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Report to the Congress; by Elmer B. Staats, Comptroller General.

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Congressional Relevance: Congress.

The Navy overinvests tens of millions of dollars yearly in inventories of repair parts for its 106 nuclear submarines because of weaknesses in establishing and maintaining inventory levels on board submarines and tenders. Findings/Conclusions: Over a 5-year period, the Navy can save as much as $106.9 million in future investments in supplies for submarines and tenders. This can be done while still keeping the submarines and tenders ready for combat. The accuracy of usage data needs to be improved and more realistic safety levels and order-ship times could be used in computing stock requirements. Submarine tenders can cancel and redistribute millions of dollars of excess stock each year by improving policies and practices. Recommendations: The Secretary of Defense should direct the Navy to eliminate initial estimates of parts needed when updating replacement rates and rely more on the last 2 years' data if the rates are not updated annually; require submarine tenders based in the continental United States to adopt a more stringent usage criterion for establishing and retaining stock levels; require a number of deployed submarines and tenders to test this more stringent criterion for 1 year under operating conditions; and change its policy so that submarine tenders will limit increases in stock levels to quantities needed for current operations. (Author/SC)

REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Submarine Supply Support Costs Can Be Greatly Reduced Without Impairing Readiness

Department of the Navy

The Navy can reduce future investments in submarine support inventories by as much as $106 million by improving policies and procedures for establishing and maintaining optimum stock levels on submarines and tenders. Although some improvements have been made or promised, the Navy could do more.

LCD-76-237

JUNE 7, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-133058

To the President of the Senate and the
Speaker of the House of Representatives

This report shows that the Navy can substantially reduce submarine supply support costs without impairing readiness.

We made our examination pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Defense; and the Secretary of the Navy.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

SUBMARINE SUPPLY SUPPORT COSTS CAN BE GREATLY REDUCED WITHOUT IMPAIRING READINESS
Department of the Navy

D I G E S T

The Navy's 106 nuclear submarines are authorized to carry enough repair parts to sustain continuous operations during resupply intervals. These submarines receive primary resupply support from 11 "submarine tenders"--ships that stock supplies of parts for submarines assigned to them--and 2 submarine bases. Six supply centers ashore provide backup supply support.

The Navy overinvests tens of millions of dollars yearly in inventories of repair parts because of weaknesses in establishing and maintaining inventory levels on board submarines and tenders. For example

--the initial 90-day supply of parts for overhauled submarines and tenders was based on outdated and overstated estimates of expected usage (see ch. 2);

--criteria used to establish the amount of additional stock needed were too lenient and resulted in frequent and large quantities of unneeded stock (see ch. 3);

--the need for stock based on usage was overstated because inaccurate data, unrealistic order-ship time, and unrealistic safety levels were used (see ch. 4); and

--large excesses of onorder and onhand stock, needed elsewhere, were not canceled or redistributed by submarine tenders (see ch. 5).

Over a 5-year period, the Navy can save as much as $106.9 million in future investments in supplies for submarines and tenders. This can be done while still keeping the submarines and tenders ready for combat. How?

--By updating more quickly and accurately the initial 90-day allowances of parts for overhauled submarines and tenders. This should include greater reliance on the latest 2 years' data on parts used by submarines. Also, tender stocks not used during the same period should be keep to a minimum. Savings? $27.1 million. (See p. 5.)

--By adopting more stringent criteria for establishing the levels of stock that are based on usage. Savings? $72.7 million. (See p. 15.)

--By improving the accuracy of usage data and by using more realistic safety levels and order-ship times in computing stock requirements. Savings? $7.1 million. (See p. 24.)

Additionally, submarine tenders can cancel and redistribute millions of dollars of excess stock each year by improving policies and practices. (See p. 32.)

The Department of Defense generally agreed with the proposals for improvement and cited several actions taken or planned by the Navy which should save about $20 million. (See pp. 13, 31, and 35.)

Defense did not agree with three proposals: (1) relying more on current data when updating the rates used for replacing submarine equipment parts, (2) having submarines and submarine tenders adopt more stringent stocking criteria, and (3) revising the Navy's policy to limit submarine tenders' increases in stock levels to quantities based on actual usage. (See pp. 13, 21, and 22.)

GAO does not feel that the reasons for disagreement are valid and, therefore, recommends that Defense direct the Navy to:

--Eliminate initial estimates of parts needed when updating replacement rates and rely more on the last 2 years' data if the rates are not updated annually. (See p. 14.)

--Require submarine tenders based in the continental U.S. to adopt a more stringent usage criterion for establishing and retaining stock levels. (See p. 22.)

--Require a number of deployed submarines and tenders to test this more stringent criterion for 1 year under operating conditions. (See p. 22.)

--Change its policy so that submarine tenders will limit increases in stock levels to quantities needed for current operations. (See p. 23.)

Contents

ABBREVIATIONS

CONUS	Continental United States
DSA	Defense Supply Agency
GAO	General Accounting Office
GSA	General Services Administration

CHAPTER 1

INTRODUCTION

The Navy's 106 nuclear submarines are authorized to carry $271 million in inventories to sustain uninterrupted supply operations. These submarines receive their primary resupply support from 11 submarine tenders and 2 submarine bases which have authorized inventories valued at $93 million.

The supply cycle of a submarine has three inventory phases. During construction, initial allowances are assigned in sufficient quantities to provide unassisted support during a stated operational period. A submarine maintains its initial inventory levels by periodically ordering replacements for material used during operations. After operating for 4 or 5 years, the submarine undergoes a maintenance overhaul. At that time, it normally receives a supply overhaul to update inventories on board.

INITIAL SUPPLY SUPPORT

The Navy provides newly constructed submarines with supplies to sustain uninterrupted operations for 90 days. These allowances, called Coordinated Shipboard Allowance List Inventories, are prepared by the Navy's Ship Parts Control Center, Mechanicsburg, Pennsylvania. To determine initial 90-day stockage quantities, the Navy uses a replacement factor which is based on a fleet-wide usage rate. It represents the expected annual failure rate for each item and is supposed to be updated annually. A technician's estimate is the basis for initial stockage of items without usage data. Items which are not expected to be used within 90 days are not stocked unless vital to the ships. These items are stocked in minimum quantities on either the submarine or tender but not both.

Initially, a submarine tender receives inventories sufficient for self-support and for performance of its industrial and resupply missions to assigned submarines for 90 days. Basic authority to stock submarine support inventories is the tender load list. It is prepared and published by the Navy Fleet Material Support Office. Quantities are based on 24-month historical demand data from the submarines to be supported. When sufficient demand histories are not available, the load list quantities are based on a fleet-wide replacement factor.

PERIODIC RESUPPLY SUPPORT

To maintain their 90-day supplies, submarines restock from tenders when they return to port from sea patrols. This time in port--the refit period--occurs once each quarter and lasts for about 1 month. During this time, the tender also provides maintenance support. Tenders maintain their 90-day supplies by ordering from supply centers, which, in the continental United States (CONUS), are located near the tenders.

Tenders and submarines add more authorized items and additional items to their inventories based on repetitive demands occurring after an operational period. The Navy's policy for authorizing additional items is based on at least two recurring demands in 6 months. Its policy for retention is a minimum of one demand in 6 months. This policy provides that nonrecurring demands for one-time requests not be considered for stocking additional items.

Although items added to submarine and tender inventories because of recurring demands represent the smallest percentage of items aboard these ships, they are the most frequently used. The Navy, therefore, gives these items (selected item management items on submarines and demand-based items on tenders) greater management attention.

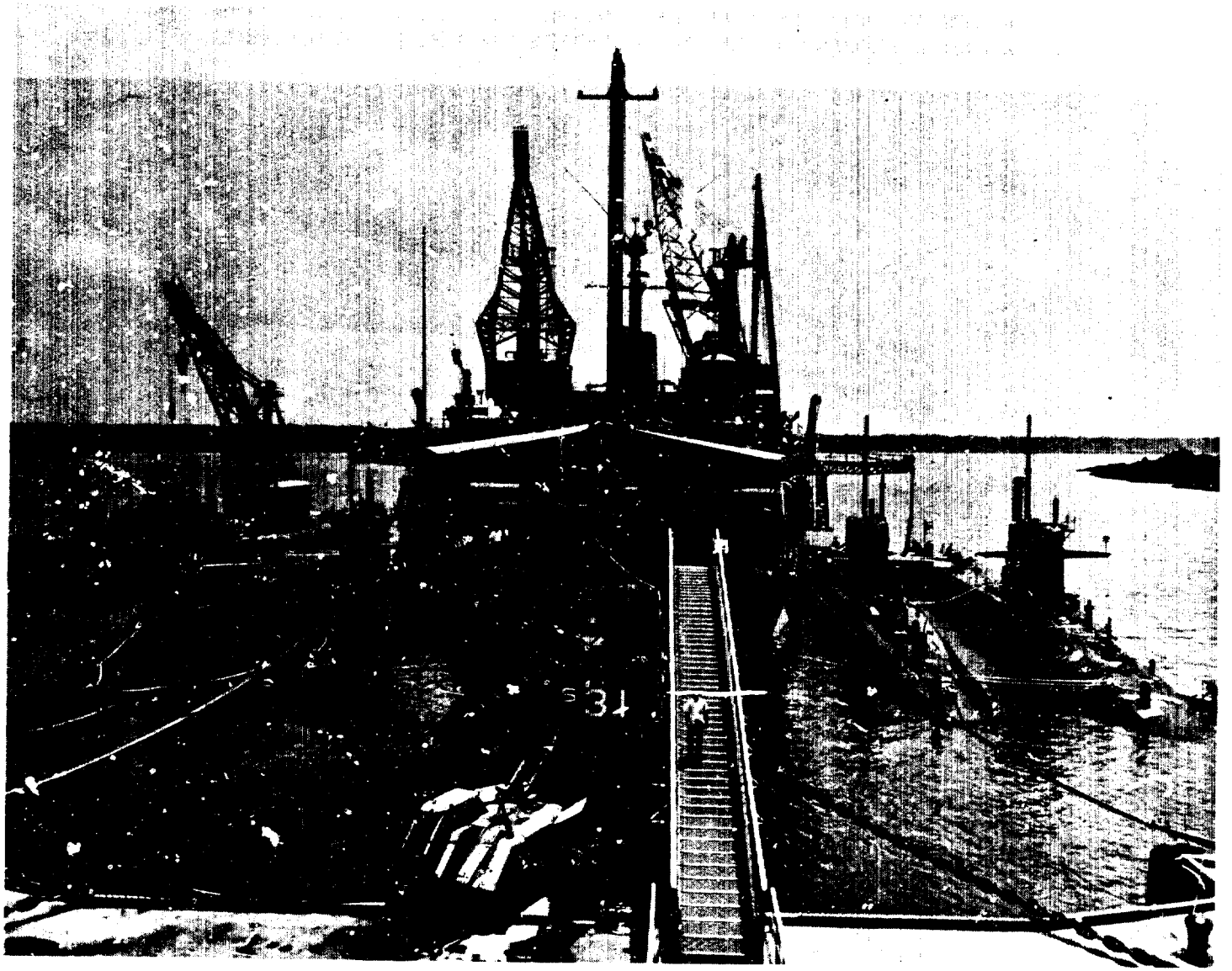
Tenders use automated systems to determine increased quantities, but submarines use manual systems. Tenders usually recompute stock levels monthly, whereas submarines review stock levels quarterly for necessary changes.

SUPPLY OVERHAUL

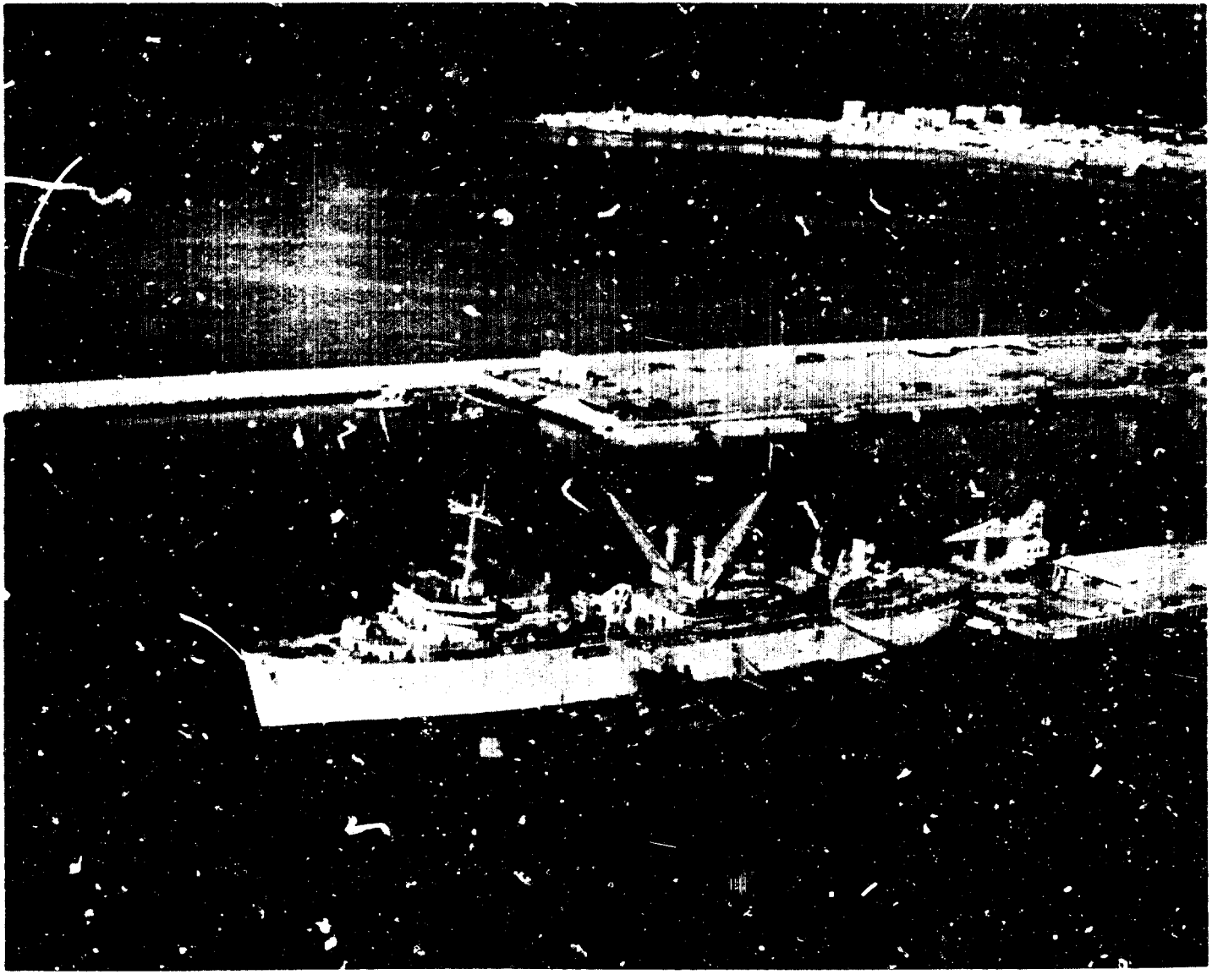
Submarines and tenders undergo supply overhauls after about 4 or 5 years, at the same time they receive a shipyard overhaul. Supply overhauls improve supply readiness by bringing repair part inventories up to the levels prescribed in updated allowance and load lists.

ORGANIZATION AND RESPONSIBILITIES

A tender normally provides supply and maintenance support to one submarine squadron consisting of about 10 submarines. The Navy has 10 submarine squadrons under the operational control of the Commander, Submarine Force Atlantic, Norfolk, Virginia, and the Commander, Submarine Force Pacific, Pearl Harbor, Hawaii. These two submarine commands are under the respective fleet commanders who are responsible to the Chief of Naval Operations.



SUBMARINES UNDERGOING REFIT (RESUPPLY AND MAINTENANCE)
BY FBM TENDER U.S.S. HUNLEY AT CHARLESTON, SOUTH CAROLINA.



SUBMARINES RECEIVING RESUPPLY AND MAINTENANCE SUPPORT
FROM FBM TENDER U.S.S. SIMON LAKE LOCATED AT ROTA, SPAIN.

CHAPTER 2

NEED FOR MORE TIMELY AND ACCURATE UPDATING OF INITIAL INVENTORY ALLOWANCES

The Navy can save an estimated $16 million to $27.1 million on initial inventory allowances of equipment repair parts for overhauled submarines and tenders without impairing submarine mission readiness. This can be done by more timely and accurate updating of the inventory allowances in response to changes in mission and demand.

UPDATING INITIAL INVENTORY ALLOWANCES FOR SUBMARINES

Initial inventory allowances for newly constructed submarines are considered part of the Navy's war reserves. They must be maintained on board submarines throughout the 4- to 5-year operating cycle between major supply and maintenance overhauls. When submarines are overhauled, their initial allowance of repair parts is updated to provide for changes in installed equipment and predicted equipment part failures.

Before 1969 the initial or updated 90-day inventory allowances of repair parts for newly constructed or overhauled submarines were based on technical estimates of expected annual part failures. These were made when equipment was introduced into the supply system. A new method--the best replacement factor technique--was introduced in 1969. This technique was designed to uniformly determine initial allowances of repair parts for all ships, including submarines. Under this method, exponential smoothing 1/ weights were assigned to recent and older usage data and initial technical estimates to obtain a desired weighted average annual usage. This average was then used to determine future requirements.

1/Exponential smoothing is a special kind of weighted moving average. The new estimate of the average is updated periodically as the weighted sum of (a) the demand in the period since the last review and (b) the old average. The new average is a weighted sum of all past demand with heaviest weight on the most recent data. Used properly, it can be made to respond smoothly, automatically, and accurately to any anticipated changes in the pattern of demand. (James A. Constantin, "Principles of Logistics Management," Meridith Publishing Company, N.Y. 1966.)

When the Navy initially began using this technique, it decided that the calculated weighted average of annual usage would minimize the impact of initial technical estimates of expected part usage over a 4-year period. This would result from applying 40 percent to the most recent annual parts usage reported by the fleet and 60 percent to the older usage data or the initial technical estimate. By applying these exponential smoothing weights to the yearly updated parts usage, the impact of the initial technical estimates of expected usage on new equipment parts would be reduced to about 13 percent over a 4-year period.

Computing an equipment parts best replacement rate fleet-wide and using this rate in updating the initial 90-day repair parts allowances of an overhauled submarine is shown below.

$\frac{1{,}000}{10{,}000}$ (annual reported fleet part failures) = 0.10 (most recent annual fleet-wide failure rate)

0.10 (latest annual failure rate) X 0.40 (exponential smoothing weight assigned to latest annual usage rate) = 0.04

0.60 (initial technical estimate of annual failure rate) X 0.60 (exponential smoothing weight assigned to older usage rate) = 0.36

0.36 + 0.04 = 0.40 Equipment part fleet-wide best replacement rate.

100 (part population on overhauled submarine) X 0.40 (best replacement rate) = 40 (yearly expected parts replacements)

40 (yearly expected replacements) X $\frac{90}{360}$ or $\frac{1}{4}$ = 10 Updated 90-day repair part allowance for overhauled submarine.

Problems in updating repair parts allowances

Several problems arose regarding the criteria used by the Navy in initially establishing fleet-wide best replacement factors in 1969. The Navy applies the lower 40 percent weight

to the most recent usage data; however, both military and commercial publications on exponential smoothing stress that the highest weight ratio should always be applied to the most recent usage data. Furthermore, yearly equipment parts usage reported by the fleet in 1969 showed that initial technical estimates of expected parts usage were too high for 54 percent of the equipment parts in use and too low for only 6 percent. In addition, the Navy's stated objective of reducing the influence of initial technical estimates of expected parts usage to a minimum of 13 percent over a 4-year period does not agree with Department of Defense (DOD) policy. This policy, as set forth in DOD Instruction 4140.42, dated August 7, 1974, states that initial technical estimates of expected usage for new equipment parts should be replaced entirely by actual usage data after a 2-year demand development period.

The Navy also has had a number of problems with applying the fleet-wide equipment part best replacement factors subsequent to their introduction in 1969. These rates have only been updated on a 3-year basis rather than yearly as intended. Also, when these rates were updated, the Navy used only the most recent year's usage as reported by the fleet. Accordingly, 2 years of actual usage experience was ignored with each update.

Additionally, despite a systematic downward trend in equipment parts usage, the Navy continued to use the previously mentioned 60-40 exponential smoothing weights in updating replacement rates. Both military and commercial publications on the exponential smoothing technique agree that a long-term upward or downward trend in usage pattern dictates an upward adjustment of the weight to be applied to the most recent usage data. Failure to do so causes the weighted average annual usage rate to adjust too slowly to consistent changes in demand trends. The systematic downward trend in equipment parts replacement rates is shown on the following page.

New rates compared to old	1969 initial best replacement rates (note a)		1970 first Navy update (note b)		1973 second Navy update (note c)	
	Number of parts	Percent	Number of parts	Percent	Number of parts	Percent
Increased	23,000	6	39,977	4	36,301	5
Decreased	210,000	54	245,915	28	311,590	46
Same	156,000	40	593,524	68	330,725	49
Total	389,000	100	879,416	100	678,616	100

a/Replacement rates for 1969 compared with initial technical estimates of expected parts usage.

b/First of intended yearly updates of equipment parts best replacement rates established in 1969. Update represents weighted average sums of 40 percent of the then most recent annual replacement rates reported by fleet plus 60 percent of 1969 rates.

c/Intended yearly updates not made in 1971 and 1972 because of other priority work. Therefore, represents update of 1970 replacement rates accomplished by obtaining the weighted average sums of 40 percent of the then most recent annual replacements reported by the fleet plus 60 percent of the 1970 rates.

Impact of problems in updating repair parts allowances

We statistically sampled updated repair parts allowances totaling $19.9 million for 24 submarines overhauled between June 1974 and June 1975. These updated allowances were obtained by using fleet-wide best replacement rates last updated by the Navy in January 1973. In arriving at these updated rates, the Navy used reported fleet usage for a 1-year period ending in March 1972. Had the Navy made a yearly update of the January 1973 best replacement rates in early 1974, based on the then latest annual reported fleet usage, the updated repair parts allowances for the 24 submarines could have been reduced by an estimated net total 1/ of $2.2 million.

1/Net total is calculated by offsetting decreases in updated allowances with increases. Our statistical sampling update of the repair parts allowances for the 24 submarines showed a decreased replacement rate for 68 percent of the repair parts and an increased rate for 15 percent.

The updated repair parts allowances could have been reduced further by an estimated net total of $4.4 million. The Navy could have obtained this reduction if, in addition to a yearly update of the best replacement rates, it had applied an 80 percent exponential smoothing weight to the then latest annual fleet reported usage. The application of an 80 percent weight to the latest annual usage would, in our opinion, have been appropriate. The majority of the equipment repair parts in our sample had been introduced into the supply system around 1970. Therefore, by 1974, these parts had been in the supply system for 4 or more years but had received only one best replacement rate update.

The Navy's single yearly update in 1973, in which a 40 percent weight was applied to the then latest annual usage, reduced the influence of the initial technical estimate of expected usage on future requirements to 60 percent. Had the replacement rates been updated yearly with continued application of a 40 percent weight to latest annual usage, the influence of the initial technical estimate through 1974 would have been reduced to 12.9 percent. On the other hand, if in addition to the 1973 update the Navy had further updated in 1974 and applied an 80 percent weight to the latest annual usage, the influence of the initial technical estimate would have been reduced to 12 percent. The potential impact of these conditions on the initial technical estimate of expected annual usage is shown below.

	Influence of initial technical estimates based on yearly updates of rates using 60-40 weight ratio	Influence of initial technical estimates based on Navy's single 1973 update using 60-40 weight ratio and GAO's 1974 update with 20-80 weight ratio
	(percent)	
1970 new item	100	100
1971--end of 1st year	60	100
1972--end of 2d year	36	100
1973--end of 3d year	21.0	60 (Navy's 1973 update)
1974--end of 4th year	12.9	12 (GAO's 1974 update)

The following examples are typical of the reductions in updated repair parts allowances for the 24 overhauled submarines based on our tests.

Equipment repair part	Unit price	Supply system entry date	Navy 1973 replacement rate	Influence of initial technical estimate on replacement rate	Updated allowance for sampled submarine based on replacement rate	GAO 1974 updated replacement rate using Navy's 60-40 weight ratio	Influence of initial technical estimate on replacement rate	Updated allowance based on replacement rate	Dollar reduction	GAO 1974 updated replacement rate using 20-80 weight ratio	Influence of initial technical estimate on replacement rate	Updated allowance based on replacement rate	Dollar reduction
3110-442-6888 (note a)	$ 6.20	1969	0.2500	60%	16	0.1500	36%	10	$37.20	0.0500	12%	4	$74.40
5910-814-1611 (note b)	24.70	1971	0.0648	60	1	0.0388	36	1	-	0.0129	12	-	24.70

a/No fleet-wide failures were experienced for this part over a 4 year period. Thus, the updated allowance of 16 units was based on a highly overstated initial technical estimate of expected usage which still had a 60 percent influence at the time of the Navy's 1973 update. As can be seen by our 1974 update, the impact of the overstated initial estimate of usage could have been reduced by a yearly update combined with application of an 80 percent weight ratio to the latest annual fleet reported usage which was zero in this case.

b/One unit of this item was included in the updated allowance of a sampled submarine as insurance stock because of the 1973 replacement rate used by the Navy which was influenced by 60 percent, the initial technical estimate. To qualify for insurance stock, a part must be vital to the submarine and there must be a 25 percent chance of 1 yearly failure. This is determined by multiplying the submarine's applicable part population times the replacement rate. The sampled submarine had a part population of 12. A part population of 12 times the 1973 replacement rate of 0.0648 equals 0.7776. Thus, there was a 77.7 percent chance of one yearly failure. However, our 1974 update involving a 20-80 percent exponential smoothing ratio reduced the annual replacement rate to 0.0129 times 12 parts population equals 0.1548. Thus, the item no longer qualified for an insurance quantity of one.

Based on the above sampling results, we estimate that when the Navy's fleet of nuclear submarines is overhauled during the next 5-year cycle, investments in updated repair parts allowances can be reduced by $13.7 million. This can be accomplished by either updating the fleet-wide equipment parts best replacement rates yearly or, if done less frequently, by using all intervening years' reported fleet usage to determine the updated replacement rates. If the Navy would use a 20-80 exponential smoothing ratio in updating the replacement rates, the estimated savings could be $24.8 million.

UPDATING INITIAL INVENTORY ALLOWANCES FOR SUBMARINE TENDERS

When the tenders are overhauled, every 3 or 4 years, their initial repair parts allowances are updated to provide for changes in supported submarines. At that time, the Navy reviews the repair parts and the past 24-month usage histories of the submarines which will be assigned to the tenders when the overhaul is completed. If the 24-month histories show past usage of the repair parts carried by the submarines, this data is used to determine the updated 90-day allowance of repair parts for the overhauled tenders. If there is no past usage for the repair parts carried by the submarines, the Navy uses the previously mentioned fleet-wide best replacement factors to update the 90-day allowance of repair parts to be stocked by the overhauled tenders.

Problems in updating repair parts allowances

We statistically sampled the updated 90-day repair parts inventories of two recently overhauled tenders. Our tests showed that 38 percent of the repair parts had not been used by the assigned submarines during the past 2 years. The parts had been in the supply system for 2 or more years. Many of these repair parts were carried by the submarines in minimum replacement quantities for insurance purposes. The remainder of the unused repair parts were initially provisioned largely because of initial technical estimates of expected usage.

The Chief of Naval Operations had issued policy guidance which directs that insurance stocks not be carried on both the tenders and their assigned submarines. As previously mentioned, insurance stocks are items for which there is little likelihood of related equipment failure (possibility of one failure in a 4-year period) but for which such failure would abort submarine operations.

Because the Navy used fleet-wide best replacement rates to compute 90-day tender allowances for repair parts that had not been used by assigned submarines during the past 2 years, the two overhauled tenders we reviewed were often provided quantities in excess of minimum replacement needs. Minimum replacement needs represent the quantity of repair parts that would be needed in the unlikely event of one equipment failure in a 90-day period. Examples of this condition follow.

Repair part	90-day minimum replacement needs	90-day allowances based on fleet-wide best replacement rates
Resistor	1	7
Resistor	1	8
Piston ring	4	26
Rubber grommet	1	9
Resistor	1	7
Resistor	1	7
Spring	1	8
Packing	1	2
Contact	8	16
Bearing	2	10

Impact of problems in updating repair parts allowances

On the basis of our tests, the updated 90-day repair parts allowances of $3.2 million for the two tenders could have been reduced by $420,000. This reduction could have been realized if the allowances for repair parts, which are not carried by the assigned submarines as insurance items and which have had no use for 2 years, had been restricted to minimum replacement quantities. Projecting this reduction to cover all tenders, we estimate that when the Navy's fleet of submarine tenders is overhauled during the next 4-year cycle, investments in updated repair parts allowances can be reduced by $2.3 million without compromising readiness.

AGENCY COMMENTS, OUR EVALUATION, AND RECOMMENDATIONS

We brought our findings and proposals for corrective action to the attention of the Secretary of Defense in August 1976. At the Secretary's request, the Acting Principal Deputy Assistant Secretary of Defense (Installations and Logistics) commented on them in a February 1, 1977, letter. (See app. I.) (For brevity, we have identified the comments merely as DOD's throughout this report.)

DOD agreed with, and the Navy implemented, our proposal that the Navy take necessary actions to insure that fleet-wide best replacement rates be updated yearly on the basis of the most recent annual fleet usage. If done less frequently than yearly, DOD agreed that all intervening years' fleet usage data should be considered in updating annual usage factors.

We believe that if the Navy continually pursues this action, it will result in estimated savings of $13.7 million in inventory investment over the next 5 years when the Navy's fleet of nuclear submarines receives updated repair parts allowances with their regular supply and maintenance overhauls.

DOD disagreed with our proposal that the Navy should apply a 60 to 80 percent exponential smoothing weight to the latest annual repair parts usage data in determining updated fleet-wide best replacement rates when the rates are updated less frequently than yearly. DOD said that, although the Navy will make a further review, other studies within DOD have indicated that strong reliance on most recent demand is generally not cost effective.

We believe DOD's comments are inconsistent with its stated policy, and we feel sure that a further comprehensive review by the Navy will show our proposal has merit. Contrary to DOD's comments, the conclusions of the studies cited in DOD's reply are consistent with the intent of our recommendation that the Navy place greater reliance on current usage experience in updating submarine equipment parts replacement needs.

The subject studies conclude that the most cost-effective method of forecasting demands is by using a monthly demand average obtained from the latest 24-month demand base period. Moreover, as mentioned on page 7, DOD policy stipulates that initial technical estimates of expected equipment parts usage will be replaced entirely by actual usage data after a 2-year demand development period.

As pointed out on pages 9 and 10, the replacement rates used by the Navy to determine equipment parts replacement needs for submarines continued to be influenced by 60 percent of the initial technical estimates of expected yearly usage even though the parts had been in the system for 4 or more years. This occurred because the Navy did not (1) update the replacement rates yearly as intended, (2) consider all intervening years' usage data in updating the replacement rates, and (3) assign a high enough weight to the latest annual usage data to appropriately reduce the influence of

initial technical estimates of usage for parts which had been in the system long enough to have a sufficient demand development period.

Therefore, we recommend that DOD direct the Navy to either (1) eliminate the influence of initial technical estimates in updating submarine repair parts replacement rates after a 2-year demand development period or (2) apply a 60 to 80 percent weight to the last 2 years' usage data when the rates are updated less frequently than yearly.

DOD did not comment on our proposal that the Navy insure that updated 90-day repair parts allowances for overhauled submarine tenders not include parts with no usage by supported submarines for the past 2 years. Or, if such parts were stocked, they should be restricted to only insurance quantities. However, DOD subsequently informed us that the Navy concurred with the objective of this proposal. Furthermore, the Navy's Fleet Material Support Office had begun a study of our recommendation together with other alternatives to identify the optimum policy for stocking items that had no usage. Also, we were informed that further action would not be taken on our proposal until the results of the study are published.

Any positive action by the Navy to reduce stocking of no demand items on its tenders is, in our opinion, a positive step. We plan to evaluate the effectiveness of the actions the Navy takes after publication of the study results.

CHAPTER 3

MORE STRINGENT POLICIES NEEDED FOR ESTABLISHING DEMAND-BASED STOCK LEVELS

The Navy can reduce future investments in demand-based stocks for submarines and their supporting tenders by an estimated $59.4 million to $72.7 million. This can be done without impairing submarine mission readiness by (1) adopting more stringent criteria for establishing demand-based stock levels and (2) limiting demand-based stockage to quantities which, in conjunction with initial inventory allowances, will sustain operations between resupply intervals.

NEED FOR MORE STRINGENT STOCKING CRITERION

Submarines and supporting tenders initially or at overhaul receive inventory allowances determined as needed to support 90 days of operation. The additional range and depth of items to be stocked for continuous operations is governed by fleet-wide policy applicable to all ships.

According to this policy, an item qualifies for initial 1/ or additional stocking when two recurring demands are received at any time within a 6-month period. Once an item qualifies for initial or increased stocking, it must have at least one recurring demand every 6 months to warrant continued stocking. This is referred to as the 2/6-1/6 frequency of demand criterion. If this degree of repetitive demand doesn't occur, the item should be dropped from stock and redistributed or disposed of.

Fleet reports indicated that the 2/6-1/6 criterion was causing frequent and substantial stock excessing actions. This prompted the Navy's Fleet Material Support Office to study alternative stocking criteria for the fleet. The study was to evaluate various alternatives and recommend criteria that would produce the best results in terms of tradeoff between investment, requisition fill effectiveness,

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1/Item not included in initial 90-day allowance stocks because it did not meet initial allowance criteria of having a 25 percent chance of one fleet-wide equipment part failure in a 1-year period. (See footnote b, page 10; and page 6 for criteria and method of determining initial allowance stocks.)

and stock excessing actions. The study results were published in September 1974.

Results of 1974 Navy study of alternative shipboard stocking criteria

A selection of five ships, including one nuclear attack submarine, was considered representative of the fleet for this study. To simulate the supply actions under 11 alternative stocking criteria, a computer model was developed. The prior 2 years' historical demand data for each of the five ships and their current stock of items were used in the simulation.

The Fleet Material Support Office concluded that a 2/6-2/12 months of demand criterion (recurring demands in 2 separate months over a 6-month period to qualify an item for stocking and thereafter recurring demands in 2 separate months over a 12-month period to retain stock) would achieve the best results. For example, the study pointed out that changing the item stock qualification and retention criterion from 2/6-1/6 to 2/6-2/12 would reduce inventory investments $281,000 for the five ships. It would also reduce stock excesses by 57 percent and decrease requisition fill effectiveness by an average of only 2 percent.

The Navy, however, did not change its fleet-wide stocking criteria based on this study. The primary reason was that fleet commanders felt that varying the stocking criteria for stock-funded items was their responsibility since they controlled the funds for purchasing these items. Also, they felt that any decrease in requisition fill effectiveness would have an adverse impact on submarine mission readiness.

Impact on appropriation-funded stocks not highlighted by 1974 study

In highlighting the results of the 1974 study for fleet acceptance, the Material Support Office emphasized the effect alternative stocking criteria would have on shipboard stocking of the relatively inexpensive stock-funded items. Results for the more expensive appropriation-funded items were shown only on the back of the report in tabular form and without comment. The Material Support Office explained that the results for appropriation-funded items were not highlighted in the report because they represented only a small percentage of the total items stocked aboard ships.

These items represent only a small percentage of the total items; however, they also represent the largest percentage of the total dollar investment in shipboard inventories. Had the study highlighted the large dollar reductions associated with appropriation-funded inventories, the results might have been more acceptable to the Navy. This especially appears reasonable since these inventories were bought out of appropriated funds and issued free to the fleet. For example, for the nuclear attack submarine, the study highlighted a reduction in stock-funded inventory investment of only $13,000 by changing to a 2/6-2/12 months of demand stock qualification/retention criterion. It did not emphasize that this change would have resulted in a $536,000 reduction in appropriation-funded inventories without any decrease in requisition fill effectiveness.

Submarines and tenders continue to have many excesses under fleet-wide stocking criteria

For each of the past 3 years, submarine tenders have offloaded an average of $24 million in stocks as excess. These stocks are returned to the supply system for redistribution or disposal. These yearly excesses represented 51 percent of the average annual investment in demand-based stocks (stocks obtained on the basis of the 2/6-1/6 frequency of demand criterion).

The fleet-wide stocking criterion used by submarines and tenders results in constant fluctuations of large volumes of items which have qualified for stocking in one 6-month period being eliminated in the next or subsequent 6-month period because of a lack of repetitive demands. For example, during a recent 1-year period, a Pacific fleet tender had 4,000, or 49 percent, of its previously established demand-based items dropped from stock because of a lack of repetitive demand. Furthermore, 25 percent of 510 demand-based items dropped by an Atlantic fleet tender during a 2-month period had been added as demand-based stocks only 6 months earlier.

Moreover, during one quarterly period, 67 Atlantic fleet submarines reported 32 percent of their previously established demand-based stocks as excess. During this same quarterly period, 10 submarines had more than 50 percent of the demand-based stocks as excess. For example, one submarine had 237, or 75 percent, of its previously established demand-based stocks as excess.

On the basis of the above observations and since the 1974 study of alternative stocking criteria did not include fleet ballistic submarines or submarine tenders, we requested the Navy to perform a computerized study of alternative stocking criteria for fleet ballistic submarines and submarine tenders.

Results of 1976 GAO-requested study of alternative stocking criteria for submarines and tenders

This study was also performed using a computerized simulation model. The past 2 years' actual demands were processed against the current demand-based inventories of selected submarines and tenders under 11 alternative stocking criteria. The results indicated that a 2/6-2/12 stock qualification and retention criterion produced the most favorable results in terms of tradeoff between inventory investment, stock excessing actions, and requisition fill effectiveness.

The study also showed that tenders could reduce their yearly stock excesses by 66 percent with a 1- to 2-percent decrease in requisition fill effectiveness by changing to a 2/6-2/12 stocking criterion. We estimate that submarine tenders could reduce yearly stock excesses by $15.8 million if the Navy adopted this criterion.

Using the 2/6-2/12 stocking criterion for a fleet ballistic missile submarine, the study showed (1) a reduction of $197,047 to $520,164 in future inventory investments over a 2-year period, (2) a 67 percent decrease in yearly stock excesses, and (3) a 1- to 3-percent decrease in requisition fill effectiveness. In arriving at the larger inventory reduction figure of $520,164, similar to the $549,000 reduction for a nuclear attack submarine shown in the 1974 study (see p. 17), a 45-day order-ship time factor was used in computing demand-based stock levels as was done for the nuclear attack submarine.

In computing the lower inventory reduction of $197,047, the 45-day factor was eliminated on the advice of higher command. The advice was based on the assumption that the Navy's policy excludes order-ship time as a factor in computing demand-based stock levels for fleet ballistic missile submarines. However, this exclusion applies only to items that can be readily obtained from tenders. Further, as pointed out on page 30, we found that fleet ballistic missile submarines used order-ship times of up to 60 days to compute demand-based stock levels even though the items were obtainable from their supporting tenders.

On the basis of the above study as well as the earlier one, we estimate that future inventory investments can be reduced from $43.6 million (65 nuclear attack submarines x $0.549m; 41 fleet ballistic missile submarines x $0.197m) to $56.9 million (65 nuclear attack submarines x $0.549m; 41 fleet ballistic missiles x $0.520m) for the Navy's nuclear submarines. This reduction can be achieved by changing from a 2/6-1/6 to a 2/6-2/12 stocking criterion for demand-based stocks.

According to Navy studies, this change in stocking criteria would decrease requisition fill effectiveness for nuclear attack and fleet ballistic submarines from 1 to 3 percent. As discussed below, we believe this decrease is overstated and would not have an impact on mission readiness.

Decrease in fill effectiveness overstated and has no impact on readiness

Gross requisition fill effectiveness is a measure of the ability to carry a sufficient range of items to fill recurring demand requisitions of supported units. Only recurring demands are supposed to be considered in measuring requisition fill effectiveness. As shown on page 24, 10 to 20 percent of submarine requisitions are coded incorrectly as recurring. This results in an understatement of requisition fill effectiveness.

Moreover, the study methodology assumed a zero balance status of beginning inventories on board the selected submarines and tenders. Therefore, no stocks were available to fill requisitions until sufficient recurring demands occurred to warrant stocking. Since the gross requisition fill effectiveness is a measure of the ability to stock and fill requisitions for repeatedly demanded items, this condition seemingly lowered the effectiveness rate.

In fact, however, most items used in the study, including all mission-essential items, were provided in initial inventory allowances in sufficient quantities to sustain operations for at least 90 days. These initial inventories would be used to fill requisitions until the items qualified for increased stocking. Therefore, although the study showed substantial numbers of requisitions not filled, thus causing a decrease in the fill effectiveness rate, in an actual situation, the majority of requisitions should have been filled from the initial inventory allowances.

Finally, fast-moving, low-cost items, known as SUBMART items, accounted for about 40 percent of the requisitions aboard submarines. Under real conditions, requisitions for SUBMART items not in stock are not counted against fill effectiveness rates. The fill effectiveness rate for SUBMART items is assumed to be 100 percent. However, in the study, SUBMART requisitions were counted. This caused a decrease in fill effectiveness if they were not filled. Although the Navy's rationale for not considering out-of-stock SUBMART items in determining requisition fill effectiveness under actual circumstances might be questionable, we feel that the study should have simulated actual conditions and excluded them from the computation of fill effectiveness.

NEED TO RESTRICT DEMAND-BASED INCREASES IN STOCK LEVELS

Submarine tenders were increasing their initial 90-day stock levels by 2 to 18 months' supply, even though the initial allowances represented as much as 703 months' supply when reevaluated on the basis of current demand experience. In some cases, these increases became excess because of a lack of repetitive demand. Examples are shown below.

Item stock number	Unit price	Actual monthly demand	Initial inventory allowance	Demand-based increase	Months of supply represented by initial allowance	Months represented by demand-based increase	Excessing of demand-based increase
4240-268-9732	$ 21.50	0.32	225	1	703	3	
5999-547-5330	.31	.91	108	13	118	14	
6665-460-7704	109.00	32	26	6	81	18	
4755-854-6105	468.00	.14	6	1	42	7	
2774-657-4710	2.48	1.83	46	13	25	7	
8415-782-2808 (note a)	3.17	10.92	200	27	18	2	27

a/Demand-based increased quantity became excess when no recurring demands were received during a subsequent 6-month period.

Initial 90-day inventory allowances provided to tenders are computed on the basis of past historical demands or initial technical estimates of expected usage. These initial inventory allowances are considered part of the Navy's war reserves, and the tenders are required to maintain these fixed levels of inventory throughout the 4-year interval between supply overhauls, regardless of changes in actual usage.

In addition to the initial 90-day inventory allowances, submarine tenders are required to establish and maintain

sufficient stock levels (generally from 2.5 to 15 months of supply, depending on the item's unit price) to sustain operations between resupply intervals. These levels are to be established based on current demand experience.

Submarine tenders could realize substantial savings without impairing supply effectiveness by applying initial inventory allowances in excess of those needed to maintain a 90-day war reserve, when reevaluated on the basis of current demand experience, to the order-ship time and operating stocks needed to support operations between resupply intervals.

The tenders already can determine the quantities in excess of the 90-day war reserve that can be applied to current demand-based stock levels. They have automated programs for calculating and monitoring current monthly demands for each item. When an item qualifies for the current demand-based stock levels, an average 12 months' demand factor is calculated. This factor is used to determine current demand-based stock levels. At that time, the quantity in excess of the 90-day war reserve requirement could be determined and applied to the current demand-based stock levels.

AGENCY COMMENTS, OUR EVALUATION, AND RECOMMENDATIONS

DOD did not agree with our proposal that the Navy change the demand-frequency criterion from two recurring demands in 6 months to qualify and one recurring demand every 6 months thereafter to retain, to two recurring demands in separate months over a 6-month period to qualify and two recurring demands in separate months every 12 months thereafter to retain. (See app. I.) The Navy believes its current policy for establishing and retaining demand-based items is critical in providing effective levels of supply support for major weapon systems.

DOD could not provide us with data either supporting this belief or refuting our finding that a slightly more stringent stocking criterion would substantially reduce excess investments in inventories without impairing the operational readiness of the Navy's submarines.

DOD informed us that, although not mentioned in its reply, the Navy had agreed with the intent of our proposal. Also, the Navy intends to perform additional studies of actual demands experienced by submarines and tenders to determine an optimum stocking criterion which will reduce excess inventory investment while maintaining current levels of supply effectiveness.

We do not see the need for further Navy studies to establish the optimum demand-based stocking criteria for submarines and their supporting tenders. Two prior Navy studies using computer simulation of prior demands experienced over a 2-year period by selected submarines and tenders under 11 alternative stocking criteria have been conducted. The results of both showed that the optimum stocking criterion was two recurring demands in separate months over a 6-month period to add an item and two recurring demands in separate months every 12 months thereafter to retain it. We believe additional simulation studies of actual demand data to establish the optimum stocking criteria for submarines and tenders would be duplicative, unnecessary, and uneconomical.

Therefore, we recommend that DOD direct the Navy to (1) immediately require all CONUS-based submarine tenders to adopt a more stringent demand-frequency criterion to add and retain items for demand-based stock levels--namely, two recurring demands in separate months over a 6-month period to establish and two recurring demands in separate months every 12 months thereafter to retain and (2) require a sample number of deployed submarines and tenders to test the 2/6-2/12 demand frequency criterion for 1 year and measure the impact on inventory investment and requisition fill effectiveness.

DOD agreed with the intent of our proposal that Navy policy be revised so that submarine tenders limit demand-based increases in stock levels to quantities needed to sustain current operations after considering initial allowance stocks in excess of the 90-day requirement when reevaluated on the basis of current demand experience. However, DOD said no policy change is necessary to comply with our proposal.

We do not agree that a policy change is unnecessary. DOD is under the impression that tenders limit their stock levels to the higher of the initial 90-day allowance or quantities needed to meet current demand experience. This is not the case. As shown by a number of examples on page 20, submarine tender stock levels for initial allowance items were increased when the items achieved demand-based status even though the initial allowances exceeded 90 days' supply by several months or years based on current demands.

The above condition occurred because Navy policy requires tenders to maintain sufficient stocks to meet expected current needs without impairing the initially allowed 90 days' supply. We would consider this a reasonable policy if it also provided for periodic revision of initial 90-day allowance stocks to reflect current demand experience and

application of excesses revealed by such revisions to the additional quantities needed to sustain current operations.

Accordingly, we recommend that DOD direct the Navy to change its policy so that submarine tenders will limit demand-based increases in stock levels to quantities needed to sustain current operations after considering initial allowance stocks in excess of the 90-day requirement when reevaluated based on current demand experience.

CHAPTER 4

NEED FOR MORE ACCURATE AND REALISTIC DATA IN DETERMINING SIZE OF DEMAND-BASED STOCK LEVELS

Submarines and tenders could save an estimated $7.1 million on future investments in demand-based stocks without compromising supply effectiveness. This can be done by improving the accuracy of recorded demand data and by using more realistic safety level and order-ship time factors in computing requirements.

NEED TO IMPROVE ACCURACY OF DEMAND DATA

Submarine tenders overrequisition an estimated $2 million of demand-based stocks yearly because they use inaccurate demand data to compute requirements. This condition exists because of (1) incorrect demand coding of requisitions, (2) recording of erroneous demand quantities, and (3) recording duplicate demands.

Incorrect demand coding of requisitions

Requisitions received by tenders should show whether the need is recurring or nonrecurring. Requisitions to replenish demand-based stock levels should be coded "recurring." Requisitions to fill a one-time requirement, such as deficiencies in submarines' initial allowance of equipment repair parts, are supposed to be coded "nonrecurring." Since tender stock levels are based on the recurring demands, it is essential that requisitions be coded to show whether the demand is recurring or nonrecurring. Coding of nonrecurring demands as recurring inflates stock requirements and results in unneeded stock purchases and eventual excessing.

Submarine requisitions for items needed to fill one-time or nonrecurring stock requirements in initial inventory allowances were often routinely coded recurring or were not coded. Requisitions not coded as to type of demand are treated as recurring demands by the tenders. Our test of 1,557 requisitions to fill nonrecurring initial allowance shortages disclosed that 87 percent were incorrectly coded as recurring or were not coded. These requisitions represented from 10 to 20 percent of the requisitions received by three tenders during test periods. Incorrect demand coding of the tested requisitions was caused by inadequate supply discipline, use of requisitions with preprinted recurring demand codes, and a general lack of understanding of the importance of proper demand coding by submarine supply personnel.

The following examples show the impact of improper demand coding on tender stock requirements.

Translator (stock number 5820-168-9560)

Submarine supply personnel incorrectly assigned a recurring demand code to a requisition for stock needed to fill intitial allowance shortages. The tender's recording of the requisitioned quantity as a recurring demand caused a change in the average monthly demand factor used by the tender in computing requirements. As a result, the tender's stock requirements were increased unnecessarily by two units, costing $3,760.

Frequency standard equipment (stock number 6625-160-0623)

The tender recorded two recurring demands for this item in a 6-month period, qualifying it for demand-based stockage. However, one of the recorded recurring demands was for stock to fill initial allowance shortages. As a result of the incorrect demand coding, the tender ordered two units of this item, costing $800, which were excess to its needs.

Recording of erroneous demand quantities

The automated supply programs on tenders provide a means for detecting abnormal changes in item demand patterns. Tenders can set these programs to detect changes varying from 300 to 600 percent in average monthly demands. Items which experience this great a change are printed out on a monthly demand trend list which also shows 24 months' demand data. Items on this list are to be investigated by tender supply personnel to determine the causes of demand changes and whether they are justified. If not, appropriate adjustments are to be made in demand histories and stock levels so that unnecessary stock ordering is prevented.

As illustrated below, supply personnel of the tenders were not effectively using the demand trend program to detect and correct erroneous demands.

Fibrous rope (stock number 4020-234-6763)

A CONUS-based Atlantic Fleet tender recorded demands totaling 2,006 units for this item in March 1975. For the prior 23 months, the demand history had not exceeded 14 units in any month. This item appeared on the monthly demand trend

list. However, no investigation was made and 535 units, costing $5,200, were ordered to meet the increased monthly demands. This order could have been avoided had supply personnel investigated the cause for the over 14,000 percent increase in demands. We found that the 2,006 units were recorded inadvertently due to a keypunch error. It should have been recorded as six units.

Packing material (stock number 5330-171-9984)

A deployed Pacific Fleet tender's monthly demand trend list showed an average monthly demand increase of about 6,000 percent for this item, from 8 to 486 units. No investigation was made. Had one been made, an order for 3,252 units to meet the increased demand could have been avoided. Our investigation revealed that the large demand increase was due to keypunch errors.

Recording duplicate demand

In numerous instances, tenders were recording duplicate recurring demands for requisitions which could only be partially filled from stock on hand. One recurring demand was recorded when the initial partial issue was made and another was recorded when the remainder was issued. This could have been prevented if the tenders had observed recommended supply procedures. In such cases, a demand exclusion code should be assigned to partially filled requisitions. This prevents the recording of a duplicate demand when the balance of a partially filled requisition was satisfied.

This duplicate recording of demands caused unnecessary increases in stock levels and related purchases as shown below.

Receptacle (stock number 5325-505-4798)

A CONUS-based Atlantic Fleet tender established a demand-based stock level of 207 units for this item on the basis of two recurring demands in 1 month. However, the two recurring demands were related to one requisition. One demand was recorded when the requisition was partially filled from stock on hand. The other demand was recorded when the remaining quantity was issued. As a result of this duplicate demand recording, the tender ordered 207 excess units of this item.

ECONOMIC ADVANTAGE OF USING MORE REALISTIC SAFETY LEVEL FACTOR

Submarine tenders could save an estimated $2.1 million on future inventory investments by using more realistic safety level factors in computing requirements.

During resupply intervals, tenders are required to have sufficient stocks on hand to provide continuous supply support to submarines. To insure this support, a safety level factor is used in computing requirements. This level is to provide support in the event of interruption of normal resupply time or unpredictable increases in demand.

The Office of the Chief of Naval Operations issued policy guidance which directed submarine tenders to use a 60-day safety level factor. This guidance also permitted use of a lower safety level factor if it would result in economic advantages without having an adverse impact on supply effectiveness.

Tender safety level stocks operate as follows to insure uninterrupted supply support in event of contingencies. Assuming that the normal supply situation involves a 60-day safety level, a 30-day order-ship time (interval between ordering and receiving stock), a 30-day operating level (stock on hand to sustain operations during resupply cycle), and an average monthly demand of 10 units. Further, assuming a contingency involving a 100-percent increase in order-ship time after placing a supply replenishment order.

	Normal situation		Contingency situation	
	Days	Qty.	Days	Qty.
Requisition objective (Max. stocks authorized. Safety level + order-ship time + operating level x average mo. demand)	120	40	120	40
Reorder point (safety level + order-ship time)	90	30	90	30
Order-ship time stock issues (normal 30-day cycle, 60-day contingency cycle)	-30	-10	-60	-20
Safety level stocks (minimum stocks on hand during resupply cycle)	60	20	30	10

In the above example, the 60-day safety level stocks permitted a 100-percent increase in order-ship time and still provided a minimum of 30 days stock on hand to sustain operations at any point during the resupply interval.

The Submarine Forces, Atlantic Fleet, suggested that its tenders use a variable safety level factor ranging from 45 to 60 days. However, the Submarine Forces, Pacific Fleet, issued guidance to its tenders which defined safety level as a 90-day demand quantity.

The two CONUS-based Atlantic Fleet tenders we reviewed were using a 30-day safety level in computing requirements. They were able to achieve the necessary degree of supply effectiveness because their supply sources were nearby. By contrast, the CONUS-based Pacific Fleet tender we reviewed was using a 90-day safety level factor despite the fact that (1) it was also close to its supply source and (2) the vast majority of its stock replenishment orders were being filled within 20 days although it used a 60-day order-ship time factor in requirement computations. (See pp. 29 and 30.)

Moreover, the three Pacific Fleet tenders were using the 90-day safety level factor even though a 1974 Navy study showed their safety level stocks could be reduced to 60 days without impairing supply effectiveness. Had this reduction been made, these tenders could reduce future inventory investments by a combined total of $1.1 million in 1 year.

After we brought the above observations to the attention of the Submarine Forces, Pacific Fleet, that command issued new policy guidance directing the two CONUS-based tenders to reduce their safety level factor to 60 days. As a result, they will be able to save $294,000 in future inventory investments over 1 year. Also, the Navy's Fleet Material Support Office was directed to perform a computerized study of the feasibility of reducing safety level stocks from 90 to 60 days for the deployed Pacific Fleet tender. This study was completed in November 1975. It showed that, by reducing its safety level to 60 days, the deployed tender could reduce future inventory investments by $945,500 in a year without impairing supply effectiveness.

The Atlantic Fleet deployed tender we reviewed was also using a 90-day safety level factor in computing requirements. Since its supply operations approximated that of the deployed Pacific Fleet tender, we estimate that a 30-day reduction in its safety level stocks would likewise result in savings of approximately $945,500. At the completion of our review,

no decision had been made concerning a reduction in the 90-day safety level stocks carried by these deployed tenders.

ECONOMY OF USING MORE REALISTIC ORDER-SHIP TIME FACTOR

Submarines and their supporting tenders could realize a one-time savings of about $3 million over a 1-year period by using more realistic order-ship time factors in computing requirements. Order-ship time is the interval between ordering and receiving stocks.

The Chief of Naval Operations policy guidance and the submarine commands prescribe order-ship times of 30 and 60 days, respectively, for use by CONUS-based and deployed tenders if actual order-ship time is unknown. However, actual order-ship time is to be used if it is known. Submarines are not authorized to use order-ship time in computing requirements for items that can be readily obtained from supporting tenders.

Three of the five tenders we reviewed were using the standard prescribed order-ship times in computing requirements. The other two tenders were using order-ship times that were higher than the prescribed standards.

These tenders had standard automated programs for monitoring actual order-ship times and making adjustments as often as necessary. However, they had not used these programs for periods of from 1 to 2 years. The primary reason given was that tender supply officials did not believe it was necessary to adjust order-ship time as long as the tenders were experiencing satisfactory supply effectiveness rates.

Had the order-ship time programs been regularly used as intended, three of the five tenders could have reduced their order-ship time factors by 15 to 30 days. This would have resulted in estimated savings of $380,477 in future inventory investments.

For example, the CONUS-based Pacific Fleet tender we reviewed was using a 60-day order-ship time in computing requirements for Defense Supply Agency (DSA) and General Services Administration (GSA) managed items. At our request, a computerized order-ship time report was produced for a 3-month period. It showed that 75 percent of the tender's 6,802 requisitions for DSA and GSA stocks were filled within 40 days. Furthermore, this tender received the majority of its DSA and GSA stocks from two west coast Navy supply centers.

Our analysis of 960 receipts from these supply centers revealed that most were filled within 20 days. Accordingly, we feel that a reduction of 20 days in this tender's order-ship time factor for DSA and GSA stocks is justified. Such a reduction would result in estimated savings of about $132,000 in inventory investment.

A CONUS-based Atlantic Fleet tender located within a mile of its primary supply source was using a 45-day order-ship time factor. Another computerized order-ship time report produced at our request showed that about 70 percent of the 7,990 requisitions submitted by this tender over a 3-month period were filled within 30 days. Subsequently, this tender's order-ship time was reduced from 45 to 30 days. This resulted in estimated savings of $55,000 in future inventory investments over a 1-year period.

Five of the seven submarines we reviewed were using order-ship times ranging from 30 to 60 days, even though needed stocks could be readily obtained from supporting tenders. As previously mentioned, Navy policy does not authorize use of order-ship time by submarines in computing requirements for stocks readily obtainable from tenders.

For example, a deployed Pacific Fleet ballistic missile submarine was using a 60-day order-ship time. Our analysis of the 1,326 requisitions submitted by this submarine to its supporting tender during a 1-month resupply cycle revealed an average fill time of 7 days. As a result of our work, this submarine reduced its order-ship time by 30 days. This saved an estimated $35,000 in future inventory investments.

We estimate that 75 submarines are using unjustified and unauthorized order-ship times of 30 or more days. Elimination of the use of these order-ship times could obtain estimated savings of $2.6 million in inventory investments over a 1-year period.

AGENCY COMMENTS AND OUR EVALUATION

DOD agreed with us and said the Navy had acted on our proposal to instruct its submarine and tender supply personnel on the fundamentals and importance of distinguishing and accurately recording the recurring or nonrecurring nature of requirements. (See app. I.)

The action taken by the Navy, if properly pursued, should reduce excess investment in submarine support inventories. We intend to evaluate the effectiveness of action taken in future supply management reviews.

DOD did not comment on our proposals that tender supply personnel be directed to (1) promptly investigate and resolve the cause and justification for unusually large increases in stock monthly demand patterns, (2) use the existing means of preventing duplicate demand recording for requisitions involving partial issues, (3) restrict safety level stocks to a maximum of 60 days supply and that a study be made to determine the feasibility of further reducing safety level stocks for CONUS-based tenders, and (4) use their automated programs for monitoring actual order-ship time experience and making appropriate adjustments to the order-ship time used in computing requirements at least quarterly. Also, DOD did not comment on our proposal that submarine personnel be directed to eliminate from their requirement computations order-ship time for items readily obtainable from supporting tenders.

DOD subsequently informed us that the Navy agreed with these proposals and had taken or was in the process of taking the necessary corrective actions. We believe that if the Navy effectively implements these actions, an estimated one-time savings of $5.1 million in inventory investment can be realized.

CHAPTER 5

IMPROVEMENTS NEEDED IN POLICIES AND PRACTICES FOR CANCELING AND REDISTRIBUTING STOCK EXCESSES

Submarine tenders could increase their cancellations of excess stock on order and redistributions of excess stock on hand by millions of dollars annually through improved policies and practices.

CANCELING EXCESS STOCKS ON ORDER

Excess material on order for the 11 tenders averages $3.7 million per quarter. The five tenders we reviewed had canceled only about 10 percent of their onorder excesses. The primary cause of the tender onorder excesses was erratic demands from submarines coupled with an overly lenient stocking criteria. (See pp. 17 and 18.)

The Submarine Forces, Pacific Fleet, established a goal for its submarine tenders which limited the value of excess onorder to 5 percent of the total value of materiel on order. This appears to be a reasonably obtainable goal. The Submarine Forces, Atlantic Fleet, established, on the other hand, a goal which limits the value of onorder excesses to 2 percent of the total value of the tender's authorized inventories. We feel this is too permissive and does not provide the necessary incentive to reduce excess onorder stock to a minimum.

The percentage relationship of excess materiel onorder to total materiel onorder for one quarter at the time of our review is shown below for the five tenders we reviewed.

	Total materiel onorder	Excess onorder	Percentage of excess onorder to Materiel onorder	Percentage of excess onorder to Total authorized inventory
Atlantic Fleet:				
U.S.S. Bunley	$1,990,756	$324,103	16.3	3.2
U.S.S. Spear	617,863	59,780	9.7	2.4
U.S.S. Simon Lake	3,791,274	346,495	9.1	2.5
Pacific Fleet:				
U.S.S. Dixon	1,257,200	273,100	21.7	5.6
U.S.S. Proteus	2,163,600	141,700	6.6	1.1

There was no standard program which allowed tenders to cancel all excess materiel onorder. The U.S.S. L. Y. Spear supply personnel researched for possible cancellation of the excess onorder items when the total value of excess onorder exceeded $25,000. Then, items with excess onorder values over $250 were manually researched for possible cancellation. Excess materiel on order as of April 19, 1975, for 307 items totaled about $60,000. Thirty-five items with excesses onorder valued at over $250 were selected for research. Cancellation was subsequently requested for excess onorder stocks totaling $27,545. On 14 items with excesses onorder totaling about $20,000, the authorized limit was erroneously raised to prevent cancellation action.

The U.S.S. Proteus supply personnel researched for possible cancellation of those items which had excesses onorder valued at $500 or more. As of September 3, 1975, excesses onorder were reported at $188,235. Although 66 items totaling $122,000 were identified with values of $500 or more, only 9 with onorder excesses valued at $9,857 were identified for possible cancellation.

The U.S.S. Dixon and Hunley had combined excesses onorder averaging about $600,000 each quarter. However, their personnel were not identifying or canceling any excesses because of alleged unsuccessful prior attempts.

In contrast to the other tenders reviewed, in 1975 the U.S.S. Simon Lake began a program to automatically identify and cancel all excesses onorder. As a result, quarterly excess onorder--once exceeding over $1 million--had been reduced to approximately $340,000, or about 66 percent.

REDISTRIBUTING ONHAND STOCK EXCESSES

Submarine tenders are required to identify and offload onhand excesses on a monthly basis. These items are to be returned to the supply system for redistribution or disposal. However, the 11 submarine tenders are indefinitely retaining an average of $10.5 million worth of onhand excesses.

Our tests showed that the Navy supply system had purchase or repair requirements for 53 percent of the excess items not offloaded by the five tenders we reviewed. The causes for not offloading onhand excesses include (1) lack of a standard program for identifying and redistributing excesses, (2) assumed but unsupported future needs, and (3) workload constraints.

In March 1975 the U.S.S. L. Y. Spear identified excess materiel totaling $178,000 subject to offload. Materiel totaling $61,500 for 109 items was not offloaded; the remainder was offloaded. The primary reasons given for retention were anticipated future usage and workload constraints. Our tests of 60 excess items not offloaded revealed that 25 percent had no usage aboard the ship in the past 24 months.

The U.S.S. Dixon used various dollar criteria to determine which excesses would be offloaded. At the time of our review, the past 3 monthly offloads were based on excessing items with extended values over $1,000, $750, and $500, respectively. Our review of the August 1975 offload disclosed that 268 line items, with excesses equaling or exceeding $500 per line item, were identified for offload. Of those identified, 97 items valued at $205,000 were not offloaded. A tender official said that anticipated future needs and workload constraints were the primary reasons for retention. Twenty of 47 items we tested had no demands in 2 years. In one instance, a line item with excess on hand totaling $14,200 represented a 178-year supply. Excess quantities on hand valued at $1,800 for a second item would last 179 years.

In February 1975 the U.S.S. Simon Lake implemented a new offload analysis program, designed to greatly reduce excesses onhand with the least personnel effort. The program stratified excesses by money value and line items within fixed dollar parameters as shown below.

Items with selected excess value of at least	Total items selected	Total excess value involved
$150	421	$254,928
200	296	232,963
300	167	202,057

The extended money value of $300 or more was selected by the tender as the best return for the effort. Excess on hand decreased from a high of $1.6 million in December 1974 to a low of $540,000 in February 1975. This indicated the program was successful.

As a result of our 1973 report to the Congress on Navy shipboard inventory management, all ships with automated capabilities, including submarine tenders, are now reporting their excess stocks quarterly to the wholesale system inventory managers. In turn, the inventory managers are reducing their procurement budgets for items for which shipboard excesses have been reported in anticipating these excesses

being promptly returned to the supply system. Such reductions to fiscal years 1976 and 1977 budgets totaled $4.3 million.

Since Navy wholesale system inventory managers are reducing procurement budgets for purchase of ship parts in anticipation of reported shipboard excesses being promptly returned to the supply system, it is essential that submarine tenders promptly identify and return all excesses to the supply system or at least return those excesses needed to satisfy supply system requirements.

AGENCY COMMENTS AND OUR EVALUATION

DOD agreed in principle with our proposals that (1) submarine tenders use their automated capabilities to identify all onorder excesses monthly or more frequently and promptly initiate cancellation action, (2) Atlantic and Pacific Fleet submarine commands adopt a standard goal for their tenders limiting the value of onorder excesses to no more than 5 percent of the total value of materiel on order, and (3) submarine tenders adopt standard excess analysis programs which permit maximum offloading of excesses with minimum personnel. (See app. I.)

DOD stated that submarine tenders are now pursuing an active program to cancel onorder excesses. Furthermore, in May 1976 submarine tenders had approximately $2.2 million excess materiel onorder which represents a reduction of a $1.5 million in the average onorder excesses at the time of our review. DOD also stated that the Navy will establish a standard goal to be used by both fleets which will limit the amount of onorder excesses. DOD further commented that the Navy recognizes the need for a uniform program to offload excesses of submarine tenders and that continued monitoring of offloading excesses and canceling onorder excesses will be pursued and specifically addressed during annual command shipboard supply inspections. DOD also provided statistics which evidenced the progress made by submarine tenders in offloading excess inventories. Since our review, the onboard excess inventories of submarine tenders had been reduced by $6.3 million.

CHAPTER 6

SCOPE OF REVIEW

We examined the Navy's submarine supply support system. We reviewed Navy policies, procedures, and practices in providing initial supply support and subsequent maintenance and replenishment of inventories for submarines and submarine tenders. We tested the procedures and practices at selected activities to the extent we deemed appropriate. Also, we observed supply practices aboard five tenders and five submarines. Our fieldwork included:

Naval Operating Commands:
- Commander, Submarine Force, Atlantic, Norfolk, Virginia
- Commander, Submarine Force, Pacific, Pearl Harbor, Hawaii
- Commander, Surface Force, Atlantic, Norfolk, Virginia

Supply Activities:
- Naval Supply Center, Charleston, South Carolina
- Naval Supply Center, San Diego, California
- Naval Supply Center, Pearl Harbor, Hawaii
- Navy Submarine Base, Pearl Harbor, Hawaii
- Polaris Material Office, Atlantic Fleet, Charleston, South Carolina

Inventory Control Activities:
- Navy Fleet Material Support Office, Mechanicsburg, Pennsylvania
- Ships Parts Control Center, Mechanicsburg, Pennsylvania

Ships:
- U.S.S. L. Y. Spear, Norfolk, Virginia
- U.S.S. Hunley, Charleston, South Carolina
- U.S.S. Simon Lake, Rota, Spain
- U.S.S. Dixon, San Diego, California
- U.S.S. Proteus, Guam, Marianas Islands
- U.S.S. Lapon, Norfolk, Virginia
- U.S.S. Lewis and Clark, Charleston, South Carolina
- U.S.S. George Bancroft, Rota, Spain
- U.S.S. Patrick Henry, Guam, Marianas Islands
- U.S.S. Drum, San Diego, California

Contractor's Plant:
- Sperry Rand Corporation, Great Neck, New York

We held several meetings and discussions with Washington officials from the Office of Chief of Naval Operations, Naval Sea Systems Command, Strategic Ships Project Office, and Naval Supply Systems Command to clarify and attempt to resolve issues raised during our review.

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

SR
INSTALLATIONS AND LOGISTICS

February 1, 1977

Mr. Fred J. Shafer
Director, Logistics &
Communications Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Shafer:

This is in reply to your letter of August 25, 1976 to Secretary Rumsfeld forwarding copies of your Draft Report entitled "Submarine Supply Support Costs Can Be Substantially Reduced Without Impairing Readiness" (OSD Case #4436).

Comments on the recommendations contained in the report are enclosed. We appreciate the opportunity to comment on this Report in draft form.

Sincerely,

David R. BABIONE
Acting Principal Deputy Assistant
Secretary of Defense (I&L)

Enclosure
As stated

DEPARTMENT OF DEFENSE COMMENTS
ON
GAO DRAFT REPORT
DATED AUGUST 25, 1976

SUBMARINE SUPPLY SUPPORT COSTS CAN BE DRASTICALLY REDUCED WITHOUT IMPAIRING READINESS

(OSD Case #4436)

GAO Recommendation: Take the necessary actions to insure that fleet-wide equipment part Best Replacement Factors (BRFs) be updated yearly on the basis of the most recent annual fleet usage, or if done less frequently than yearly, all intervening fleet usage data be considered in updating annual usage factors for equipment parts.

Comment: Concur. The recommendation to update BRFs yearly was implemented April 7, 1976. BRFs were recomputed in January 1976; the next scheduled BRF update will be January 1977.

GAO Recommendation: Apply a 60 to 80 percent exponential smoothing weight to the latest annual usage factors in arriving at updated fleet-wide BRFs rates in those instances when the BRFs are updated on a less than yearly frequency.

Comment: Nonconcur. It is well known that demand patterns within the Department of Defense (DoD) form peaks and valleys. Although further review will be made by the Navy, other studies within the DoD have indicated that a strong reliance on most recent demand is generally not cost-effective.

GAO Recommendation: Change the demand-frequency criteria used by submarines and tenders to establish and retain demand-based stock levels from 2 recurring demands in 6 months to qualify and 1 recurring demand every 6 months thereafter to retain, to 2 recurring demands in separate months over a 6-month period to qualify, and 2 recurring demands in separate months every 12 months thereafter to retain.

Comment: Nonconcur. The current policy for the establishment and retention of demand-based items aboard submarines and submarine tenders, is critical to providing effective levels of supply support for major weapon systems and is a significant contributor to fleet readiness.

GAO Recommendation: Limit demand-based increases in stock levels to quantities needed to sustain operations after taking into consideration initial allowance stocks in excess of the 90-day requirement based on current demand experience.

Comment: Concur. It is understood that this recommendation is in relation to an assumption that when a Tender Load List (TLL) item experiences demand, the computer demand quantity is additive to the TLL quantity, thus establishing a requisition objective equal to the sum of TLL quantity plus computer demand quantity. The Shipboard Uniform Automated Data Processing System (SUADPS) establishes the higher of TLL/Consolidated Shipboard Allowance List (COSAL) quantity versus demand computed quantity as the requisitioning objective. Therefore, levels would not exceed the higher of the two. No policy change is necessary to comply with this recommendation, as levels are not additive.

GAO Recommendation: Instruct submarine and tender supply personnel on the fundamentals and importance of distinguishing and accurately recording the recurring or nonrecurring nature of requirements.

Comment: Concur. Action will be taken to assure correct requisition demand coding.

GAO Recommendation:

[See GAO note, p. 40.]

Comment:

GAO Recommendation: Direct submarine tenders to use their automated capabilities to identify all excess on-order stocks on a monthly or more frequent basis and promptly initiate cancellation action. Also, the GAO recommends that the Atlantic and Pacific Fleet submarine commands adopt a standard goal for their tenders limiting the value of excess on-order stocks to no more than 5 percent of the total value of materiel on order and that positive actions be taken by these commands to insure that this goal is achieved and sustained.

Comment: Concur in principle. The submarine tenders in May 1976 had approximately $2.2 million in excess material on order. An active program of cancellation is being pursued. The excess on-order value cannot be reduced without a confirmed cancellation from the system so there will always be a residual value of excess on order. A standard policy will be determined establishing a common excess on-order goal for use by both Fleets. A determination has not yet been made of the most desirable procedure. Due consideration will be given to the GAO recommendation.

GAO Recommendation: Adopt standard automated excess offload analysis programs which permit maximum excess offloads with minimum personnel effort such as that implemented by the USS SIMON LAKE in 1975.

Comment: Concur. The need for a uniform offload program is recognized.

GAO Recommendation:

[See GAO note.]

Comment:

The chart below shows the excess on-board stock position of submarine tenders as of May 31, 1976 and reflects a total excess position of $4.2 million as compared to the $10.5 million indicated in the GAO Draft Report:

($ - Thousands)

SHIP	APA	NSA	TOTAL
AS12	38	147	185
AS19	66	234	300
AS11	147	140	287
AS31	35	37	72
AS32	389	525	914
AS33	329	240	569
AS34	361	383	744
AS37	149	261	410
TOTALS	1,660	2,550	4,210

Continued monitoring of excess offload and cancellation of dues will be pursued and will be specifically addressed during annual supply inspections, both for submarine tenders and other units.

GAO note: GAO recommendation and related DOD reply deleted because recommendation stricken from final report.

PRINCIPAL OFFICIALS OF THE DEPARTMENTS OF DEFENSE AND THE NAVY RESPONSIBLE FOR ADMINISTERING ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Dr. Harold Brown	Jan. 1977	Present
Donald H. Rumsfeld	Nov. 1975	Jan. 1977
James R. Schlesinger	July 1973	Nov. 1975
William P. Clements, Jr. (acting)	May 1973	July 1973
Elliot L. Richardson	Jan. 1973	May 1973
Melvin R. Laird	Jan. 1969	Jan. 1973
DEPUTY SECRETARY OF DEFENSE:		
Charles W. Duncan, Jr.	Jan. 1977	Present
William P. Clements, Jr.	Jan. 1973	Jan. 1977
Kenneth Rush	Feb. 1972	Jan. 1973
ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS AND LOGISTICS):		
Dale Babione (acting)	Jan. 1977	Present
Frank A. Shrontz	Feb. 1976	Jan. 1977
Dr. John J. Bennett (acting)	Apr. 1975	Jan. 1976
Aruthur I. Mendolia	June 1973	Mar. 1975
Hugh McCullough (acting)	Feb. 1973	June 1973
Barry J. Shillito	Feb. 1969	Feb. 1973
DEPARTMENT OF THE NAVY		
SECRETARY OF THE NAVY:		
William Graham Clayton, Jr.	Feb. 1977	Present
Gary Penisten (acting)	Jan. 1977	Feb. 1977
J. William Middendorf II	June 1974	Jan. 1977
John W. Warner	May 1972	May 1974
John H. Chafee	Jan. 1969	May 1972

APPENDIX II

DEPARTMENT OF THE NAVY

	Tenure of office	
	From	To
UNDER SECRETARY OF THE NAVY:		
Vacant	Jan. 1977	Present
David R. MacDonald	Sept. 1976	Jan. 1977
David S. Potter	Aug. 1974	Mar. 1976
J. William Middendorf II	Aug. 1973	June 1974
Frank Sanders	May 1972	June 1973
John W. Warner	Feb. 1969	May 1972
ASSISTANT SECRETARY OF THE NAVY (INSTALLATIONS AND LOGISTICS)		
Dr. John J. Bennett	Sept. 1976	Present
Jack L. Bowers	June 1973	Sept. 1976
Charles L. Ill	July 1971	May 1973
CHIEF OF NAVAL OPERATIONS:		
Adm. James L. Holloway III	June 1974	Present
Adm. Elmo R. Zumwalt, Jr.	July 1970	June 1974
COMMANDER, NAVAL SUPPLY SYSTEMS COMMAND:		
Rear Adm. Wallance R. Dowd, Jr.	Jan. 1973	Present
Rear Adm. Kenneth R. Wheller	Jan. 1970	Jan. 1973
COMMANDER, SUBMARINE FORCE ATLANTIC FLEET:		
Vice Adm. Joe Williams, Jr.	Oct. 1974	Present
Vice Adm. Robert L. J. Lone	June 1972	Oct. 1974
Vice Adm. Eugene P. Wilkson	Feb. 1970	June 1972
COMMANDER, SUBMARINE FORCE PACIFIC FLEET:		
Rear Adm. Charles H. Griffiths	Oct. 1975	Present
Rear Adm. Frank B. McCullen, Jr.	Oct. 1972	Oct. 1975
Rear Adm. Paul L. Lacy, Jr.	Oct. 1970	Oct. 1972
COMMANDING OFFICER, SHIPS PARTS CONTROL CENTER:		
Rear Adm. J. E. McKenna	June 1974	Present
Rear Adm. E. E. McMorries	June 1972	June 1974
Rear Adm. J. A. Scott	Aug. 1969	June 1972