exists today, the Department concurs with the Navy that some flexibility must be permitted when rigorous adherence to EOQ mathematical computations does not produce sound management decisions.

The Navy is continuing to refine its order constraint policy. The 12-month EOQ order constraint at SPCC has been modified to recognize that investment risk is primarily a function of uncertainty, and that risk can be minimized by applying order quantity constraints, based on demand stability and item cost. The level of the constraints under the Navy policy at SPCC is as shown in the following table:

New Minimum EOQ Policy--SPCC

<u>Category</u> <u>Constraint</u>	<u>Characteristics</u>	<u>Minimum Order Quantity</u>
I	Very stable, predictable demand, relatively low cost	8 or 10 quarters
II	Stable, predictable demand, low to moderate cost	4 quarters
III	No well-established demand pattern and/or very high cost	No minimum constraint, normal ICP EOQ rules

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DoD POSITION: Partially concur. The DoD agrees that the Navy is not minimizing variable costs; however, the Department does not agree that this is inherently bad or that it necessarily results in higher total costs for the Government. The price breaks that are realized through larger procurement buys must be considered. The failure to do so overstates the benefits of procuring a computed EOQ.

Now on p 17.

On page 22 of the draft report, the GAO recognizes that quantities larger than the EOQ may be cost-effective if they result in price discounts. However, the impact of lower prices should be considered in the assessment of the Navy EOQ policy. For example, the ASO realized a 5 percent savings in FY 1980, after increasing the 3-month minimum EOQ to 6 months for 3,655 items. In FY 1984, the EOQ was increased to 12 months for these items. An analysis of contractor quotes for 3, 6 and 12-month quantities indicated that the Navy would realize a 7 to 10 percent price reduction under the annual buy concept. Further analysis also indicated a 30 percent reduction in purchase workload would be achieved.

A 1986 Navy Fleet Material Support Office (FMSO) study concluded that, by using a 12-month constraint on EOQ at SPCC, total variable costs (Navy Stock Fund and Operations and Maintenance Fund) were reduced by 7 percent and item availability increased by 2 percent. Although several earlier FMSO studies indicated that total variable costs would increase as the result of a 12-month EOQ, these studies evaluated only the impact on the Navy Stock Fund.

The establishment of minimum EOQs was one of the Navy efforts to comply with the Secretary of Defense 10-point program to improve spare parts procurement. A major initiative was included in the Navy Buy Our Spares Smart (BOSS) program to minimize purchase of uneconomical quantities of materiel. The beneficial result of increased buy quantities on lowering procurement prices was recognized by the GAO, in June 1987, in its report entitled, "PROCUREMENT: Navy Implementation of the Spare Parts Initiatives (GAO/NSIAD-87-149/OSD Case #6851-D).

FINDING D: Long Supply Assets Growth. The GAO reported that the Navy inventory of long supply (i.e., assets on hand and on order that exceed the requirements for the asset by either a 24 or 30 month supply) has shown dramatic increases since the one year minimum order policy took effect. The GAO reported that items fall into a long supply position because of decreases in projected demands due to (1) program phaseouts, (2) engineering changes, (3) flying hour decreases, and (4) weapon system deployment changes. According to the GAO, the following table

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\$.5 billion, if any, is attributable to the Navy minimum order constraint policy.

The Department acknowledges that a correlation exists between annual buys and long supply. Increasing the size of any procurement, even from less than an EOQ quantity to an EOQ, creates some additional risk of long supply. The Department maintains, however, that the added risk created by the Navy minimum EOQ constraints is minimal. The 12-month EOQ policy does not procure more materiel; it only buys it sooner, and not more than nine months earlier for any item. Variable EOQ and safety levels apply to approximately 723,200 items at SPCC and ASO. In FY 1985, only 25 percent of these items had a computed EOQ that was less than 12-months demand and were affected by the 12-month EOQ policy constraint--the remaining 75 percent already had an unconstrained EOQ in excess of 12-months demand. Since the majority of the EOQs generated during the period of increasing long supply were not affected by the 12-month EOQ, this policy change was not a principal contributor to long supply.

Other factors identified by the GAO are the primary causes of long supply--i.e., (1) program phaseouts, (2) engineering changes, (3) flying hour (programmatic) changes, and (4) weapon system deployment changes. In addition, policies to accommodate other priority objectives also contribute to long supply, e.g., materiel with a weapon system application, which formerly was disposed of because the end item is being phased out, is now being retained as contingency stock until the weapon system is completely phased out of operational use.

FINDING E: Navy Safety Levels Do Not Adequately Consider Risk.
The GAO explained that safety level stock acts as a buffer against unexpected increases in demand or delays in delivery from a contractor. According to the GAO, the quantity of safety level stock is driven by the assumed degree of acceptable risk of being out of stock on a given item. The GAO observed that DoD policy requires the Navy to maintain a wholesale safety stock level geared toward filling 85 percent of all requisitions received. The GAO found that, to compute the safety levels, the Navy uses a set of complex mathematical formulas, which consider such factors as demand variation, item cost, shortage cost, and acceptable risk of stockout. The GAO also found, however, that if the computed risk does not trigger a safety level requirement, the Navy lowers (constrains) the degree of acceptable risk so that almost every item has a safety level. The GAO concluded that the Navy:

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some other item and noted that making this differentiation is ordinarily referred to as determining the essentiality of an item. The GAO explained that determining the essentiality involves establishing the relationship of an item to the subsystem and the importance of the subsystem to the system in comparison to other systems. The GAO recognized that the Navy has developed a wholesale item mission essentiality coding system at the SPCC and is in the process of doing so at the ASO. The GAO observed that the Navy requirement formulas include an item essentiality factor, which (if used properly) would vary depending upon the essentiality of the item. The GAO further found, however, that the requirement formulas currently being used at both the SPCC and the ASO assign equal essentiality to all items. According to the GAO, Navy officials indicated that the use of variable item mission essentiality coding in wholesale safety level requirement computations needs further study and, therefore, is still several years away from implementation. Although acknowledging this may be the case, the GAO nevertheless obtained preliminary data from the ASO on the essentiality of the 129 items included in its review and found that 13 of the items had no impact on the mission capability of an aircraft. The GAO estimated, therefore, that 621 items, in the sample universe, valued at \$11.1 million, had no impact on mission capability. The GAO concluded that the Navy one-year policy does not take item essentiality into consideration. (p. 2, p. 4, pp. 26-29/GAO Draft Report)

DoD POSITION: Partially concur. The Department agrees that the Navy needs to improve the degree to which it considers essentiality in safety levels, but does not agree with the GAO conclusion that the Navy does not presently take essentiality into consideration.

At the SPCC, current risk protection policy assumes all high and medium demand-based items (demand greater than 1 per quarter) receive at least some minimal protection against stockout. Essential (item mission essentiality code (IMEC) 2, 3, and 4) low demand items are constrained to ensure that the lead time demand is protected, but safety levels are not forced. Items with minor mission impact (IMEC 0 and 1) with low demand have absolutely no constraints and often result not only in no safety level being generated, but in no protection for even the forecasted lead time demand. As a result of this policy, the SPCC saved the Navy Stock Fund \$148 million, plus variable holding, storage and investment costs estimated to be at least \$9 million annually.

The ASO ability to consider essentiality in its safety level computations is more limited than that of the SPCC. The ASO presently lacks the capability to use IMEC codes to reflect

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DoD POSITION: Concur. The Navy intends to utilize item essentiality in both provisioning and replenishment, both in wholesale and retail levels. The SPCC is already using IMEC codes to reflect mission essentiality to a limited extent. The Navy will implement decisions based on IMEC codes at the ASO when (1) the current review of reasonableness of IMEC codes is complete and (2) modernization efforts to allow for direct utilization of IMEC codes in requirements determination is complete. The full capability to use essentiality within the Navy will be available when modernization efforts are completed in the 1990 time frame.

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essentiality in its safety level computations. Currently, the ASO sets risk constraints by weapon system to ensure some safety level on high cost items, which are generally considered high risk items. The current risk settings are necessary to maximize readiness until system modernization efforts permit IMEC codes to be included in ASO files.

RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of the Navy direct the Commander, Naval Supply Systems Command, to rescind the policy of routinely buying more than the EOQ and instead require that the EOQ be used in ordering materiel. The GAO added that deviations from the EOQ should be allowed only (1) when the quantities are outside the overall parameters of DoD's 3-month minimum and 3-year maximum ordering quantities or (2) when it can be shown that larger procurements result in quantity discounts that more than offset the additional holding costs. (p. 6, p. 22/GAO Draft Report)

Now on pp 4 and 17

DoD POSITION: Nonconcur. Not all of the relevant costs and benefits of the current 12-month minimum EOQ policy have been considered in the GAO analysis. As stated in the DoD response to Findings B and C, there have been major changes in the contracting environment since DoDI 4140.39 was developed in 1970. The 12-month minimum EOQ policy is a reflection of the impact of those changes and the DoD policy to increase competition through reliance on larger buy quantities that provide an incentive for suppliers to bid on Navy contracts and for contractors to provide lower prices. The DoD agrees that demand trends must be considered in any buy decision. In recognition of the risks inherent in procuring larger quantities, the policy implemented by the Navy at the SPCC calls for selectively screening items for demand stability and trends. For those that are considered to be "stable," relative risk is assessed based on the item's value of annual demand and a minimum procurement floor is specified. This policy does not adversely impact long supply, since stable demand items do not contribute to long supply.

RECOMMENDATION 2: The GAO recommended that the Secretary of the Navy direct the Commander, Naval Supply Systems Command, to base safety level requirements on the relative importance of the items rather than constraining acceptable stockout risks for certain items. The GAO also recommended that the Navy use mission essentiality in safety level requirements determinations where this information is available. (p. 6, p. 29/GAO Draft Report)

Now on pp 4 and 22

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- allows safety level in virtually all items in order to minimize the requisition fill rate (which is the primary measure of wholesale inventory management effectiveness); and
- spreads the safety level across all weapon systems so that one system does not have an overly high fill rate at the expense of another.

In order to determine the impact of the Navy safety level policy, the GAO analyzed 129 items (64 consumable and 65 reparable items) and found that 59 of the items had safety level requirements only because the ASO constrained the acceptable risk, while the mathematical formula computed a safety level requirement for the remaining 70 items. The GAO then projected the value of the increased safety level requirements over the universe included in the review and estimated that the ASO had added \$80 million inventory costs by lowering what had been considered the acceptable risk of running out of stock. (p. 2, p. 4, pp. 23-25/GAO Draft Report)

Now on pp 2, 3, 19 and 20

DoD POSITION: Nonconcur. The risk constraints used by the Navy do not guarantee that almost every item qualifies for a safety level as identified in the following table:

Safety Level Distribution

<u>ICP</u>	<u>COG</u>	<u>% With SL</u>	<u>% Without SL</u>
SPCC	1H	88	12
	7G	74	26
	7H	66	34
ASO	1R	40	60
	7R	40	60

Risk is not arbitrarily changed on a line item basis in order to drive a safety level requirement. The current DoD goal is to achieve an 85 percent supply availability for all items. The Navy ICPs use a model (Computation and Research Evaluation System (CARES)) to analyze alternative inventory policies. Given budget constraints and a targeted 85 percent fill rate, CARES determines the risk necessary to achieve the goal.

FINDING E: Navy Safety Levels Do Not Adequately Consider Essentiality. The GAO observed that the logistics community has long recognized the importance of identifying and measuring the relative merit of maintaining stock of a given item over stocking

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reflects the value of assets in long supply, as well as the growth in this area since FY 1986:

Type of Materiel	Fiscal Year		
	1986	1987	1988
	----- (in millions) -----		
Air Consumable	\$1,525.8	\$2,169.9	\$ 2,466.1
Ship Consumable	757.9	1,158.9	1,239.6
Air Repairable	1,993.1	1,470.2	6,270.1 a/
Ship Repairable	3,731.2	3,941.1	4,018.2
Total	\$8,008.0	\$8,740.1	\$13,994.0

a/ The GAO reported that the principal reason for the projected FY 1988 increase in long supply for aviation repairables is that outdated prices were indexed to show current values. This was brought about by the change from appropriation funding to stock funding for these repairables.

The GAO observed that the growth in long supply assets has been of continuing concern to the DoD. According to the GAO, during a recent budget review, the DoD noted that between FY 1984 and FY 1986, the Navy spent \$2.4 billion for spares, for which there was no support requirement after the parts were delivered and, as a result, the Navy request for stock fund obligational authority was cut by \$442.8 million for FY 1987 and \$134.8 million for FY 1988. In addition, in recognition of significant amounts of materiel being reclassified as long supply, even before it was delivered, the GAO reported that the Navy Comptroller Office had already cut the Navy FY 1986 and FY 1987 request for stock fund obligational authority by \$50 million. (pp. 2-3, pp. 12-21/GAO Draft Report)

DoD POSITION: Partially concur. The Department agrees that the Navy inventory of long supply has increased since 1986; however, the Department does not agree with the dollar value attributed to the annual buy policy or that the growth in long supply is directly related to the policy.

The implication that the "dramatic increase" in long supply to \$14 billion in FY 1988 is a direct result of the annual buy policy is inconsistent with table 2.3. The table indicates that estimated long supply assets increased from \$8 billion to \$8.7 billion from FY 1986 to FY 1987 and from \$8.7 to \$14 billion in FY 1988. However, \$4.8 billion of the \$5.3 billion change in FY 1988 is due to accounting changes acknowledged by the GAO in table 2.3. The GAO does not quantify what part of the remaining

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These constraints affect a minimum (10 to 15 percent) of all active demand-based items, i.e., items with a demand within the last two years, and are applicable only if the standard EOQ is less than the constrained value. While the GAO found that a greater percentage of items are affected by the constraints, the GAO did not consider all active items when selecting its sample. The Navy is continuing to refine the constraints at SPCC and, after further testing, plans to apply similar constraints at the ASO. The Navy is tracking this initiative closely to ensure proper stewardship of this investment.

FINDING C: Navy Is Not Minimizing Variable Costs. The GAO explained that operating an inventory control point involves the variable costs of ordering and holding materiel and an implied shortage cost of running short of materiel, as follows:

- ordering costs are associated with determining requirements, processing purchase requests, and taking other control actions until orders are received;
- holding costs are associated with the interest that could have been earned on an alternative investment, and the obsolescence and storage of inventories; and
- shortage costs are associated with the impairment of military operations by being out of stock and are based on forecasted delays in the availability of the materiel.

The GAO found that DoD policy requires the minimization of total variable costs. Since the Navy one-year policy often precludes the procurement of the EOQ, total variable costs are increased. Based on its samples from two of the ASO FY 1986 periodic reviews, the GAO estimated that the Navy ASO incurred additional variable costs of \$10.5 million because it ordered a minimum of a one-year supply, i.e., rather than the EOQ, for the items included in the study. The GAO concluded that the Navy one-year supply policy, i.e., rather than ordering the EOQ, does not minimize the total variable cost of ordering and holding inventories. The GAO also reported that several Fleet Material Support Office studies of various groupings of items managed by the ASO and the SPCC have provided cost/benefit analyses of the impact on variable costs by increasing the DoD ordering floor from a three-month supply to a one-year supply. According to the GAO, the studies concluded that it was not cost-effective to increase the minimum ordering quantity because increases in holding costs outweighed decreases in ordering and shortage costs. (pp. 2-3, pp. 16-19/GAO Draft Report)

Now on pp. 2, 3, 13, 14
and 15.

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which will result in the lowest total costs for ordering and holding inventory to meet expected supply requirements. The GAO reported the DoD normally requires the Services to use a minimum order quantity of 3-months supply and a maximum of 3-years supply. The GAO explained that deviations from these limits are permitted, if particular commodity characteristics (shelf life, seasonal buy, etc.) or industry procurement practices (quantity discounts, etc.) dictate otherwise. The GAO further explained that:

- the DoD set the minimum at 3 months to avoid uneconomic repetitive procurements of high-dollar/demand items; and
- similarly, set the 3-year maximum to recognize that economic, technological and political events influence requirements and could impact on future needs despite these DoD requirements.

The GAO found that, in 1985, in order to reduce the purchase workload, the Navy adopted a policy to override the use of EOQ formulas and, instead, required a minimum of one year supply on all items. The GAO evaluated the results of two periodic reviews, in which the ASO compared materiel requirements with available assets, and found that the ASO initiated procurement for \$133.7 million in materiel that exceeded the EOQ. The GAO also found that the SPCC ordering policies during the time the audit field work was conducted were substantially the same as those of the ASO. The GAO observed that, subsequently, for procurements initiated after June 1987, the SPCC revised its reordering policy, under which the SPCC consumable and reparable items having stable and increasing demand trends will be assigned a minimum order quantity ranging from one year to a two and one-half year supply. The GAO concluded that, as a result of this latest SPCC policy, the inventory situation will worsen for some items, while improving for others. The GAO further concluded that the new procedures will continue to override the EOQ for some items. The GAO generally concluded that the Navy one year supply policy (instead of ordering on the basis of the EOQ) increases the risk of overbuying. (pp. 2-3, pp. 12-16/GAO Draft Report)

Now on pp. 2, 11, 12, and 13

DoD POSITION: Partially concur. The DoD agrees that the Navy overrides the EOQ; however, the Department does not agree that overriding the EOQ is necessarily bad and has adverse economic consequences. The Department policy on EOQ is prescribed in DoD Instruction 4140.39, "Procurement Cycles and Safety Levels of Supply for Secondary Items." The policy applies some common sense constraints to the EOQ computation model by specifying that no order quantity will be less than 3-months demand or more than

Comments From the Assistant Secretary of Defense



ASSISTANT SECRETARY OF DEFENSE
WASHINGTON D C 20301 8000

PRODUCTION AND
LOGISTICS

SEP 23 1987

(L/SD)

Mr. Frank C. Conahan
Assistant Comptroller General
National Security and International
Affairs Division
U.S. General Accounting Office
Washington D.C. 20548

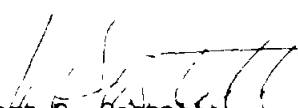
Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "NAVY SUPPLY: Economic Order Quantity and Item Essentiality Need More Consideration," dated July 20, 1987 (OSD Case 7355/GAO Code 394103).

The Department nonconcurrs with the GAO recommendation that, in most instances, spare parts procurements be limited to the computed Economic Order Quantity (EOQ), rather than the current Navy policy of buying at least one year's demand quantity for stable demand items. The Department concurs, however, with the recommendation that essentiality receive added consideration in requirements determination. A detailed discussion of the DoD position is enclosed.

The GAO letter transmitting the draft report to the Department questioned whether the "FOR OFFICIAL USE ONLY" designation on page 20 of the draft report is appropriate. The Department agrees with removal of the designation.

Sincerely,


Robert B. Costello

Enclosure

is no need for a safety level of four housings valued at \$8,044. Also, the computed safety level for this item was zero, based on an acceptable risk of stockout of 74 percent. ASO overrode the safety level formula and lowered the acceptable risk to 40 percent, causing the safety level requirement of four housings.

In another instance, ASO initiated the purchase of nine repairable sensor assemblies (NSN-6615-01-180-4158), costing \$2,605 each, for the A-7 aircraft. ASO assigned mission essentiality code 1 to the assembly because a 3-year history of maintenance data showed no impact on the operational readiness of the aircraft without the item. Under this code, there is no need for a safety level of seven sensor assemblies valued at \$18,235. Also, the computed safety level for this item was zero, based on an acceptable risk of stockout of 96 percent. ASO overrode the safety level formula and lowered the acceptable risk to 45 percent, causing the safety level requirement of seven sensor assemblies.

Conclusions

Constraining acceptable risks of stockout while simultaneously assigning equal mission essentiality to all items generates millions of dollars in safety level requirements without regard to the relative importance of items. Because the acceptable risk is lowered and mission essentiality is not considered, items are given safety level requirements when there is little or no need for such protection. The Navy, therefore, is missing opportunities to manage resources more prudently and to procure safety level stocks that are based on the relative importance of the items being procured.

The requirement for a full complement of safety levels for almost all items could adversely affect the increasing long supply situation. If more risks were assumed and less safety levels were required for low or unessential items, the potential for such items to go into a long supply position would be less.

Recommendations

We recommend that the Secretary of the Navy direct the Commander, Naval Supply Systems Command, to base safety level requirements on the relative importance of the items rather than constrain acceptable stockout risks for certain items. We also recommend that the Secretary direct the Commander to use mission essentiality in safety level requirement determinations when this information is available.

To determine the impact of the Navy's safety level policy, we analyzed the 129 items (64 consumables and 65 repairables) in our ASO samples. We determined that 59 items had safety level requirements only because ASO had constrained the acceptable risk. The mathematical formula computed a safety level requirement for the remaining 70 items. We determined the values of the safety level requirement of the 129 sample items and projected them to the value of the safety level in our universe. On the basis of our sample, we estimate that ASO increased safety level requirements by \$80.6 million by lowering the acceptable risk of stockout on items included in the two procurement reviews.

Table 3.1 Comparison of Stockout Risks

Dollars in millions			
	Constrained risk	Computed risk	Difference
Consumables	\$88.0	\$33.3	\$54.7
Repairables	80.9	55.0	25.9
Total	\$168.9	\$88.3	\$80.6

Equal Mission Essentiality Assigned to All Items

The logistics community has long recognized the importance of identifying and measuring the relative merit of maintaining stock of a given item over stocking some other item. Making this differentiation is ordinarily referred to as determining the essentiality of an item. It involves establishing the relationship of an item to the subsystem and the importance of the subsystem to the system in comparison to other systems.

In 1981 and 1982 we reported that the Navy needed to use mission essentiality coding in computing wholesale safety levels. The methods for determining safety levels at that time did not consider whether the items were essential in carrying out a military mission or maintaining a high level of readiness. We concluded that the Navy could make more informed logistics decisions in determining requirements and setting funding priorities if mission essentiality coding was determined and used.

The Navy has developed a wholesale item mission essentiality coding system at SPCC and is in the process of doing so at ASO. Items are coded into five categories ranging from those that have no impact on mission capability (code 1) to those that could cause a total loss of mission capability (code 5). Requirement formulas include an item essentiality factor that, if used properly, would vary depending upon the essentiality of an item. However, in practice both activities assign equal essentiality to all

already is covered in the cost to order portion of the EOQ formula. Second, weekly replenishment orders will not occur if the Navy complies with the DOD requirement that a minimum quantity of 3 months' supply be ordered. Third, multiple buys in process should not happen under the Navy's policy to consolidate such buys. Finally, increases in administrative leadtime should not be reflected in the EOQ portion of the requirements computation but rather in the leadtime portion. As noted previously, the requirements determination process considers three factors: EOQ, leadtime level, and safety level. Leadtime and safety level requirements are computed separately from the EOQ.

On DOD's point that larger buy quantities provide an incentive for suppliers to bid on Navy contracts and for contractors to provide lower prices we note that DOD's current policy allows larger quantities than the EOQ to be ordered under such circumstances, and we agree with permitting such deviations when it can be shown on individual items that the quantity price discounts more than offset the additional holding costs. In this regard, some of the Fleet Material Support Office studies included price breaks for quantity discounts and still concluded that annual buys were not cost effective.

DOD also stated that a 1986 Fleet Material Support Office study concluded that the 1-year policy would reduce total variable costs by 7 percent. We have reviewed the study and believe that DOD misinterpreted the results. The study actually concluded that increasing the ordering quantity from 3 months to 1 year would increase total variable costs by 7 percent.

DOD also commented on the growth of long supply. Although acknowledging that increasing the size of a procurement creates some additional risk of long supply, DOD does not believe that the growth in long supply is directly related to the annual buy policy. We are not saying that the entire increase in long supply is a direct result of the annual buy policy, but some of it is. Our follow up on the 63 sample items that were affected by the 1-year minimum order policy showed that, by March 31, 1987, 6 items had fallen into a long supply position or had increased their long supply position because a 1-year supply was ordered instead of the EOQ.

authority by \$442.8 million for fiscal year 1987 and \$134.8 million for fiscal year 1988. Recognizing that a significant amount of material was being reclassified as long supply even before it was delivered, the Navy Comptroller's Office had previously cut the Navy's fiscal years 1986 and 1987 request for stock fund obligational authority by \$50 million.

The Comptroller's Office noted that several audits had addressed the long supply problem and had recommended various management actions to alleviate the problem. Two of the recommended actions (increasing the cancellation of procurements for unneeded material and more timely reclassification of material in suspended, not-ready-for-issue status) also were recommended by us in previous reports. The \$50 million reduction in the request for obligational authority was made to recognize the savings from these management actions.

Items fall into a long supply position for numerous reasons. These include decreases in projected demands due to (1) program phaseouts, (2) engineering changes, (3) flying hour decreases, and (4) weapon system deployment changes. Since changes of this nature can be unavoidable, a Logistics Management Institute study concluded that buying a year's supply of material instead of the EOQ increases the risk of overbuying spares. The Institute reasoned that, as a result of long procurement leadtimes, the Navy was routinely buying a year's supply of material 2 years in advance of the expected need. The Institute stated that because of possible demand changes, the risks inherent in this large investment were substantial. In addition, the Fleet Material Support Office analyzed the impact of buying a minimum of 1 year's supply and concluded that this procurement cycle likely would generate surplus and obsolescent stock in the long run.

Conclusions

The EOQ principle, along with DOD's allowable deviations from it, appear to adequately balance the cost and other considerations involved in acquiring, storing, and issuing inventories, without unduly increasing long supply potential. The Navy's policy of ordering a year's supply of material instead of the EOQ increases the risk of overbuying material with a resultant potential for increasing long supply quantities. Also, the policy does not minimize the total variable costs of ordering and holding inventories. Although the Navy's policy decreases shortage and ordering costs, the increased holding costs more than offset the decreases.

and the obsolescence and storage of inventories. Shortage costs are associated with the impairment of military operations by being out of stock and are based on forecasted delays in the availability of material.

DOD's policy requires the minimization of total variable costs. In implementing this policy, the Navy specifies the use of the EOQ as the optimum order quantity that will minimize the total variable costs for each item. If the quantity ordered for any given item is different than the EOQ, the resulting total variable cost will always be higher. For example, ordering more than the EOQ decreases the ordering and shortage costs, but the increased holding costs of larger inventories more than offset these decreases.

Since the 1-year policy often precludes the procurement of the EOQ, total variable costs are increased. Based on our samples from two of ASO's fiscal year 1986 periodic reviews, we estimate that ASO incurred additional variable costs of \$10.5 million because it had ordered a minimum of 1 year's supply for the items included in the two reviews. In determining variable costs we used the same computer programs, records, and statistics the Navy used. We did not independently determine their reliability. Our comparison of the ordering, holding, and shortage costs applicable to the EOQ and the costs applicable to the 1-year policy is shown in table 2.2.

Table 2.2: Comparison of Variable Costs

Dollars in millions			
	1-year policy	EOQ	Difference
Consumables	\$27.2	\$17.6	\$9.6
Repairables	2.8	1.9	0.9
Total	\$30.0	\$19.5	\$10.5

^aThe projected variable cost for the EOQ is based on the actual EOQ even when it is less than DOD's minimum 3-month criterion. If the 3-month criterion is applied, the projected difference amounts to \$9 million for consumables and \$800,000 for repairables, or \$9.8 million in total.

The following examples illustrate the differences in variable costs for the items previously discussed.

- ASO incurred variable costs of \$14,112 on its purchase of consumable switch assemblies. If ASO had ordered the EOQ instead of 1 year's supply, variable costs would have been \$8,831, or \$5,281 less.

The Navy's requirement formulas calculate an EOQ that is the best quantity to buy to minimize the variable costs of ordering and carrying individual items. However, in March 1985 ASO, with the concurrence of the Naval Supply Systems Command, implemented procedures that overrode the EOQ and set a minimum ordering quantity of 1 year's supply for all consumable items. ASO did this to reduce its workload by making annual purchases instead of more frequent purchases. Before March 1985, ASO ordered a minimum of 3 months' supply for consumable items except for intensely managed items where annual procurements were made. SPCC, with the concurrence of the Naval Supply Systems Command, made similar changes during the summer of 1985. With regard to repairable items, ASO and SPCC also have been ordering a minimum of 1 year's supply.

Subsequent to completion of our field work, SPCC revised its procedures for purchases initiated after June 1987. Under the new procedures, consumable and repairable items having stable and increasing demand trends are assigned a minimum order quantity ranging from 1 year's to 2-1/2 year's supply. As a result, the new procedures will continue to override the EOQ for these items. All other consumable and repairable items will be assigned an EOQ ranging from a minimum of 3 months to a maximum of 3 years in accordance with DOD's requirements.

ASO and SPCC make periodic reviews (called Supply Demand Reviews) to compare material requirements with available assets. If the comparison shows a shortage of assets, a procurement recommendation is made to the inventory manager responsible for the item. The inventory manager validates the accuracy of the recommendation and initiates procurement action as needed.

In fiscal year 1986 ASO made 16 of these periodic reviews. To determine the effect of the annual procurement policy, we drew samples from two of ASO's periodic reviews—one sample was of consumable items reviewed in August 1986 and one was of repairable items reviewed in July 1986. We found that 48 of 64 consumable items and 15 of 65 repairable items sampled had been affected by the 1-year minimum order policy. For the remaining items, the EOQ exceeded a 1 year's supply. Projecting the samples, we estimate that ASO had initiated procurements for \$133.7 million in material that exceeded the EOQ, as shown in table 2.1.

Chapter 1
Introduction

We performed our review in accordance with generally accepted government auditing standards.

Introduction

The Navy maintains wholesale inventories at various stockpoints to fill requisitions from customers worldwide. These inventories include two types of material: consumables and repairables. Consumables are individual parts or assemblies that are disposed of when replaced. Repairables are components or assemblies that are returned to the supply system to be repaired when replaced.

The Naval Supply Systems Command administers the Navy's supply system and provides supply management policies and procedures to its inventory control points. The Aviation Supply Office (ASO) and the Ship Parts Control Center (SPCC) are the inventory control points responsible for determining the wholesale requirements for aviation and ship material. They use distinct requirement determination processes for initial provisioning stock, replenishment or peacetime operating stock, and mobilization stock. Replenishment stock requirements are based either on historical demand rates (past requests by users) or on other factors such as estimated usage rates.

In determining replenishment inventory needs, the Navy considers three factors: economic order quantity (EOQ), leadtime level, and safety level. The EOQ is the amount needed to meet demand between successive replenishment orders and is equal to the replenishment quantity when assets reach the reorder level. Ideally, it is the quantity that results in the lowest total cost for ordering and holding stock. The leadtime level is the amount needed to meet normal demand during the time required to order and receive delivery of stock. The safety level is the amount needed to meet fluctuations in demand and leadtime.

The Navy had budgeted almost \$3 billion to purchase stock fund replenishment material in fiscal year 1987, as shown in table 1.1.

Table 1.1 Replenishment Material Budget for Fiscal Year 1987

Organization	Consumables	Repairables	Total
ASO	\$781.6	\$876.6	\$1,658.2
SPCC	492.0	820.6	1,312.6
Total	\$1,273.6	\$1,697.2	\$2,970.8

Objectives, Scope, and Methodology

Our objectives were to evaluate the requirements determination process for replenishment material and to assess those requirement computation factors offering the greatest potential for cost avoidance. We performed this review because the growth of long supply assets in the Navy

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Abbreviations

ASO	Aviation Supply Office
DOD	Department of Defense
EOQ	Economic Order Quantity
GAO	General Accounting Office
SPCC	Ships Parts Control Center

The requirement for a full complement of safety levels for almost all items could have an adverse impact on the increasing stocks beyond current needs. If less safety levels were required for low or unessential items, the potential for such items to go into this position would be less

Recommendations

GAO recommends that the Navy:

- Use the economic order quantity except where it can be shown that other factors offset the cost/benefits of doing so.
- Take into account the relative importance of items in determining safety level requirements for certain items.
- Use item mission essentiality in requirement computations when this information is available.

Agency Comments

The Department of Defense agreed that relative importance and essentiality should receive added consideration in determining requirements but did not agree that the economic order quantity normally should be used in ordering material in lieu of ordering a 1-year supply. (See app. I.) After reevaluating the matter, GAO still believes that the Navy should rescind its policy of routinely buying more than the economic order quantity. GAO concluded, however, that larger procurements should be allowed when quantity discounts more than offset the additional costs of holding larger inventories.

Executive Summary

Purpose

In fiscal year 1987, the Navy budgeted almost \$3 billion to purchase replenishment material for peacetime operating stocks. GAO evaluated whether the Navy's requirements determination process was accurate in determining the need for this material. GAO focused on the economic order quantity and safety level portions of the process.

Background

In determining replenishment requirements, the Navy considers three factors: economic order quantity, leadtime level, and safety level. The economic order quantity is the quantity that will result in the lowest total costs for ordering and holding inventory to meet expected requirements. The leadtime level is the amount needed to meet normal demand during the time required to order and receive delivery of stock. The safety level is the amount needed to meet fluctuations in demand and leadtime.

Results in Brief

Navy policy requires that when the economic order quantity is calculated to be less than 1 year, a year's supply of material nonetheless be ordered. About 50 percent of the stock items reviewed by GAO had economic order quantities under a year. The Navy could reduce the potential for increasing its stocks beyond current needs (long supplies) and minimize the costs of ordering and holding inventory by ordering the economic order quantity rather than a 1-year supply.

Navy policies on acceptable risk of running out of stock and on mission essentiality enable almost every inventory item to have a safety level of stock. The Navy could also reduce the potential for increasing its stocks beyond current needs by revising these policies.

Principal Findings

Policy Overrides Economic Order Quantity

GAO evaluated selected procurement actions taken by the Aviation Supply Office in fiscal year 1986, which amounted to \$1 billion. GAO found this office had ordered \$133.7 million in material that exceeded the economic order quantity. Additional costs of \$10.5 million were incurred on this material because the increased holding costs of the larger inventories more than offset the decreases in ordering costs and the implied cost of shortages.
