GAO

ARMY INVENTORY

Need to Improve Process for Establishing Economic Retention Requirements

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GAO United States
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National Security and
International Affairs Division

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The Honorable Earl Hutto
Chairman, Subcommittee on
    Readiness
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

This report responds to your concerns about the Army's process for determining economic
retention inventory requirements. In this regard, you asked us to

- evaluate the methodology of the computer model the Army has developed to calculate economic
  retention requirements,
- determine the extent to which this model was being used and evaluate the quality of the cost
  factors and rates input into the model to calculate economic retention requirements, and
- determine the impact on supply operations of any inadequacies or inaccuracies found in the
  computer model or in the input data.

We are sending copies of this report to the Director of the Office of Management and Budget;
the Chairmen of the House Committee on Government Operations, the Senate Committee on
Governmental Affairs, the House and Senate Committees on Appropriations, and the Senate
Committee on Armed Services; and the Secretaries of Defense and the Army. Copies will also be
made available to others on request.

Please contact me at (202) 275-4141 if you or your staff have any questions. Major contributors
to this report are listed in appendix I.

Sincerely yours,

Richard Davis
Director, Army Issues

Executive Summary

Purpose

About $4.7 billion of the Army's $24.9 billion total wholesale inventory is not needed to support current operating and war reserve requirements. Of this $4.7 billion inventory, items worth about $1.8 billion—about 38 percent—are being retained on the basis that it is more economical to keep them than to dispose of them.

Concerned about how the Army determines how large its economic retention inventory should be, the Chairman of the Subcommittee on Readiness, House Committee on Armed Services, asked GAO to

- evaluate the methodology of the computer model the Army has developed to calculate economic retention requirements,
- determine the extent to which this model was being used and evaluate the quality of the cost factors and rates input into the model to calculate economic retention requirements, and
- determine the impact on supply operations of any inadequacies or inaccuracies found in the computer model or in the input data.

Background

On March 31, 1991, the "inapplicable inventory" of the Aviation Systems Command, where GAO performed most of its review, contained items valued at about $1 billion. "Inapplicable inventory" is defined as inventory that is not needed to support current operating and war reserve requirements. Economic retention inventory accounted for $300 million, or about 29 percent, of this total.

Results in Brief

An analytical model developed by the Army in 1969 to determine economic retention requirements may provide a sound basis for making economic retention decisions. However, the computer programs that implement the original model have been modified many times over the years and now include errors and several nonmodel-based computations. As a result, economic retention requirements have been established (1) for items that do not meet the criteria for economic retention, (2) for items the Army no longer intends to support, and (3) at levels higher than those that would have been established by the model.

While the Army is aware of the problems and is revising and refining the model and the computer programs that implement it, the economic retention decisions will not improve until the inventory control points uniformly input accurate cost factors and rates into the model.

Not knowing what and how much economic retention inventory is appropriate can have serious effects on the supply system. An overstatement of economic retention requirements can result in unnecessary holding costs and reduced supply system effectiveness. Conversely, an understatement can result in the premature disposal of inventory.

Principal Findings

The Model, As Designed, Is Not Being Used for Most Items

Because of errors in the computer programs that implement the economic retention model, the economic retention decisions for most items are based on nonmodeled computer computations.

At the Aviation Systems Command, the overall economic retention requirements were $32.5 billion. (The economic retention requirement represents a "ceiling" amount. In other words, the Command could retain inventory up to the ceiling amount. It does not procure inventory for this requirement.) GAO found, however, that in certain cases, items would not have had economic retention requirements if the model had been used. In other cases, the amount of the economic retention requirements would have been less if the computer model had been used. For example, GAO found the following:

- Economic retention requirements for 8,424 items valued at $1.9 billion had been computed on bases other than the economic routines in the Army's economic retention model. If these items had been subjected to the model, no economic retention requirements would have been computed.
- Economic retention requirements for 9,427 items valued at $29.4 billion were established even though the "support review date" for the items was arbitrarily assigned. The "support review date" is the date beyond which the Army no longer intends to provide logistical support for an item. Because support review dates for these items had not been entered into the data base, an arbitrary support review date of 18 years was used. If these items had been subjected to the economic retention model, without assigning an arbitrary support review date, the computer model would not have computed an economic retention requirement for the items.

Army officials told GAO that they are aware of the problems and are refining and revising the model and rewriting the implementing computer programs.

While the development of a new model and computer programs should go a long way toward solving many of the problems, the new model and its programs need to be validated as methodologically sound. Validation will ensure that they are working as intended and that all problems have been resolved.

Cost Factors and Rates Input Into the Computer Model Are Inconsistent

Despite Army efforts to develop a new model, better economic retention calculations will not be made until the quality of the data input into the model improves.

GAO found that some of the cost factors and rates input into the model had not been uniformly calculated by the inventory control points. Because the model is to varying degrees sensitive to these factors, the use of inaccurate or incomplete factor values can significantly distort the computed economic retention requirements.

The Aviation Systems Command, for instance, did not adhere to the prescribed policy for determining its obsolescence rate factor. As a result, its rate was understated by 1 percent. Because the economic retention model is sensitive to this factor, even a small variance can have a significant effect on the calculation of how much inventory should be retained. According to a recent Army study, the overstatement of the obsolescence rate by 100 percent would result in an retention error of about 60 percent.

Because of a lack of clear guidance from the Departments of Defense and the Army on how to determine the various rates and factors used in the model, the national inventory control points apply different methodologies in calculating these rates.

Another factor used in determining economic retention requirements is the "other inventory losses" factor. Army regulations state that the loss rate should be computed by dividing the projected applicable inventory losses by the average value of on-hand inventory.

At the Tank-Automotive Command, where GAO performed a limited amount of work, the Command determined its on-hand inventory balance for "other inventory losses" by including on-order inventory and applicable inventory for stock-funded items but not procurement-funded items. In contrast, the Aviation Systems Command included stock-funded,

procurement-funded, applicable, and inapplicable inventories but not on-order inventory.

Effect of Incorrect Economic Retention Requirements on the Supply System

Unless economic retention requirements are correctly calculated, the Army has no assurance that it is, in fact, economical to retain these items. If too much inventory is retained, unnecessary holding costs are incurred, and the effectiveness of the supply system is jeopardized by cluttering the system with unneeded inventory. On the other hand, if these requirements are set too low, items may be disposed of prematurely.

Recommendations

GAO recommends that the Secretary of the Army direct the Commander of the Army Materiel Command to take the following actions:

- Require that the economic retention program the Army is now developing be validated as methodologically sound.
- Require that the national inventory control points use the newly developed model for determining all economic retention inventory requirements.
- Require that when an item does not qualify for economic retention but there is a valid need to retain it its retention be justified on another basis.
- Issue guidance to the national inventory control points that clearly defines the data to be considered and the methodology for calculating the cost factors and rates to be used in the model.
- Require that the cost factors and rates related to obsolescence, inventory losses, and disposal revenue be uniformly calculated by the inventory control points.

Agency Comments

The Department of Defense provided oral comments. It agreed with all of GAO's recommendations and provided information on how and when the recommendations would be implemented.

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Introduction

The Army's wholesale-level inventory, valued at about $24.9 billion as of March 31, 1991, consists of two distinct categories: "applicable" and "inapplicable" inventory. "Applicable" inventory is that portion of the inventory that is needed to meet current operating and war reserve requirements. "Inapplicable" inventory refers to the difference between total inventory and the applicable inventory. It is further subdivided into the following categories:

- Potential excess: that portion of the inventory that the Army has determined is not needed and can be processed for disposal.
- Contingency retention: that portion of the inventory for which there is no predictable demand and that would normally be processed for disposal except that the Army has decided to retain it for contingencies.
- Economic retention: that portion of the inventory that has been determined to be more economical to maintain than to dispose of and reprocure to meet a future need. In other words, the economic retention decision is supposed to be based on a comparison of the benefit to be gained by disposing of an item now with the cost of retaining the item for a period of time in order to satisfy a demand.

As of March 31, 1991, of the Army's $4.7 billion of inapplicable inventory, about $1.8 billion, or about 38 percent, was economic retention inventory.

The Aviation Systems Command (AVSCOM), where we performed most of our review, had about $1 billion of inapplicable inventory. This represents about 14 percent of its total inventory of $7.6 billion. Economic retention inventory accounted for about $300 million, or about 4 percent, of the total inventory and about 29 percent of the inapplicable inventory.

As of June 1991, AVSCOM managed about 47,250 line items. According to the Command's master data record (data base), about 26,840 of these items have serviceable and unserviceable economic retention requirements valued at $32.54 billion.[1]

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[1]The economic retention requirement represents a "ceiling" amount. In other words, the Command could retain inventory up to the ceiling amount. It does not procure inventory for this requirement.

In previous reports, we have evaluated the decision-making process for determining the amounts of retention-level stocks to be maintained.[2] As we have pointed out, decisions for retaining economic retention stock are made using a computer model, whereas decisions to retain the other categories of retention-level inventory are essentially made manually. Our prior reviews have assessed the reasonableness of these decision-making processes but have not attempted to validate the model used in the economic retention decision process or to determine whether the model was being implemented as designed.

How the Economic Retention Level Is Computed

Decisions to retain economic retention stock are made by the Army's Commodity Command Standard System (CCSS), an Army-wide computer system for calculating requirements. Decisions on what and how many economic retention items to retain are made using a mathematical (economic) model developed in 1969 by the Army's Inventory Research Office (IRO) and programmed into CCSS by the Army's Systems Integration Management Activity (SIMA). The system is used by each of the six Army national inventory control points for making economic retention decisions.

The objective of the economic retention model is to determine the point at which the holding cost of retaining an item is greater than the economic loss suffered by disposing of it. For the economic retention model to operate, various factors must be input, including the item's average monthly demand; its wear-out rate (for repair/rebuild items); the date the item is expected to be phased out of the Army's inventory; and the item's low, medium, or high dollar value. Other factor values that are input into the system include the cost of money; obsolescence, storage, and loss rates; the transportation cost of returning an item to the depot; the rate of recovery value of disposing of the item; and the ratio of unserviceable to serviceable inventory.

[2]Army Inventory: Growth in Inventories That Exceed Requirements (GAO/NSIAD-90-68, Mar. 22, 1990) and Army Inventory: Army Annually Spends Millions to Keep Retention-Level Stocks (GAO/NSIAD-90-236, Sept. 11, 1990).

Objectives, Scope, and Methodology

Concerned about how the Army determines how large its economic retention inventory should be, the Chairman of the Subcommittee on Readiness, House Committee on Armed Services, asked us to

- evaluate the methodology of the computer model the Army has developed to calculate economic retention requirements,
- determine the extent to which this model was being used and evaluate the quality of the cost factors and rates input into the model to calculate economic retention requirements, and
- determine the impact on supply operations of any inadequacies or inaccuracies found in the computer model or in the input data.

We reviewed Department of Defense (DOD) and Army policy, procedures, and related documents pertaining to the retention, transfer, and disposal of assets. We also interviewed DOD and Army personnel responsible for developing and implementing the policy. The information we obtained provided us with the rationale for the policy and a working knowledge of the establishment of retention levels.

To determine the total value of the Army's wholesale inventory, we obtained and analyzed the March 31, 1991, budget stratification reports, which showed the dollar value of the wholesale inventory of secondary items and the portions of the inventory categorized as applicable and inapplicable.

To determine the adequacy of the Army's model for establishing economic retention requirements, we obtained the services of an operations research and logistics expert. On the basis of his analysis of the Army's economic retention model, he concluded that it was methodologically sound and should produce valid economic retention decisions.

To determine whether the Army's model, as designed, was being used by AVSCOM, we held discussions with AVSCOM officials. We selected AVSCOM for testing the model's implementation because it is located near the activity (SIMA) that was responsible for programming the model into the Army's CCSS requirements system. We also held discussions with IRO officials who were responsible for developing the model and with SIMA officials.

We also selected a judgmental sample of consumable and reparable items and input the required factors and rates into the model to try to replicate the economic retention quantities computed by AVSCOM. However, because the model has been modified several times over the years and because

documentation on the modifications was incomplete or not available, we could not replicate the amounts computed by the Aviation Systems Command.

In our discussions, officials responsible for designing and programming the model, as well as those responsible for implementing it, said that they were uncertain how the model operated and that the model as originally designed was not the model currently being used to make economic retention decisions.

We held discussions with various national inventory control point representatives and reviewed available documentation to determine the validity of the factors and rates being used in the economic retention formula.

The computer model used in making economic retention decisions is a standard Army system used by all six of the national inventory control points. Our findings relating to the implementation of the computer model and the lack of consistency in developing and applying the cost factors and rates therefore indicate what could be found at the other national inventory control points.

We performed our review from February to November 1991 in accordance with generally accepted government auditing standards.

The Economic Retention Decisions for Most Items Do Not Conform to Army Policy

The analytical model developed by the Army in 1969 to determine economic retention requirements may provide a sound basis for making economic retention decisions. However, the computer programs that implement the original model have been modified many times over the years and now include errors and several nonmodeled-based computations. As a result, AVSCOM cannot be assured that the proper amount of economic retention inventory is being retained. If too much inventory is being retained, unnecessary holding costs are incurred, and the effectiveness of the supply system is jeopardized by cluttering the system with unneeded inventory. Conversely, the retention of too little inventory because items have been prematurely disposed of can lead to costly reprocurement.

Programming Problems With the Economic Retention Model

While the economic retention model developed by IRO in 1969 may be a sound model for making economic retention decisions, it has had to be modified numerous times since its development. It, therefore, is not being used in its original format.

IRO and SIMA officials told us that, because of these numerous modifications and because the documentation of programming changes was either not complete or not available, they could not determine what effect the modifications have had on economic retention levels.

IRO officials told us that they had been tasked by the Army Materiel Command to reevaluate the economic retention model because of complaints received from some of the national inventory control points concerning what appeared to be illogical economic retention decisions. For example, following the model's logic would result in more unserviceable items' being returned from field units to the depot than the total number of items (serviceable and unserviceable) to be retained. The officials said that the logic incorrectly implied that more unserviceable than serviceable assets should be retained. As a result of such examples, the national inventory control points did not have much confidence in the decisions being made.

In response to these concerns, IRO evaluated the model and found that the programming changes made over the years were affecting the accuracy of the retention and return-level computations. Furthermore, the lack of complete programming documentation to explain the nature of the modifications or the computer routines affected by the modifications made it impractical to try to correct the existing model. As a result, the Army decided to completely redo the program.

IRO is revising and refining the original economic retention model and clarifying many of the key inputs. These changes will require a rewrite of the programs used to calculate economic retention. The revised model and new computer programs have not yet been implemented by the national inventory control points. Therefore, it is premature to evaluate the effects of the planned changes on economic retention requirements.

While the revised model and new computer programs should go a long way toward solving the many problems, the new model and programs need to be validated as methodologically sound. Validation will ensure that they are working as intended and that all problems have been resolved.

Economic Retention Requirements for Many Items Are Not Based on the Model

In our review of the application of the model and the computer programs, we found that for many of AVSCOM's 26,840 items with economic retention requirements economic retention decisions (1) had not been based on the economic retention model, (2) had been made to retain items that did not meet the criteria for economic retention, (3) had been based on "support review dates"[1] that had passed or were not valid, or (4) had been based on manual computations at rates higher than those that would have been computed by the model.

Table 2.1 shows the number of line items and the value of the economic retention requirements in each of the above categories.

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[1] The "support review date" is the date beyond which the Army no longer plans to provide logistical support for the item.

Table 2.1: Value of Economic Retention Requirements Not Based on the Economic Retention Model

Dollars in millions

Category of items	Number of line items	Value of economic retention requirements
Not based on model		
Initial provisioning	296	$1,600.1
Insurance	3,908	95.1
Mission essential	4,220	200.4
Criteria not met		
Nonstocked[a]	801	85.2
No demand	5,510	52.3
Invalid support review date		
Support review date passed	145	2.6
Support review date invalid	9,427	29,389.3
Manually developed requirements	3,774	27,866.9

[a]Items that do not meet the criteria for stocking.

Because of errors in the computer program for determining economic retention requirements, we could not, in all cases, determine what should have been the precise retention requirements. Additionally, as shown in table 2.2, many of the items were in more than one of the above categories. For that reason, we could not always determine what basis had been used to compute the economic retention requirements.

Table 2.2: Placement of Items In More Than One Inventory Category

Category of Items	Initial provisioning	Insurance	Mission essential	Nonstocked	No Demand	Support review date Passed	Support review date Arbitrarily assigned	Frozen economic retention level
Initial provisioning	296	0	0	13	34	0	6	246
Insurance items	0	3,908	0	0	2,883	41	20	322
Mission essential	0	0	4,220	0	2,414	101	143	232
Nonstocked items	13	0	0	801	124	1	41	2
Zero demand	34	2,883	2,414	124	5,510	83	52	343
Support review date								
Passed	0	41	101	1	83	145	0	2
Arbitrarily assigned	6	20	143	41	200	0	9,427	2,052
Frozen economic retention level	246	322	232	2	1,096	2	2,052	3,774

Economic Retention Requirements Not Based on the Model

Our analysis showed that the economic retention requirements for initial provisioning, insurance, and mission-essential items had not been determined by the economic model and were not based on Army policy. Contrary to Army policy, the economic retention requirements for initial provisioning items were determined by computing how much the quantity of stock on hand exceeded the current operating and war reserve requirement. Again, contrary to policy, in the case of insurance and mission-essential items, the requirements were calculated by multiplying the reorder point quantity by 10.

The economic retention requirements for 296 provisioning items we reviewed were valued at $1.6 billion. For 128 items with economic retention requirements of $1.59 billion, the amount of provisioning stock on hand was less than the amount needed to meet current operating and war reserve requirements. Therefore, economic retention requirements should not have been computed for these 128 items.[2]

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[2]Because the provisioning items are also in other inventory categories, we could not determine which method had been used to compute the economic retention requirements for these items.

The economic retention requirements for insurance and mission-essential items we reviewed, like those for the provisioning items, had not been based on the economic retention model. These items had been stocked because of their perceived importance to readiness, even though they did not qualify for stocking based on demand. Table 2.3 displays certain information about the insurance and mission-essential items we reviewed at AVSCOM.

Table 2.3: Economic Retention Requirement, On-Hand Inventory, and Retention Inventory for Insurance and Mission-Essential Items at AVSCOM

Dollars in millions

Type of items	Number of line items	Economic retention requirement	On-hand inventory	Economic retention inventory
Insurance	3,908	$95.1	$32.1	$27.2
Mission essential	4,220	200.4	212.1	208.0

We could not determine what the correct economic retention requirements for the insurance and mission-essential items should have been because of the computer programming problems discussed in the previous section. However, because these items are infrequently demanded, it is unlikely that a predictable demand pattern, one of the criteria for having economic retention requirements, can be established for these items. Therefore, the amount of economic retention requirements should have been very small.

We are not suggesting that these items should not be retained. However, the justification for their retention should be based on grounds other than economics.

Items Do Not Meet the Criteria for Having Economic Retention Requirements

Army Regulation 710-1 states that for an item to qualify for economic retention, it must have a reasonably predictable demand rate. Our analysis showed, however, that economic retention requirements had been established and inventory was being retained for items that did not have reasonably predictable demand rates. Therefore, the items did not meet the criteria for having an economic retention requirement.

Our analysis showed that, even though 6,311 items at AVSCOM did not meet the criteria for having economic retention requirements, these items had economic retention requirements valued at $137.5 million.[3] To support these items, the Command had $137.9 million of stock on hand, including $133 million of retention stock. In other words, to support current operating and war reserve requirements valued at $4.9 million, the Command was retaining $137.9 million of inventory. For example, AVSCOM had a current operating and war reserve requirement for one muffler assembly (with a unit price of $2,010), which is used on the UH-60 helicopter. To support this item, AVSCOM had an economic retention requirement of 562 and had 51 items in inventory.

Invalid Support Review Dates Caused Overstated Economic Retention Requirements

An important input for determining economic retention requirements is the "support review date"—the date beyond which the Army no longer intends to logistically support the item. The support review date serves as a factor in limiting the length of time an item is retained.

In the economic retention decision process, the computer model determines the maximum length of time an item can be economically retained (this is measured in "economic retention months"). Economic retention months are then compared to the number of months the Army plans to support the item. The lesser of the two is then multiplied by the average demand to compute the economic retention requirement.

Our review disclosed that the support review dates for 9,572 items with economic retention requirements valued at $29.4 billion had already passed or had not been entered into the data base. In the latter case, the computer had assigned a support review date that was 18 years in the future.

Support Review Dates Already Passed

At AVSCOM the computer program had established economic retention requirements valued at $2.6 million for 145 items whose support review dates had already passed. In support of these items, the Command had inventory on hand valued at $1.03 million, including $1.02 million of retention inventory.

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[3]These items consisted of 801 items categorized as "nonstocked items" (items that do not meet the demand criteria for stocking) and 5,510 demand-based items for which there had been no recurring demands during the past 2 years and no overhaul requirements for the past 4 years.

Economic retention requirements should not have been established for these items because there is no reason to continue to logistically support items that have been phased out of the Army's inventory system. However, this was not the case. For example, the support review date for an aircraft seat (with a unit price of $3,336) used on the U-21 aircraft expired in 1984. However, AVSCOM had an economic retention requirement for 32 of the seats and had 4 in inventory even though there was no current operating or war reserve requirement for the item.

As shown in table 2.2, 41 of the items we reviewed at AVSCOM are also classified as "insurance items," and 101 are classified as mission essential. As discussed previously, economic retention requirements for insurance and mission-essential items are not computed using the economic model. Instead, their requirement levels are calculated by multiplying the reorder point quantity by 10. This special routine ignores the support review date in its computations.

Support Review Dates Arbitrarily Assigned

For the economic retention model to correctly compute the retention requirement, the support review date in the data base must be correct. Our review showed, however, that the support review dates for 9,427 items had not been entered into the data base and an arbitrary support review date of 18 years had been assigned to these items. Assignment of this date had resulted in the establishment of economic retention requirements of $29.4 billion for the 9,427 items. To support these items, the Command retained $3.6 billion of inventory, including $535.9 million of retention inventory.

In a previous report on retention-level inventory, we identified the same problem.[4] At that time, AVSCOM had 5,293 line items whose phase-out dates had been arbitrarily established, and these items had $474.3 million of retention inventory. Our analysis of 25 items to determine whether the arbitrarily established phase-out dates were later or earlier than the actual phase-out dates showed that in the majority of the cases (17 out of 25), the actual phase-out date was earlier than that shown in the computer data base. Now the situation has worsened, as evidenced by the fact that the Command has 9,427 items with arbitrarily established phase-out dates and $535.9 million of retention inventory for these items.

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[4]Army Inventory: Army Annually Spends Millions to Keep Retention-Level Stocks (GAO/NSIAD-90-236, Sept. 11, 1990).

In response to our previous report, the Army stated that the assignment of arbitrary support review dates would be stopped. According to SIMA officials, this change was planned for the third quarter of fiscal year 1990. However, corrective action was delayed because another problem was discovered concerning the computation of the economic order quantity. The officials said that, because the computation of economic order quantity affects the decision of how much to buy, it had been decided that the problem with the economic order quantity had priority and needed to be corrected first.

Manually Determined Economic Retention Requirements

Our analysis of the computer programs used to calculate the economic retention requirements disclosed that a computer-determined retention requirement was shown only when a certain data field in the data base contained a "C" code. The computer program calculates a requirement level and scans the data base to see if there is a "C" there. If there is no "C," the program compares the calculated quantity to the economic retention requirement shown in the economic retention limit file (this file is a record of previously calculated requirements). Then it uses the larger of the two values as the economic retention requirement. If the computer-calculated value is larger, the program assigns a "C" code to the appropriate data field. Otherwise, it assumes that the economic retention requirement value has been "frozen," and it will continue to use that value as the requirement.

According to SIMA officials, the "frozen" value, designated by an "M" code, remains from a time when item managers were permitted to manually input an economic retention requirement for an item. The officials said, however, that the "M" codes are not supposed to be used and that the "M" codes should have been deleted so that the computer would compute the requirement. That is, the computer model should not defer to these previously calculated requirements. AVSCOM officials told us they do not have the ability to change or even access the data field that causes the computer to do this. Action to correct the problem would have to be made by SIMA and would involve changes to the retention level program.

Our analysis showed that the economic retention requirements for 3,774 items had been based on the frozen value rather than on the computer-calculated amount. The 3,774 items had economic retention requirements valued at $27.9 billion, and AVSCOM had $2.9 billion of inventory on hand, including $475.3 million of retention inventory.

Conclusions

The Army developed an economic retention model in 1969 to help it determine how much and which inventory to retain as economic retention stock. The original model, which may be methodologically sound, is not the model being used in the economic retention decision process. For the most part, these decisions have been made on bases other than the model. However, even when the modified model was used, the computed requirements have often been wrong because of programming errors that have been introduced into the system through numerous program modifications over the years.

As a result, economic retention requirements have been established for many items that should not have such requirements, and the economic retention requirements for many other items are overstated.

The Army is aware of the computer programming problems affecting the determination of economic retention requirements and is developing a new model. While the new model should aid in eliminating the programming problems, it will not, by itself, solve the problems related to (1) bypassing the model to compute economic retention requirements, (2) having economic retention requirements for items whose support review dates have passed or whose support review dates have been arbitrarily assigned, or (3) having economic retention requirements for nonstocked and no-demand items.

These types of problems can be corrected only by requiring the Army to use the model to determine all economic retention requirements. If there is a need for items that do not qualify for economic retention, their retention should be justified on some basis other than economics.

Recommendations

We recommend that the Secretary of the Army direct the Commander of the Army Materiel Command to take the following actions:

* Require that the economic retention program the Army is now developing be validated as methodologically sound.
* Require that the national inventory control points use the newly developed model for determining all economic retention inventory requirements.
* Require that when an item does not qualify for economic retention but there is a valid need to retain it its retention be justified on another basis.

Agency Comments

DOD agreed with our recommendations and made the following oral comments:

- The new economic retention model is being validated and is planned for implementation in the fourth quarter of fiscal year 1992.
- The new model will standardize Army economic retention decisions across all Army Materiel Command inventory control points, and all economic retention decisions will be made using the results of the mathematical model.
- If an item is needed but does not qualify for economic retention, its need will be justified in writing. Otherwise, the item will be placed in the potential excess category.

Cost Factors Used in the Economic Retention Model Are Outdated or Incomplete

The new economic retention model being developed by the Army could eliminate many of the methodological problems being experienced with the current model. However, the end result—more accurate economic retention requirements—will not improve until the quality of data entered into the model improves. Establishing accurate and realistic economic retention requirements requires that the storage cost, obsolescence rate, inventory losses, and disposal factors are accurately entered into the data base by the national inventory control points.

Our review showed that some of these factors had not been recently updated, had been arbitrarily established, or were not available. Because the model often exhibits a high degree of sensitivity to these factors, the use of inaccurate or incomplete factor values can significantly distort the computed requirements.

Furthermore, the lack of clear guidance from DOD and the Army as to how to calculate the various rates and factors results in the national inventory control points' applying different methodologies in calculating the rates they use in the economic retention model.

How the Cost Factors Interact With the Economic Retention Model

Computing economic retention requirements is a multistep process that first requires determining the maximum retention limit, or "T" factor (expressed in months). This factor represents the maximum length of time that the command can justify, for economic reasons, the retention of inventory. Generally, the "T" factor is 10 years for nonreparable items and 8 to 10 years for reparable items, depending on whether the items are serviceable or unserviceable.

The cost factors considered in determining the "T" factor include the "disposal rate" (the percentage of an item's value to be gained by selling it), "the transportation rate" (the percentage of an item's value to be lost by returning it from the user to the depot), and the "unserviceable/serviceable rate" (the ratio of unserviceable to serviceable items). The "T" factor is used to determine the economic retention requirement.

As discussed previously, the objective of the economic retention model is to balance the holding cost of an item (which includes a consideration of storage cost, obsolescence, other losses, and the cost of money) against the cost of procuring the same item at a future date (the estimated acquisition cost minus the revenue to be gained through disposal). Except in the cases of the storage rate and the cost-of-money rate, both of which

are prescribed by the Army, each individual national inventory control point is responsible for establishing the cost rates used in the model. Table 3.1 shows the cost rates being used by AVSCOM in the economic retention model.

Table 3.1: Cost Rates Used by AVSCOM In Its Economic Retention Model

Numbers in percentages

Cost factor	Rate
Cost of money[a]	10
Storage[a]	1
Obsolescence	3
Other inventory losses	0
Disposal	1

[a]Rates prescribed by the Army for use by all the national inventory control points.

At AVSCOM, the obsolescence, other losses, and disposal rates were not always developed on a sound basis. As a result, there is no assurance that the economic retention decisions based on these rates represent accurate portrayals of the true conditions.

Obsolescence Rate

The "obsolescence rate" involves a consideration of inventory losses due to technological improvements, overforecasted requirements, and other causes of inventory's exceeding needs. According to DOD policy, the obsolescence rate is to be calculated by dividing the value of property sent to the Defense Reutilization and Marketing Office by the average value of the preceding year's on-hand and on-order applicable inventory.

Instead of using the actual amounts of inventory sent to disposal, AVSCOM estimated the amounts based on what it expected to dispose of during the upcoming year. The Command also overstated the value of on-hand and on-order applicable inventory by including the value of inapplicable inventory as well.

On the basis of inventory information available on March 31, 1991, we believe that if AVSCOM had computed its obsolescence rate according to the prescribed method rather than the way it did, its rate would have been about 4 percent rather than 3.

The economic retention model is very sensitive to the obsolescence rate. Consequently, an incorrect obsolescence rate significantly affects the

economic retention requirement. According to a recent study by IRO, the obsolescence rate has more impact on retention levels than any other cost parameter.

The study stated that an understated rate would result in the return and retention of too many items and, conversely, that an overstated rate would result in the return and retention of too few. According to IRO, an obsolescence rate that is overstated by 100 percent (for example, a 1-percent rate that is represented as 2 percent) results in a retention error of about 60 percent.

Other Inventory Losses Rate

"Other inventory losses" are inventory losses due to pilferage, fire, shrinkage, and inventory adjustments. Army regulations state that this loss rate should be computed by dividing projected applicable inventory losses by the average value of on-hand inventory. DOD and Army policy also state that when inventory gains exceed losses, an inventory adjustment rate of zero should be used. The DOD regulation states that care should be exercised in the treatment of inventory adjustments. It suggests that a 3-year and preferably a 5-year smoothed average be used to determine inventory losses.

While Army policy prescribes the elements involved in establishing a loss rate, it does not specify (1) how to project inventory losses, (2) how to derive the average value of on-hand inventory, or (3) how to balance inventory gains and losses each year or on a cumulative basis for the 3- to 5-year period being considered.

In the absence of clear guidance for computing the inventory loss rate, national inventory control points have computed the rate differently. For example, the Tank-Automotive Command, in determining its on-hand inventory, included on-order inventory and applicable inventory for stock-funded items but not procurement-funded items. In contrast, AVSCOM included stock-funded, procurement-funded, applicable, and inapplicable inventories but not on-order inventory.

Because it is unclear how the Commands were supposed to compute the other inventory loss rate, we could not determine the extent to which the rates were over- or understated or the impact of these differences on the economic retention requirements.

Disposal Rate

The "disposal rate" is the percentage of an item's acquisition cost that is recovered when the item is disposed of by the Defense Reutilization and Marketing Office. This rate is used as an offset to the acquisition cost in the economic retention formula for balancing the cost of holding an item with the cost of disposing of an item and reprocuring it at a later date.

Although AVSCOM uses a 1-percent disposal rate in its economic retention model, AVSCOM officials told us that the rate is just an estimate. They said that disposal revenue information is not maintained by the Defense Reutilization and Marketing Office. As a result, the Command cannot determine what the actual disposal rate should be.

According to an Army Material Command official, disposal revenue information has not been available for a number of years. The disposal activities are developing a new computer system that will be capable of providing the needed information to the national inventory control points. However, development of this system is many years away.

According to an IRO study, the model is also sensitive to the disposal rate factor. The study noted that an overstatement of the disposal value has about twice the effect of an understatement on the retention levels.

Because disposal revenue information was not available to determine the actual disposal rate, there was no way to determine whether the rate being used was realistic. However, according to IRO, the disposal rates being used by the national inventory control points vary from 1 percent, in the case of AVSCOM, to 6 percent in the case of the Tank-Automotive Command. With such a wide range of rates, economic retention requirements may be significantly distorted.

Conclusions

The Army has no assurance that its current economic retention inventory is made up of items that it is truly economical to retain. While the development and implementation of a new economic retention model should give greater assurance that retention decisions are sound, the new model, in and of itself, will not solve all the problems. Until the input cost factors and rates are based on current information and there is greater uniformity in the way the national inventory control points develop this information, the overall quality of the retention decisions will not substantially improve.

Recommendations

We recommend that the Secretary of the Army direct the Commander of the Army Materiel Command to take the following actions:

- Issue guidance to the national inventory control points that clearly defines the data to be considered and the methodology for calculating the cost factors and rates to be used in the model.
- Require that the cost factors and rates related to obsolescence, inventory losses, and disposal revenue be uniformly calculated by the inventory control points.

Agency Comments

DOD agreed with our recommendations and provided oral comments. It said that responsibility for updating and validating cost rates and factors has been assigned to the Army Materiel Command Management Engineering Activity to ensure the standardization of these cost factors among the major subordinate commands. All rates and factors will be updated by the fourth quarter of fiscal year 1992, when the new economic retention model will be completed.

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