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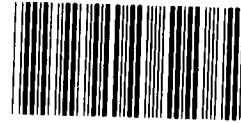
Report To The Congress

OF THE UNITED STATES

Less Costly Ways To Budget And Provision Spares For New Weapon Systems Should Be Used

Procedures the Army, Navy, and Air Force use for providing spares for new aircraft and helicopters are not achieving optimum support levels. Assuring the timely availability of required spare stocks at using organizations and at maintenance and supply activities to sustain programed operations and providing this support at the least investment cost are major objectives of the provisioning process.

The Department of Defense needs to change its budgeting and provisioning procedures to make them more cost effective and to provide better visibility for the Congress.



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COMPTROLLER GENERAL OF THE UNITED STATES
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To the President of the Senate and the
Speaker of the House of Representatives

This report discusses the Department of Defense's budgeting and provisioning procedures for spare parts for new weapon systems. It recommends a number of changes in the procedures to make them more cost effective and to provide better visibility for the Congress. The report also recommends a different procurement practice for spare parts which could significantly reduce the overall cost of each weapon system fielded.

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

A handwritten signature in black ink, reading "Milton J. Fowler".

Acting Comptroller General
of the United States

D I G E S T

GAO found that the budgeting and provisioning procedures employed by the Army, Navy, and Air Force for spare parts for new weapon systems generally conform to Department of Defense (DOD) guidance. However, changes are needed in the procedures to make them more cost effective and to provide better visibility for the Congress.

GAO initiated its review of spares provisioning for new aircraft and helicopters in response to (1) congressional concern about the low readiness rates of new aircraft being deployed because of a lack of spare parts, (2) previous GAO reviews which discussed both excesses and shortages of aircraft spares, and (3) broad congressional interest in reducing life cycle costs of major weapon systems.

CURRENT BUDGETING PROCEDURES
DO NOT PROVIDE THE VISIBILITY
NEEDED BY THE CONGRESS

While funding for investment spares (reparable items) needed to initially support new aircraft and helicopters being fielded is requested by weapon system, the majority of investment spares needed to support follow-on buys are consolidated and requested as replenishment spares. This split budgeting for similar items does not give the Congress the visibility it should have on total aircraft or helicopter system costs. (See p. 7.)

For example, for fiscal year 1981, DOD requested \$1.8 billion to buy 180 F-16 aircraft. Also requested was \$57.4 million for initial spares. However, total F-16 spares costs (initial and replenishment investment spares and spare engines) totaled \$214 million. (See p. 12.)

The \$214 million, however, was much less than the \$671.9 million the Air Force calculated it needed for the F-16s. The Congress needs to be made aware of the total cost of spares needed.

With more information on the services' calculated needs and DOD's budget request by system, the Congress may choose to evaluate the merits of options other than authorizing the number of end items DOD requests. One option would be to buy fewer aircraft and helicopters and invest more money in support. (See p. 13.)

SAVINGS ARE BEING LOST BECAUSE
SPARES ORDERS ARE NOT COMBINED
WITH PRODUCTION REQUESTS

When delivery time for a part is long (2 to 4 years), a contractor can order it in advance so it will be available for the production line. However, DOD policy greatly inhibits the services from advance ordering the same part when it is to be used as a spare. (See p. 15.)

Combined purchasing offers large potential savings from economies of scale, insures spares are delivered in the same configuration as those on the aircraft to be supported, and improves early support of new systems by enabling more timely delivery of spares.

The Air Force has used the combined purchasing practice with mixed results. On the F-16, the Air Force stopped using combined purchasing after 3 years, not because it was not cost effective, but because of administrative and implementation problems. For the A-10 aircraft, however, an Air Force study concluded that \$64 million had been saved. This savings represented 14 percent of the estimated spares costs. More recently, DOD directed that combined purchasing be used on the F/A-18 and estimated savings to be between \$250 and \$330 million. (See p. 16.)

With annual expenditures for aircraft and helicopters investment spares in the billions --in fiscal year 1981, \$2.6 billion--the further potential of savings from combined purchasing is great. (See p. 16.)

SPARE PARTS ARE NOT BEING STOCKED
AT COST-EFFECTIVE LEVELS

The services buy spares based on engineering estimates. However, the underlying reason in the amount purchased appears to be the amount of money available.

While there may have been sound management reasons for the stock levels, the services need to better justify the stock levels to be used. In addition, the services need to comply with DOD policy to minimize the investment cost of initial spares. Advantages of high stock levels, in terms of increased support or possibly reduced costs, should be better justified, recognizing the potential consequences. For example, while the F-16 experience may not be representative, it does show the magnitude of these potential consequences:

- Stocking cost being greatly increased.
Stocking to an 85-percent demand rate versus a 90- to 95-percent demand rate may have reduced the F-16 investment by over \$50 million.
- Spares being bought that are not needed.
During the first 18 months of operations, 35 percent of the items bought were not used.
- Spares needing modification before they are used. A planned F-16 modification will involve 11 percent of initial spares in stock. (See p. 20.)

The services could also reduce the range of spares by using phased provisioning more often--a technique that DOD encourages. With phased provisioning, purchases of selected items are deferred until later stages of production when operational programs and design are more stable and operational data is available to better project requirements. (See p. 22.)

OPERATIONAL DEMAND DATA IS NOT
BEING USED SOON ENOUGH

While DOD policy requires that needs for investment spares requirements be computed based on operational and/or test demand data

whenever available, the services are significantly extending the demand development period during which they compute requirements based on engineering estimates. (See p. 25.)

Using engineering estimates results in either too many or not enough items being bought. This raises the question of why the services do not use actual data earlier. While varying interpretations of DOD policy may be a contributing factor, the underlying cause appears to be the services' desire to stretch out the initial provisioning period because funds during this period are plentiful. Once operational data is used for computations, requirements are funded from the replenishment spares budget which is constantly underfunded. (See p. 28.)

RECOMMENDATIONS

GAO recommends that the Secretary of Defense:

- In submitting budget requests for major weapon systems, show total spares needs by weapon system. (See p. 14.)
- Redefine, for budget purposes, initial spares to include all spares needed to field a weapon system, and provide a breakdown of the initial spares budget request in more descriptive terms. (See p. 14.)
- Amend the DOD policy on the use of advanced funding and allow its use for spares to take advantage of combined purchases of spare parts with production components: (See p. 19.)
- Direct that other systems be evaluated for potential use of the combined purchasing concept and request the money needed to use the concept. (See p. 19.)
- Require that the services better justify how their levels of initial provisioning of spares meet DOD's policy on minimizing initial investment costs. (See p. 24.)
- Direct the services to use the phased provisioning concept as was recommended by the Defense Audit Service. (See p. 24.)

--Review and revise DOD guidance on using operational demand data to (1) clarify language that could result in differing interpretations and (2) require that the services establish demand development periods as early as possible and start using operational demand data after 6 months to adjust requirements computations.

(See p. 29.)

AGENCY COMMENTS

DOD commented (see app. I) that the report should help improve the initial spare parts budgeting process and ongoing efforts to increase the visibility of the cost of fielding weapons and support systems. DOD generally agreed with most of GAO's draft report proposals, except for the one recommending early use of operational demand data, which, in GAO's opinion, DOD misunderstood (see p. 29). GAO's analysis of DOD's comments is included in each report chapter, and recommendations have been changed accordingly.

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ABBREVIATIONS

DOD	Department of Defense
GAO	General Accounting Office
POC	preliminary operational capability
SAIP	spares acquisition integrated with production

CHAPTER 1

INTRODUCTION

The magnitude of the annual dollar investment and the effect of spare parts provisioning on operational readiness for new aircraft and helicopters are of primary concern for the Department of Defense (DOD) and the Congress. Funding for aircraft and helicopter spares will exceed \$2.6 billion in fiscal year 1981 and may exceed \$4 billion during fiscal year 1982.

The provisioning process for aircraft and helicopters is a series of critically timed actions designed to ensure that new systems will have adequate support. The process extends over a wide range of functions, including design, maintenance planning, supply, requirements determination, procurement, and inventory control. Assuring the timely availability of required spare stocks at using organizations and at maintenance and supply activities to sustain programed operations and providing this support at the least initial investment cost are major objectives of the provisioning process.

The current process of budgeting, provisioning, and acquiring spare parts is divided into two phases--initial and replenishment. The initial spares phase involves the budgeting and provisioning of spare parts needed to support a given quantity of new aircraft or helicopters through an initial support period 1/ that is established by the service. The replenishment spares phase involves the budget and acquisition of spares to (1) support aircraft and helicopters delivered following the initial support period, (2) replace parts that cannot be repaired, and (3) increase the quantity of spares in the system necessitated by changes in weapon system reliability, support system policies, and/or programed activities (for example, flying hour programs).

The effectiveness of the provisioning process was discussed during congressional hearings on DOD appropriations for 1981. Congressional concern about spares provisioning has significantly increased over the past year, since the readiness rates of some of the newer fighter aircraft, such as the F-14 and F-15, have been severely affected because of a lack of spare parts.

OBJECTIVES, SCOPE, AND METHODOLOGY

We initiated our review of spares provisioning for new aircraft and helicopters in response to (1) congressional concern about the low readiness rates for new aircraft being deployed because of a lack of spare parts, (2) previous GAO reviews which

1/Reflects the time needed by the services to verify the operational failure and demand rates for that weapon system's spares.

discussed excesses and shortages of aircraft spares, and (3) broad congressional interest in reducing life cycle costs of major weapon systems. Our objective was to determine (1) the effectiveness of DOD's budgeting and provisioning procedures for aircraft and helicopter spares and (2) if the procedures could be improved to make them more effective.

This report is based on our analysis of DOD's budgeting and provisioning guidance and the services' implementation thereof, interviews with DOD and contractor officials responsible for providing logistics support for the Army's Blackhawk helicopter, the Navy's F/A-18 aircraft, and the Air Force's F-16 aircraft, and review of published DOD, Defense Audit Service, and GAO reports on initial provisioning and spare parts stockage. We made our review at the following locations:

- Office of the Secretary of Defense, Washington, D.C.
- Office of the Chief of Naval Operations, Washington, D.C.
- Headquarters, Department of the Army, Washington, D.C.
- Headquarters, Department of the Air Force, Washington, D.C.
- Naval Air Systems Command Headquarters, Washington, D.C.
- Army Materiel Development and Readiness Command, Washington, D.C.
- Air Force Logistics Command, Wright-Patterson Air Force Base, Dayton, Ohio.
- Naval Aviation Supply Office, Philadelphia, Pennsylvania.
- Army Troop Support and Aviation Command, St. Louis, Missouri.
- Army Materiel Readiness Command, St. Louis, Missouri.
- Air Force Logistics Center, Ogden, Utah.
- McDonnell-Douglas Corporation, St. Louis, Missouri.
- General Dynamics Corporation, Fort Worth, Texas.

We first examined the current DOD guidance on provisioning of initial spares and then examined the methodologies used by the services to provide logistics support for their new weapon systems now being deployed. During our review, we examined (1) the processes used by each service to develop initial spares budgets and to compute initial requirements, (2) the services' application of interim contractor support and phased provisioning techniques, (3) the cost effectiveness of the procedures being used by each service, and (4) the visibility being provided the Congress on the systems' spares support needs.

CHAPTER 2

BUDGETING AND PROVISIONING PROCEDURES FOR AIRCRAFT SPARES

NEED TO BE MADE MORE EFFECTIVE

The budgeting and provisioning procedures employed by the Army, Navy, and Air Force for aircraft and helicopter spares generally conform to DOD guidance. However, the provisioning methodologies we examined are not providing an optimum range and quantity of initial investment spares 1/ or providing the support at the least initial investment cost. Changes in the budgeting and provisioning procedures are needed to make them more cost effective and to provide better visibility for the Congress.

ENSURING NEW WEAPON SYSTEMS ARE ADEQUATELY SUPPORTED IS A MUST

Since a significant portion of the operating and support costs of a new aircraft or helicopter, over its service life, involves initial and replenishment spares costs, the need for optimizing the type and quantity of spares and their associated costs is crucial. While we generally found that the provisioning process for initial spares was adequate, problems, due to a lack of replenishment spares, have been reported for such aircraft as the F-14 and F-15. As discussed in chapter 3, a separate budgeting process for initial and replenishment spares may be a contributing cause to this problem.

DOD policy requires the provisioning process to be effective, efficient, and timely

When a new weapon system is fielded, DOD requires that effective, efficient, and timely methods be used during initial provisioning. DOD defines provisioning as a management process for determining and acquiring the range and quantity of support items necessary to operate and maintain an end item of material for an initial period of service.

DOD policy 2/ requires:

- Initiation of provisioning planning early in the life cycle of the weapon system development program as part of the integrated logistics support program.

1/Items of durable nature which, when unserviceable, normally can be economically restored to a serviceable condition through regular repair procedures.

2/DOD Directive 4140.40, "Basic Objectives and Policies on Provisioning of End Items of Material" (Feb. 20, 1973).

- Computation of initial requirements for support items using (1) latest end item program or delivery data, (2) actual failure and/or test data wherever available in lieu of engineering estimates, and (3) minimum operating and depot stockage levels.
- Use of contractors' in-production capabilities to assist in initial supply support through the application of phased provisioning 1/ techniques and other such management techniques to reduce initial investment costs.

CURRENT PROVISIONING METHODS ARE
NOT OPTIMIZING SPARES SUPPORT

The provisioning methodologies being used by the Army, Navy, and Air Force are not providing an optimum range and quantity of initial investment spares or providing the support at the least initial investment cost. For example:

- In the Army, the contractor for the Blackhawk helicopter, Sikorsky, estimated the provisioning requirements for the initial 4 years of the helicopter's operations without using a logistics support analysis or an optimization model. The range and quantity of spares stocked have not provided the level of support that the Army had hoped for. Readiness rates for the Blackhawk are down because of a shortage of spares. Army officials told us that, because of highly optimistic demand rates and increased flying hours to support an operational exercise, nearly one third of the spares are out of stock at any given time.
- In the Air Force, the contractor for the F-16 aircraft, General Dynamics, computed the provisioning requirements for the initial 2 years of the aircraft's operations using the Air Force's optimization model and a logistics support analysis of each item. However, the Air Force still did not achieve an optimum spares support level. Approximately one third of the items stocked were not used during the first 18 months of F-16 operations.
- In the Navy, the contractor for the F/A-18 aircraft, McDonnell-Douglas, used an optimization model, which considered logistics support analysis and F-15 and F-4 experience data, to compute the provisioning requirements for the initial 4 years of the aircraft's operations. How effective this method will be is still unknown because delivery of the first F/A-18 to the fleet was not made until February 1981.

1/Under phased provisioning, procurement of all or part of the total requirement for selected spares is deferred and a buffer stock at the contractor is used.

A November 26, 1979, Defense Audit Service report 1/ criticized DOD for allowing the services to use different methods to compute requirements for initial spares and for not reviewing the effectiveness of the processes being used. The report stated that none of the services' provisioning processes were achieving optimum spares support levels and recommended the development of a new optimization model to be used by all three services. The Defense Audit Service examined six aircraft and helicopter systems.

An August 31, 1980, report 2/ by DOD's stockage policy analysis group stated that the services' different methodologies would lead to different requirements being established for the same item. The study recommended the development of a DOD model that would enable the services to better estimate the range and quantity of spares needed to support a given operational program.

MISSION ESSENTIALITY SHOULD BE
USED TO DETERMINE REQUIREMENTS

DOD has long recognized the need to determine stock levels based on mission essentiality. During the initial provisioning process, the services have developed some variation or approach for identifying essential items applicable to a new weapon system and for assigning an essentiality coding. However, essentiality coding is being used only for

- selecting war reserve items,
- setting priorities for spares repair schedules,
- computing variable safety levels, and
- selecting nondemand items for stockage.

Although essentiality coding should be the primary selection criterion for determining the range and quantity of initial spares to be stocked, the services are not utilizing the coding. The services' current practice is to give equal weight to all spares

1/"Report on the Review of Initial Spares Provisioning for Tactical Aircraft" (Defense Audit Service No. 80-034, Nov. 26, 1979).

2/The report, "Stockage Policy Analysis," was based on a comprehensive analytical review of secondary item stockage policies and management practices by the three services and by the Defense Logistics Agency. The review was initiated by the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics) in response to several "supply efficiency" issues raised by the Office of Management and Budget in its fiscal year 1980 budget review.

requirements when determining the stockage level. In our opinion, this is why the services have not been able to optimize the type and quantity of spares and their associated costs.

DOD's 1980 stockage analysis report urged the services to develop an essentiality coding technique for use in computing spares requirements and to integrate the technique with an optimization model. The report indicated that more essential items should be stocked at a higher level and should receive the greater share of management attention and funding than less essential items.

REVISED BUDGETING AND PROVISIONING PROCEDURES SHOULD BE USED

In addition to the proposals made by the Defense Audit Service and the DOD stockage policy analysis group, the budgeting and provisioning procedures for spares could be made more understandable and more cost effective if the services:

- Change the present procedure of budgeting initial and replenishment spares requirements separately to a budget procedure that would include the investment spares requirements as part of the procurement package submitted annually for aircraft and spare engines. (See ch. 3.)
- Require that orders for spares and production items be combined and allow long-lead funding for spares. (See ch. 4.)
- Require the use of a contractor production buffer stock in lieu of procuring the total range and computed quantities of initial spares. (See ch. 5.)
- Require that engineering data used for spares computation be adjusted to reflect operational demand experienced, starting as early as the first 6 months of operational use. (See ch. 6.)

CONCLUSIONS

The services' budgeting and provisioning procedures generally provide the initial spares needed to support a new aircraft and/or helicopter program. However, on the basis of our review and that of the Defense Audit Service, the diverse methodologies being used to compute requirements have not been achieving optimum spares support levels or providing the support at the least initial investment cost. Changes are needed in the budgeting and provisioning procedures to make them more cost effective and to provide better visibility for the Congress.

CHAPTER 3

GREATER VISIBILITY OF INVESTMENT SPARES REQUIREMENTS IS NEEDED TO JUDGE AFFORDABILITY

Because of a lack of visibility of total spares support costs, investment spares costs are not being adequately considered during congressional evaluations for new aircraft and helicopter procurement. Investment spares needed to support operations of new systems during the initial deployment period are being budgeted as part of the annual procurement request. However, spares needed to support other new aircraft or helicopters being deployed after the initial period are not budgeted by system. Rather, these spares requirements are lumped together with other aircraft and helicopter requirements and are submitted as one requirement. Thus, the Congress does not have the visibility it needs to evaluate the overall total cost and affordability of new aircraft and/or helicopters.

BUDGETING FOR INITIAL AND REPLENISHMENT SPARES SEPARATELY IS NOT WELL UNDERSTOOD

The current process of budgeting, provisioning, and acquiring investment spares in two distinct phases--initial and replenishment--is not well understood. Managing investment spares, from initial budgeting to final stocking and distribution, is a single process, and the spares manager and users are not concerned with whether the spares incorporated into an aircraft are called initial or replenishment spares. The total cost of providing investment spares support for new aircraft and helicopters remains the same regardless of how they are categorized.

The term "initial spares" as used in
weapon system budget requests
is confusing

Laypersons would interpret initial spares to mean the spare parts initially needed to support the weapon system. However, they would be incorrect because the term, as used, includes

- investment (reparable) parts, not consumables,
(nonreparable),
- investment parts needed to support aircraft operations
during an initial deployment period,
- initial stockage of investment parts that are required
because of a configuration change or modernization, and
- all spare engines for the life of the weapon system.

For example, the first 150 F-16 aircraft deployed during the first 2 years were supported by initial spares, whereas the remaining 1,238 F-16 aircraft to be bought will get funding for spares from the replenishment budget.

In reviewing fiscal year 1981 congressional hearings on DOD's budget request for aircraft and helicopters, we found that although there was high interest and many questions on the spares request and the differentiation between initial and replenishment spares, DOD's responses were still unclear. For example, an Air Force official stated that initial spares requests provided for a group of peculiar initial spares for each weapon system buy and that replenishment spares requests were to replenish the initial spares that failed or were condemned. Another Air Force official stated that spare engine requirements were included in the replenishment spares request after a given period of time, while a Navy official stated that all engines were classified initial spares for budget purposes.

In discussions with congressional staff during our review, we also found that they had different understandings on what initial spares meant.

Initial spares requests differ by services

Initial spares requests for new aircraft and helicopters being bought by the services each year differ significantly because of the way each service has implemented the DOD guidance. This guidance states that initial spares are only to be funded until their demand history has been established or for a period not to exceed 2 years. For the three systems we reviewed, initial spares requests submitted by the Army and the Navy provide for a much longer support period than initial spares requests submitted by the Air Force.

Air Force

In the Air Force, F-16 investment spares requirements were funded only as initial spares during the first 2 years of deployment. For example, only spares needed to support the first 150 aircraft deployed between January 1979 and 1981 were funded as initial spares. Investment spares needed to support F-16 aircraft deployed after January 1981 have been considered as part of the replenishment request.

As stated earlier, the replenishment program is not shown by weapon system. F-16 initial spares requests for fiscal year 1979 and after reflect only spare engine requirements and an initial quantity of newly designed spares which have not been stocked. As a result, F-16 initial spares requests dropped significantly after the fiscal year 1978 request (see following chart).

F-16 Cost Data Sheet Submitted to the Congress

<u>FY</u>	<u>No. of aircraft</u>	<u>Cost of initial spares</u> (millions)
1978 and before	105	\$276.3
1979	145	105.6
1980	175	98.8
1981	180	57.4
1982	120	114.0

Navy

In the Navy, F/A-18 investment spares requirements are computed and funded as initial spares for all aircraft being deployed before, and 19 months after, the Navy assumes aircraft support responsibility. For example, the first F/A-18 was delivered to the fleet in February 1981. However, because of planned contractor maintenance support, the Navy will not assume aircraft support responsibility until October 1983 and will fund spares requirements for the 217 F/A-18s to be deployed between February 1981 and March 1985 as initial spares, a period of 4 years. Investment spares requirements for F/A-18s being deployed after March 1985 will be included as part of the single replenishment request. Initial spares requests for fiscal year 1983 and after will reflect only initial spare engine requirements for aircraft to be deployed after March 1985 and initial stockage of redesigned spares. The following chart details the F/A-18 initial spares requests.

F/A-18 Cost Data Sheet Submitted to the Congress

<u>FY</u>	<u>No. of aircraft</u>	<u>Cost of initial spares</u> (millions)
1979	9	\$ 50.9
1980	25	97.4
1981	53	209.2
1982	58	305.6
1983	84	101.5

Army

In the Army, only investment spares requirements needed to support aircraft and/or helicopter operations before, and 2 years after, an initial operational capability is achieved are to be funded as initial spares. However, on the Blackhawk helicopter program, investment spares requirements needed to support the helicopters' operations during the first 6 years of deployment will be funded as initial spares. The normal procedure was not used because the Army is using contractor support for the Blackhawk during the first 4 years of operations.

REPLENISHMENT SPARES REQUIREMENTS
ARE NOT BEING FULLY CONSIDERED
FOR NEW AIRCRAFT

Investment spares requirements information being provided to the Congress as budget information does not provide the Congress with the visibility it needs to assess weapon system affordability. For example, replenishment spares funding requests submitted to the Congress are presented for a group of systems, rather than for individual systems, and do not provide data to determine if requirements are being fully funded to meet peacetime and wartime needs.

The services are computing replenishment spares requirements to meet projected peacetime and wartime needs by weapon system. However, the Congress receives only the lump-sum funding request for replenishment spares for all service aircraft and/or helicopters, not the computed requirements. For example, the fiscal year 1981 budget request for Air Force aircraft only showed a funding request for \$846 million for peacetime operating stock and \$337 million for war reserve stock. The request did not reflect what the overall requirement was nor did it provide a funding breakdown by system.

If the fiscal year 1981 replenishment request had been submitted by weapon system and the computed requirements had been reflected, it would have shown the following on the F-15 and F-16 aircraft:

Requirements and Funding - FY 81

	<u>Peacetime</u>			<u>War reserve</u>		
	<u>Computed</u>		<u>Per-</u>	<u>Computed</u>		<u>Per-</u>
	<u>requirements</u>	<u>Funded</u>	<u>centage</u>	<u>requirements</u>	<u>Funded</u>	<u>centage</u>
	(millions)			(millions)		
F-15	\$162.9	\$70.4	43	\$135.0	\$23.6	17
F-16	93.2	61.4	66	349.0	94.5	27

CURRENT SPLIT BUDGETING PROCEDURE
CAN BE IMPROVED

From DOD's perspective, there are advantages to the current split--initial and replenishment--budgeting procedure for spares provisioning.

--Initial spare money for each new weapon system is budgeted as a percentage of the end item's procurement cost and is only available for that system; there is no competition for these funds from other systems.

--The single replenishment budget provides a great amount of flexibility for allocating the funds to the weapon system with the greatest need.

However, the split budgeting procedure can be further improved to provide the visibility congressional decisionmakers need to judge the the total cost of weapon system purchases. DOD could provide a breakdown of the replenishment spares request by weapon system. Thus, the Congress would be more informed on the total spares needs for each new system.

TOTAL SPARES COSTS SHOULD BE
CONSIDERED WHEN JUDGING SYSTEM
AFFORDABILITY

Because the initial provisioning budget may be misleading and the replenishment spares budget does not show requirements or funding by weapon system, the Congress does not have the information it needs to judge the total cost and affordability of various weapon systems. This lack of information affects the Congress control over the budget. If spares must be funded later to keep a weapon system operational, the Congress has little choice but to provide the funds or to limit the use of the weapon. To improve the budgeting process, the Congress could keep the initial and replenishment budget items as they are but require DOD to also provide information on spares needs by weapon system and on the services' projections of spares needs. However, we believe a better system would be for the budget request to show the number of aircraft and the investment spares and spare engine requirements needed to support the system.

When the services decide on how many aircraft to buy, the Congress should fully fund the total cost of the aircraft and the initial and replenishment spares when the procurement is initiated. We believe that this full funding approach provides the Congress and the public knowledge about the full cost of an item when it is presented for funding and helps congressional decision-making regarding funding priorities within the budget year spending ceiling. If an item is funded incrementally, it enjoys an advantage in that only a portion of its cost competes for dollars in a given year. Further, full funding increases the Congress initial control and oversight over total spending and outlays in future years. We believe this is one of the primary objectives of the Congressional Budget Act of 1974.

We realize that, depending on the timing of the budget requests for other procurements, requesting the cost of the end item and needed investment and engine spares could require higher budget authority requests than under current procedures. But the Congress would be in a better position to judge whether total funds are available to buy the spares and the number of aircraft or helicopters requested.

Spare engines probably have been given visibility because of their high cost and potential adverse effect on readiness if not available. Because many aircraft investment spares, such as radar and avionics, cost over \$100,000 per unit and are essential for performance, they should also be given full visibility.

An example demonstrates our proposed change

To better show total investment spares costs, the line item for initial spares could be replaced by two line items--spare engines/modules and investment spares. The latter category would include much of the amounts previously grouped in the replenishment budget.

For example, the 1981 fiscal year budget request for F-16 aircraft did not reflect investment spares (peacetime and war reserve) needed to support F-16s. Instead, as the following table shows, these F-16 needs were combined with all other weapon system needs in the single replenishment budget.

F-16 Budget Request Submitted to the Congress

<u>FY</u>	<u>No. of aircraft</u>	<u>Weapon systems</u>	<u>Cost of</u>		<u>Procurement</u>
			<u>Initial spares</u>		
----- (millions) -----					
1980	175	\$1,557.7	\$ 98.8		\$1,656.5
1981	180	1,819.9	57.4		1,877.3
1982	120	1,392.7	114.0		1,506.7

However, showing these needs by weapon system presents a more accurate picture of total weapon systems costs. As shown below, total F-16 spare costs in fiscal year 1982 are \$461 million, or 31 percent, higher than shown in the F-16 budget submission.

Budget Request Including F-16 Replenishment Spares

<u>FY</u>	<u>No. of aircraft</u>	<u>Weapon systems</u>	<u>Cost of</u>		<u>Spare engines</u>	<u>Procurement</u>
			<u>Investment Peacetime</u>	<u>spares Wartime</u>		
----- (millions) -----						
1980	175	\$1,557.7	\$ 23.5	\$ -	\$ 87.5	\$1,668.7
1981	180	1,819.9	74.9	94.5	44.6	2,033.9
1982	120	1,392.7	113.7	240.7	220.2	1,967.3

Even more dramatic, however, is an examination of the computed investment spares requirements which were not part of DOD's funding requests. As shown below, the Air Force computed these much higher than the budget request. Again using fiscal year 1982, the computed requirements were over \$800 million, or 54 percent, higher than the budget request.

FY	No. of aircraft	Cost of				
		Weapon systems	Investment spares		Spare engines	Procurement
			Peacetime	Wartime		
------(millions)-----						
1980	175	\$1,557.7	\$ 39.2	\$176.8	\$218.0	\$1,991.7
1981	180	1,818.9	106.6	349.0	216.3	2,490.8
1982	120	1,392.7	130.0	403.4	400.4	2,326.5

Such information would provide a better picture of the costs of weapon systems and provide the Congress with more accurate data on which to judge affordability before authorizing a purchase. In the F-16 example, the Congress would know that, in addition to the \$1.5 billion of acquisition funds for 120 F-16s and some support, there would also be \$460 million of other F-16 investment spares funding requested. According to Air Force computations, this information would still result in an F-16 investment spares and spare engine shortfall of \$359 million.

With this type of information, the Congress may choose to evaluate the merits of options other than authorizing the total number of aircraft requested.

CONCLUSIONS

While there are some advantages to the current split--initial and replenishment--budgeting procedure for spare parts, there are also disadvantages. For example:

- The use of initial provisioning funds differs between services and the concept of what is to be bought with these funds is not well understood by the Congress.
- Because replenishment funds are budgeted together for all aircraft and helicopters, there is no visibility on the spares needs by system.

To better judge the overall affordability of a system, the Congress should have more information on spares needs as they relate to the proposed aircraft or helicopter buy. The Congress should know the total spares needs for each system, rather than total replenishment needs as a lump-sum requirement. With this information, the Congress could better evaluate the overall affordability of a system and evaluate alternatives, such as

buying fewer but better support end items. Such evaluations would have to consider potential increased unit costs of less economical production quantities.

AGENCY COMMENTS AND OUR EVALUATION

DOD agreed with our recommendation that, in submitting budget requests for major weapon systems, it should identify all the spares required to field a weapon system. To do this, we proposed in our draft report that DOD eliminate the budget distinction between initial and replenishment spares and instead use more descriptive categories, such as "investment spares" and "spare engines." DOD correctly concluded that we did not intend that initial and replenishment needs be computed with the same methods but just be identified together by weapon system.

While agreeing with the intent of our recommendations--to improve visibility by having all spares required to field a system identified with that system--DOD believed that it could better accomplish our recommendations by redefining initial spares, for budget purposes, to include all spares needed to field a system. The term "replenishment spares" would then only include the replacement spares bought throughout the life of the system and would be maintained.

We consider DOD's proposal to be responsive to our intent and we have changed our recommendation accordingly. The dollar amounts shown in the initial spares budget requests should significantly increase, with corresponding decreases in the replenishment budget, over the fielding period of the system (for example, 5 to 10 years). However, we still believe that to further improve visibility, the redefined initial spares budget should be shown in the descriptive categories that we originally proposed.

RECOMMENDATIONS

We recommend that the Secretary of Defense:

- In submitting budget requests for major weapon systems, show total spares needs by weapon system.
- Redefine, for budget purposes, initial spares to include all spares needed to field a weapon system and provide a breakdown of the initial spares budget request in more descriptive categories, such as "investment spares" (peacetime and war reserve shown separately) and "spare engines."

CHAPTER 4

COMBINED PURCHASE OF INVESTMENT

SPARES WITH PRODUCTION ORDERS

OFFERS SIGNIFICANT SAVINGS

The spares acquisition integrated with production (SAIP) concept may reduce the high cost of aircraft and helicopter investment spares. Savings of 14 percent or more could be achieved by combining investment spares orders with those orders placed by the contractor for its production line requirements. However, greater use of this concept has been hampered by DOD policy on long-lead funding, which only allows advance funding for long-lead items 1/ to meet production schedules. With current delivery leadtimes in excess of 2 years for many spares, the policy has resulted in the same item being ordered once for production and much later as a spare. Economies of scale are lost, administrative costs are increased by separate orders, and spares are subject to being a different configuration from the produced end item.

AIR FORCE HAS SAVED MILLIONS USING SAIP

SAIP and the benefits to be derived from its application are not new. Consolidation of manufacturing requirements is a prudent business practice which is used by industry to reduce unit production cost. Savings are achieved through economies of scale by cost avoidances associated with separate materiel orders and by manufacturing actions when spares and production parts are not ordered and managed together. While not always successful, the Air Force has used SAIP to save millions of dollars on certain aircraft spares.

The SAIP process and procedures, which were adopted by the Air Force and used to buy initial investment spares for the F-16 and A-10 aircraft, were developed by McDonnell-Douglas, the prime contractor for the F-15 aircraft. Anticipating DOD to increase the number of F-15s it planned to buy, McDonnell-Douglas had developed contractual options with its vendors to obtain additional parts. However, when the Air Force did not increase the F-15 buy, McDonnell-Douglas offered to let the Air Force take advantage of the options and buy the additional parts as spares. By exercising these options, according to a March 1980 Air Force study, 2/

1/Items that require ordering more than 24 months in advance of need.

2/"SAIP Study - Final Report" (Air Force Acquisition Logistics Division, Mar. 1980).

the Air Force was able to save approximately \$100 million over a 3-year period for F-15 initial spares.

On the F-16 and A-10 programs, the Air Force had mixed results using SAIP to procure 10 to 15 percent of high-cost initial spares. The Air Force study found that the F-16 SAIP program had problems from the beginning and was canceled after the Air Force attempted three annual buys. The study cited poor implementation procedures, failure of the prime contractor, General Dynamics, to include SAIP in the subcontractor's productions contract, and a lack of order quantity stability as reasons for little or no savings being achieved using the SAIP concept. However, on the A-10 program, SAIP did result in substantial savings and the Air Force concluded that A-10 SAIP experience was an excellent example of what could be saved because many of the same items bought under SAIP were also bought separately. After contracting to use SAIP for 364 items, the Air Force found that it had to purchase additional quantities of 167 of these same items to meet an increased need in war reserve stock and to provide additional spares for an increased flying hour program. The Air Force study found that SAIP resulted in a \$64 million, or approximately 14 percent, savings.

Other advantages of SAIP

Although reducing the cost of investment spares and items for production installation is the key benefit of using SAIP, the concept also provides the advantage of part compatibility (configuration control) between production parts and spares and improves early support of new systems by enabling more timely delivery of spares. Having spares delivered in the same configuration as those on the aircraft to be supported minimizes retrofit costs and prevents obsolescence created by unstable design.

SAIP USAGE COULD SAVE MILLIONS IN INVESTMENT SPARES COST

Billions of dollars are spent annually for weapon systems' investment spares. In fiscal year 1981, for example, \$2.6 billion was budgeted just for aircraft and helicopter spares. Therefore, the potential for savings is great. In response to our previous report 1/ on logistics support of the F/A-18 where we recommended the use of SAIP, among other logistics improvements, DOD has recently agreed to use SAIP in its F/A-18 program and estimates the savings to be between \$250 and \$330 million.

1/"Operational and Support Costs of the Navy's F/A-18 Can Be Substantially Reduced" (LCD-80-65, June 6, 1980).

EXPANDING SAIP USAGE MAY BE HAMPERED BY
DOD FUNDING POLICY

The DOD policy ^{1/} that allows usage of advanced funding for long-lead items needed to meet production schedules but not for long-lead spares was established in an era when aircraft materials and components had leadtimes generally of 18 months or less. Spares orders could still be placed after production and be delivered in time to support the new aircraft when operational. However, today's procurement and delivery of needed aircraft and helicopter spares are being sharply affected because of expanding delivery leadtimes, many in excess of 2 years, and rapid rising prices.

While the services and DOD have been responsive to recommendations to use SAIP, unless the funding policy is changed, SAIP may not get broad usage. For example, in our June 1980 F/A-18 report, the Navy agreed to use SAIP but pointed to DOD's restrictive policy. DOD, in turn, said it encouraged the Navy to use SAIP but only when it did not conflict with the full funding policy.

SAIP PROBLEMS SHOULD BE MINIMAL

Also, in response to our F/A-18 report, DOD acknowledged that SAIP showed promise but pointed to two potential problems: overprocurement based on inaccurate forecasts of demand and spares becoming obsolete before they are used. Nevertheless, DOD said it would continue to review SAIP experience, considering both the potential cost savings and other advantages and the potential risks, and would reevaluate its policies based on the results.

Regarding the potential problems identified by DOD, it appears that SAIP should actually minimize them. While overprocurement of spares is a potential problem (actually, as discussed in ch. 5, it is also a current problem under non-SAIP), the configuration control aspects of SAIP should minimize any spares not being available because of obsolescence. Under SAIP, spares are ordered in the same configuration as the production parts. They can only become obsolete if the design of the aircraft is modified.

DOD's June 29, 1981, memorandum directing the Navy to use SAIP for the F/A-18 apparently resulted from DOD's review and reevaluation of SAIP. However, the Navy still says that to implement SAIP, as directed by the Secretary of Defense, will require approval to use advanced funding for long-lead spares. Approximately 75 percent of F/A-18 spares have long leadtimes.

^{1/}DOD Directive 7200.4, "Full Funding of DOD Procurement Programs" (Oct. 30, 1969).

It is too soon for us to evaluate whether the use of SAIP to buy F/A-18 spares will be an exception or a policy change for use in other systems. However, we are encouraged. DOD has told us that in its proposed revision to DOD Directive 4140.40, "Basic Objectives and Policies on Provisioning of End Items of Material," it has included wording to encourage concurrent ordering of spares with production components and the use of special contract clauses to assure that spares are always delivered in the current configuration.

CONCLUSIONS

The Air Force has used the SAIP concept successfully. On the A-10 program, the Air Force documented an actual savings of \$64 million using SAIP to buy 364 spares items. For the F/A-18, the Navy estimates using SAIP will save between \$250 and \$330 million. With annual purchases of weapon systems spares being in the billions of dollars, the potential for further significant savings under SAIP is great. Potential problems--overprocurement and spares becoming obsolete--actually appear to be less under SAIP than under current non-SAIP spares purchases.

DOD's policy of limiting the usage of advanced funding for long-lead items needed for production is not realistic in today's environment where the leadtime for some investment spares exceeds 2 years.

AGENCY COMMENTS AND OUR EVALUATION

In our draft report, we proposed that DOD rescind its policy of not allowing usage of advanced funding to buy spares and direct the services to use SAIP. In commenting on this proposal, DOD said that existing policy does not prevent the services from using SAIP. However, in a subsequent discussion with the Office of the Secretary of Defense (Manpower, Reserve Affairs and Logistics and Comptroller) officials, they agreed that the current policy on limiting the usage of advanced funding to long-lead items needed for production could prevent the usage of SAIP. They stated that DOD would be agreeable to a recommendation that DOD amend the directive to allow the usage of advanced funding for spares to take advantage of concurrent ordering of spares with production components.

In its comments, DOD also suggested that we not recommend the usage of SAIP, per se, since it is an Air Force term with certain connotations. Instead, we should recommend combined ordering of spares and production components. We agree and have changed our recommendation accordingly.

We are encouraged by DOD's comment that in its proposed revision to DOD Directive 4140.40, "Basic Objectives and Policies on Provisioning of End Items of Material," it included wording designed to encourage the use of combined ordering of spares with production components. DOD believed that this was responsive to the intent of our recommendations. We agree, but we feel that

because of the great potential involved, as demonstrated by the recent estimate of savings on the F/A-18, DOD should act immediately to determine if combined purchasing can be used on other systems.

RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Amend the DOD policy on the use of advanced funding and allow its use for spare parts to take advantage of combined purchases of spare parts with production components.
- Direct that other systems be evaluated for potential use of the combined purchasing concept and request the money needed to use the concept.

CHAPTER 5

INITIAL STOCKAGE INVESTMENT FOR

SPARE PARTS CAN BE REDUCED

DOD's policy is to minimize investment in initial spares, but the services are responsible for the final determination of the range and quantity of initial spares to buy. On the systems we reviewed, initial spares were bought to meet anticipated demand rates of 80 to 95 percent. While there may have been sound management reasons for the stock levels, there needs to be more justification that DOD's minimum investment policy is being followed.

The potential exists to reduce initial investment spares cost by using lower stock levels and making greater use of phased provisioning--a management technique, endorsed by DOD, which defers the purchase of selected initial investment spares.

DOD POLICY IS TO MINIMIZE INVESTMENT

The principal objectives of DOD provisioning are (1) to assure the timely availability of required spare stocks to sustain operations until normal replenishment is available and (2) provide this support at the least initial investment cost. DOD policy recognizes that initial demand estimates which are based on engineering estimates have inherent inaccuracies and may result in large quantities of investment spares being stocked that have little or no demand during the initial support period.

Service officials are using initial provisioning budget estimates, based on a percentage of procurement cost, to determine the stockage levels of initial investment spares. The Air Force stocked initial investment spares for the F-16 aircraft to meet a 90- to 95-percent demand rate. The Navy is stocking initial investment spares for the F/A-18 to meet an 80-percent demand rate, and the Army allowed the contractor to use its own judgment as to how many investment spares to stock for the Blackhawk helicopter.

There may be sound reasons for high initial stock levels (for example, we were told that because the F-16 was a multinational effort, high initial readiness was a primary concern). However, more support is needed to justify such a decision. DOD's instruction 1/ on determining initial stocks of spare parts

1/DOD Instruction 4140.42, "Determination of Initial Requirements for Secondary Item Spare and Repair Parts" (Aug. 7, 1974).

recognizes that high stock levels may not be necessary to achieve desired support. The instruction states, in part:

"There have been many audit reports and studies which indicate that the range of items stocked is often far greater than that necessary to provide adequate support, and that a reduction in the range of stocked items can often be made without adversely affecting support."

ADVANTAGES AND POTENTIAL CONSEQUENCES OF HIGH INITIAL STOCK LEVELS

High levels of initial spares generally provide increased support and, if the requirements for the parts remain valid, the parts bought may be less expensive than if purchased later. However, as noted previously, support may be achievable with a lower investment. Also, there are potential adverse consequences of high stock levels. For example,

--parts may be bought which are not initially needed and may have to be modified before they are used and

--the incremental costs of increasing stock levels may be great and could be deferred.

Parts may not be needed and may require modification

Because the services cannot accurately determine initial requirements for investment spares, spares can become obsolete before use, or modification costs to conform them to configuration changes may be costly, or both.

For example, according to a November 1980 spares usage report, approximately 35 percent (423 of approximately 1,200) of peculiar F-16 investment spares items stocked at depots were not used during the first 18 months of operations.

Stocking initial investment spares to meet a high demand rate significantly increases the risk of having to modify a large quantity of spares because of aircraft modifications. For example, in October 1981 the Air Force is scheduled to begin a major modification program involving approximately 150 F-16 aircraft. This modification program will require the Air Force to incur an additional cost (exact amount not yet determined) to modify nearly 11 percent of the initial investment spares in stock.

The modification program is designed to correct operations deficiencies, improve the existing systems, and bring all F-16 aircraft, as well as support assets, to a current production configuration.

Incremental costs of higher stock levels may be great

Stocking at various levels can increase costs significantly. While the money will be spent to purchase parts eventually, initially buying to lower levels may defer investment and avoid the added costs if modifications become necessary.

During fiscal years 1976-78, the Air Force spent more than \$171 million for investment spares to support 150 F-16s during the first 2 years of operations. Air Force officials stated that F-16 investment spares were stocked to meet a 90- to 95-percent demand rate primarily because funds were available and that the Air Force wanted to insure a high readiness rate because the F-16 was being coproduced with four North Atlantic Treaty Organization countries.

Stocking F-16 investment spares at a 90- to 95-percent demand rate versus, for example, an 80- or 85-percent demand rate, increased the initial spares cost by approximately 50 percent. On the basis of our review of the computation runs used to compute the optimum mix of line replacement and shop replacement units for the 95 ^{1/} spare items procured under SAIP, we found that the Air Force could have deferred spending \$13.5 million if it had used an 85-percent demand rate and \$16.5 million if it had used an 80-percent rate, as the Navy did for the F/A-18.

If our analysis of the 95 spare items is applicable to the overall buy of approximately 1,200 spare items, then use of an 85-percent demand rate could have reduced initial spares costs by approximately \$56 million and an 80-percent demand rate could have reduced costs by about \$70 million.

PHASED PROVISIONING SHOULD BE USED TO REDUCE THE HIGH COST OF INITIAL SPARES

DOD encourages the services to use the phased provisioning concept ^{2/} because it may save millions of dollars in initial investment costs. However, according to a Defense Audit Service report, ^{3/} the services have been hesitant to use the concept during initial provisioning.

^{1/}Our analysis was limited to the 95 items procured under SAIP because the computation runs for the other spares were no longer available.

^{2/}DOD Directive 4140.19, "Phased Provisioning of Selected Items for Initial Support of Weapon Systems, Support Systems, and End Items of Equipment" (May 1, 1968).

^{3/}"Report on the Review of Initial Spares Provisioning for Tactical Aircraft" (Defense Audit Service No. 80-034, Nov. 26, 1979).

Phased provisioning is a management tool whereby procurement of all or part of the total requirement of selected spares is deferred until the later stages of production when operational programs and design configurations of assets are more stabilized and the services have acquired sufficient operational data to more accurately predict requirements. This management tool is logical because it is designed to

- defer the purchase of total initial requirements;
- avoid excessive stock on hand, especially if a weapon system undergoes modification;
- provide easy access to spare parts held by the contractor; and
- avoid obsolescence.

However, current DOD guidance only requires the services to include phased provisioning as an option in all production contract for complex weapon systems and other high-cost items. According to the November 1979 Defense Audit Service report, weapon system project managers not using phased provisioning could cause DOD to incur costs unnecessarily. The report indicated that the services generally do not use phased provisioning because they lack confidence in the concept. According to the report, the Air Force was the only service who had used the phased provisioning concept.

The report recommended that DOD require the services to use phased provisioning and provide additional guidance on how to implement it. As of January 1981 DOD had not taken any specific actions on these recommendations.

CONCLUSIONS

DOD guidance for initial provisioning states that minimum initial spare stocks should be bought to sustain operations until normal replenishment is available and that such support should be at the least investment cost. However, the guidance does not define minimum and because funds budgeted for initial support are based on a fixed percentage of the weapon system costs, the amount of money available appears to be the driving force in determining the level of initial spares to stock.

While there may be other management reasons for levels of stocking that appear high, the reasons should be justified in context with DOD's stated policy that initial investment costs be minimized. Advantages of these stock levels, in terms of increased support or possibly reduced costs, should be better justified recognizing the potential adverse consequences. For example, while the F-16 experience may not be representative, it does show the magnitude of these potential consequences:

- Stocking cost being greatly increased. Stocking to an 85-percent demand rate versus a 90- to 95-percent demand rate may have reduced the F-16 investment by over \$50 million.
- Spares being bought that are not needed. During the first 18 months of F-16 operations, 35 percent of the items bought were not used.
- Spares needing modification before they are used. A planned F-16 modification will involve 11 percent of initial spares in stock.

DOD has also endorsed the phased provisioning concept, but the services have been hesitant to use it. Although a November 1979 Defense Audit Service Report recommended that DOD require the services to use phased provisioning, as of January 1981, there has been no DOD action.

RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Require that the services better justify how their levels of initial provisioning of spares meet DOD's policy on minimizing initial investment costs.
- Direct the services to use the phased provisioning concept as was recommended by the Defense Audit Service.

AGENCY COMMENTS

DOD agreed with our recommendation on the need to improve verification and justification procedures for initial provisioning of spare parts. DOD stated that it is currently experimenting with new mathematical models that would size weapon system spare parts inventory levels to meet explicit weapon systems availability objectives, and once adopted, would incorporate improved means of verification and justification of the requirement.

DOD also agreed in principle with our findings and recommendation that the services be required to use the phased provisioning concept and correctly pointed out that phased provisioning was not appropriate in all cases. DOD confirmed that the services have not applied the concept and stated that it intended to review previous applications of phased provisioning, problems that have been encountered, and the potential for expanding the concept.

CHAPTER 6

OPERATIONAL DEMAND DATA SHOULD BE USED

SOONER TO COMPUTE INVESTMENT SPARES REQUIREMENTS

DOD policy requires that investment spares requirements be computed based on operational and/or test data whenever available, in lieu of engineering estimates. However, the services are greatly extending the period during which they determine requirements based on engineering estimates.

While varying interpretations of DOD policy may be contributing to this, the underlying cause appears to be the services' desire to stretch out the initial provisioning period because funds during this period are plentiful. Once operational data is used for computations, requirements are funded from the replenishment spares budget which, as discussed earlier, is constantly underfunded.

DOD GUIDANCE IS BEING INTERPRETED DIFFERENTLY

DOD guidance 1/ on using contractor estimates for computing initial spares and establishing a demand development period for verifying operational failure rates for each spare is being interpreted differently by each service. The DOD guidance states that a demand development period will be established beginning with the preliminary operational capability (POC) data and extended to a point in time, not to exceed 2 years, when requirements can be forecasted based upon actual demands or other empirical data indicative of the need for spare and repair parts. However, for the three weapon systems we reviewed, the services are using different demand development periods.

In the Air Force, the POC date for the F-16 aircraft was established for January 1979--the date the first F-16 was delivered to Hill Air Force Base, Utah--with the demand development period extending from January 1979 to January 1981.

For the Blackhawk helicopter, the Army said that the demand development period would extend from November 1979--the initial operational capability date--to January 1982. However, because the Army has been using contractor support for the Blackhawk since fielding it in October 1978, the Army initially received little operational demand data on any of the helicopter investment spares and, as of October 1980, was still using engineering estimates to compute requirements. However, Army officials told

1/DOD Instruction 4140.42, "Determination of Initial Requirements for Secondary Item Spare and Repair Parts" (Aug. 7, 1974).

us that the contractor has preserved all demand data and had provided it to the Army.

The Navy does not plan to start the demand development period for the F/A-18 aircraft until after it assumes supply support responsibilities from the contractor in October 1983. However, we have been told that the Navy has begun using actual spares usage data to evaluate the impact of projected procurement on readiness. The Navy stated that the initial analyses have been completed and will be updated starting in July 1981.

As a result, operational demand estimates will not be used to compute investment spares requirements for some weapon systems for up to 4 years after initial deployment, as shown below.

<u>Type of aircraft</u>	<u>Initial deployment date</u>	<u>Actual or planned initial usage of operational data</u>	<u>Actual or planned full usage of operational data</u>
Blackhawk	Oct. 1978	-	a/Jan. 1982
F-16	Jan. 1979	Mar. 1980	Jan. 1981
F/A-18	Feb. 1981	-	Apr. 1985

a/This target date appears optimistic because the Army will not assume supply support for the Blackhawk until Mar. 1982. Operational demand data acquired during the contractor support period had not been given to the Army as of Oct. 1980.

OPERATIONAL DEMAND DATA SHOULD
BE USED AS EARLY AS POSSIBLE

Obviously, actual operating data is better for computing spares needs and should be used as early as possible, instead of relying on engineering estimates. DOD Instruction 4140.42 recognizes this. For example, in discussing policy for computing requirements during the demand development period, DOD guidance states that, except for unusual circumstances where temporary conditions have caused past demands not to be indicative of the future, actual demand data will be given increasing emphasis during the development demand period. This is expressed as the minimum amount of weight given to actual data in calculating requirements, as shown below.

Minimum weight

POC date plus 6 months	0
POC plus 6 to 12 months	.25
POC plus 12 to 18 months	.50
POC plus 18 to 24 months	.75
POC plus 24 or more months	1.00

In other words, after 6 months of experience, actual demand data is to be increasingly the determining factor in calculating requirements. However, for the three systems we reviewed, none of the services were complying with this requirement. Only the Air Force, for the F-16, considered actual demand at all during the first 2 years of operations. Even then, it did so only after the F-16 had operated for 12 months instead of 6 months.

F-16 experience demonstrates
need for actual demand data

Once the Air Force started considering actual demand data for the F-16, it found that it rarely achieved the engineering demand estimates (based on predicted failure rates). This is understandable since, initially, demand must be based on various assumptions. However, it also explains why it is important to use operational data as soon as possible.

Our review of 30 F-16 investment spares showed that the predicted failure rate compared to actual experience was greater 17 times, less 11 times, and close 2 times. In cases where the predicted failure rate was greater, insufficient spare parts were ordered. For example, as shown below, accelerometer assemblies were predicted to operate for 2,100 flying hours before failing, but in actual experience they lasted only 543 hours.

	<u>Failure rate</u>	
	<u>Predicted</u>	<u>Actual</u>
	(hours)	
Accelerometer assembly	2,100	543
Fire control computer	214	91
Radar antenna	372	88
Radar computer	250	95
Control interface unit	250	117
Radar control panel	1,040	844

Conversely, in cases where the predicted failure rate was less, more parts were ordered than needed. For example, the pneumatic sensor assembly was expected to fail every 382 flying hours but only experienced a failure every 945 hours.

	<u>Failure rate</u>	
	<u>Predicted</u>	<u>Actual</u>
	(hours)	
Flight control computer assembly	100	142
Pilot display unit - heads up display	113	177
Pneumatic sensor assembly	382	945
Rate gyro assembly, flight control	1,500	3,248
Central air data computer	247	490

Because many spare parts have leadtimes in excess of 2 years or more, the sooner actual data is used the more valid are planned purchases. Otherwise, engineering estimates are used to plan third and fourth year procurements when actual data, according to DOD policy, should be considered.

Services may not be using
operational data sooner because of funding policy

Since early use of operational data would benefit the services by better matching spares requirements to needs, why are not the services complying with DOD policy that requires the use of actual demand data? The underlying reason may be that during the demand development period spare parts are bought with initial provisioning funds.

As discussed earlier, funds for initial provisioning are stated as a percentage of weapon system cost and are adequate to meet a high purchase rate--for example, for the F-16, a 90- to 95-percent demand rate. On the other hand, services' computed requirements for replenishment spares requirement have seldom been fully funded. For example, only 35 percent of the replenishment spares requirement for the F-16 was funded for fiscal year 1981. Therefore, it is advantageous for the services to lengthen the time a weapon system program can purchase parts from initial provisioning funds.

The budgeting change we proposed earlier--eliminating the distinction between initial and replenishment funding for investment spares--should erase any advantage of a longer development period. Then, in our opinion, the services would comply with the DOD policy on using actual demand data after 6 months' experience.

CONCLUSIONS

DOD guidance requires that actual demand data be used whenever available, instead of engineering estimates, to compute spare parts requirements. However, on the three weapon systems we reviewed, only the Navy indicated that it was complying with the guidance. Using actual data would alleviate the potential problems of estimated data--either not enough quantities are bought, affecting readiness, or too much is bought, wasting money.

While differing interpretations of DOD policy may be contributing to the services not complying with the policy, the underlying cause may be the services' desire to extend the demand development period during which initial provisioning funds can still constantly be used. Otherwise, requirements must be funded from the replenishment spares budget which is constantly underfunded.

The changes in the budget process discussed earlier--funding all investment spares needed to field a weapon system as

initial spares--should negate any advantage of stretching out the demand development period.

AGENCY COMMENTS AND OUR EVALUATION

DOD agreed with our recommendation that DOD guidance on using operational demand data should be clarified to prevent differing interpretations. DOD stated that it would address this area in its efforts to redefine the term "initial spares."

DOD also agreed that demand development periods should be established as early as possible but pointed out that the periods must be representative of actual operating requirements. We agree.

In disagreeing with the second part of our recommendation that the services start using operational demand data after 6 months to adjust requirements computations, DOD, in our opinion, misunderstood our intent. DOD commented that a 6-month development demand period would provide inadequate demand data to forecast requirements realistically. In some cases this may be true, but DOD guidance states that, except for unusual circumstances, actual demand data should be given increasing emphasis, starting at 6 months. The intent of our recommendation is not to shorten the demand development period from the 2 years currently allowed, but rather to allow DOD to be more stringent in requiring that actual usage data be used as early as 6 months into the development period as currently required in DOD Instruction 4140.42.

RECOMMENDATION

We recommend that the Secretary of Defense review and revise DOD guidance on using operational demand data to (1) clarify language that could result in differing interpretations and (2) require that the services establish demand development periods as early as possible and start using operational demand data after 6 months to adjust requirements computations.



SR
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ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

JULY 21, 1981

Mr. Donald J. Horan
Director, Procurement, Logistics,
and Readiness Division
General Accounting Office
Washington, D.C. 20548

Dear Mr. Horan:

This is in reply to your letter of June 3, 1981 to the Secretary of Defense which transmitted your Draft Report SMD-81-17 titled "Improved Methods For Budgeting and Provisioning Spares For New Aircraft Are Needed" (OSD Case #5718).

Your report has been reviewed with interest and it is believed that it will help generate improvements in the initial spare parts budgeting process and in ongoing efforts to increase the visibility of the cost of fielding weapons and support systems. We concur generally in the intent of the recommendations but we believe there is a lack of clarity in the way some of the findings and recommendations are presented. Furthermore the report reflects some misconceptions regarding the nature of initial and replenishment spares and the DoD policy on long-lead funding and its relation to contracting policy. The enclosed comments address these and other subjects in detail and set forth recommendations for your consideration in preparing the Final Report.

We appreciate the opportunity to comment on this report in draft form.

Sincerely,

James N. Juliana
James N. Juliana
Principal Deputy Assistant
Secretary of Defense
(Manpower, Reserve Affairs, and Logistics)

Enclosure
As stated

GAO NOTE: The page numbers in this appendix refer to pages in the draft report.

DOD COMMENTS ON GAO DRAFT REPORT, "IMPROVED METHODS FOR BUDGET-
ING AND PROVISIONING SPARES FOR NEW AIRCRAFT ARE NEEDED"
(SMD-81-17) (OSD CASE #5718)

COMMENTS ON RECOMMENDATIONS

GAO Recommendation: That the Secretary of Defense, in submitting budget requests for major weapon systems, show total spares needs by weapon system.

DoD Comment: Concur in what is believed to be the intent of the recommendation. The entire report deals with spare parts in support of new aircraft. We believe that the intent of this recommendation is to have all the spares required to field a weapon system identified to that weapon system. We concur in that objective with the qualification that common items (i.e., items used on more than one weapon system) preclude complete requirement identity by weapon system.

GAO Recommendation: Eliminate the budget distinction between initial and replenishment spares for weapon systems; instead show budget submissions in more descriptive categories such as investment spares (peacetime and war reserves shown separately) and spare engines.

DoD Comment: Nonconcur. The report does not address the factor that currently provides the basic distinction between initial and replenishment spares, i.e., the method of requirements computation. Initial spares requirements are computed using a more restrictive stockage formula than that used for replenishment spares because it is recognized that information available in the initial phase of a weapon system's life upon which to base spare and repair parts range and depth determinations is, of necessity, based upon various unproven assumptions and subject to change. When sufficient operational experience has been gained, the resultant data is used in stockage formulas that result in more liberal stockage levels than those computed for initial spares. We do not believe that the GAO intended to recommend that the same stockage formulas be used regardless of whether estimates or actual experience are used to determine the requirement.

We recognize the desirability of identifying all the spares required to field a weapon system, and think this can be accomplished best by redefining the term initial spares, for budget purposes, to encompass all spares required to field a weapon system. The term replenishment spares encompasses replacement spares bought throughout the life of the weapon system, and should not be eliminated. This type of redefinition would allow us to continue to compute spares requirements in a judicious manner and at the same time provide the desired visibility.

GAO Recommendation: Rescind the DoD policy of not allowing usage of long-lead funding for investment spares and direct usage of SAIP.

DoD Comment: Recommend that Chapter 4 and this recommendation be rewritten to reflect more clearly and without ambiguity what the GAO position and recommendation actually are.

The DoD policy does permit the programming and procurement of spare parts in advance of the end item procurement. As stated in the DoD response to the GAO Draft Report entitled, "Operating and Support Costs of the Navy's F/A-18 Can Be Substantially Reduced" (included as Appendix 1 to the GAO Final Report) (OSD Case #5394), the Spares Acquisition Integrated with Production (SAIP) approach comes into conflict with current DoD policies only in those instances where spares are procured in advance of "leadtime away" of their need date in order to make spares buys concurrent with production. Therefore, an application of SAIP where items are procured "leadtime away" can be accomplished within the existing policy. It is suggested that the GAO recommendation be rewritten to make it clear whether GAO is recommending that spares be bought earlier than they normally would be in order to obtain price reductions through concurrent buys, or that SAIP be used only in those cases where concurrent buys can be made without having to procure spares earlier than a "leadtime away." If GAO is recommending earlier buys, it would seem to be in conflict with the discussion under the Report section entitled "Advantages and Potential Consequences of High Initial Stocking Levels."

With regard to that part of the GAO recommendation which says the Secretary of Defense should direct the usage of SAIP, the term SAIP means different things to different people. It is not a DoD term, but one coined by the Air Force. Generally, the Air Force applications of SAIP embrace the following three concepts: (1) spares are procured concurrent with production, (2) the spares are procured by use of a sole source contract with the prime contractor, and (3) the contract contains a clause stating that spares will be delivered in the latest configuration of the end item.

There are two areas where it is not clear what the GAO position on SAIP is and what GAO is recommending. First, is GAO recommending that spares be procured earlier than a procurement "leadtime away?" This issue is discussed above. Second, is GAO recommending that initial spares be procured from the prime contractor? An example of the confusion about this issue is reflected on page 76 of a GAO Draft Report dated February 13, 1981, "Logistics Planning for the XM-1 Tank: Implications for Reduced Readiness and Increased Support Costs," (OSD Case #5640). On this page GAO recommended breakaway of spares procurement from the prime contractor, and also recommended the use of SAIP.

In a proposed revision of DoD Directive 4140.40, "Basic Objectives and Policies on Provisioning of End Items of Materiel," we have included

wording designed to encourage the use of concurrent ordering of spares with production and the use of special contract clauses to assure that spares are always delivered in the current configuration. We believe these actions are more responsive to what we think is intended in the GAO report than a directed "usage of SAIP" which would be subject to varied interpretations.

GAO Recommendation: Require that the Services better justify how their levels of initial provisioning of spare parts meet DoD's policy on minimizing initial investment costs.

DoD Comment: Concur. We are always receptive to improvement in the way in which weapon systems spares support is provided. In the DoD Logistics Guidance dated March 31, 1980, applicable to fiscal years 1982-86, the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics) requested the Military Services to continue working to develop the ability to size weapon system spare parts inventory levels to meet explicit weapon system availability objectives. We are currently experimenting with this approach that deviates from the traditional stockage objective of meeting a targeted supply availability, i.e., the capacity to satisfy a requisition on the first pass, and attempts to weigh the effect of shortages of individual items on the operational availability of the system. Mathematical models have been constructed that consider numerous options regarding range, depth and stockage location trade-offs. Logistics parameters, such as order and ship time, are entered into the model and the model is run with the objective function of maximizing the operational availability for the system. This concept shifts the supply manager's concern from inventory performance to weapon system performance. Along with the adoption of new techniques for spares requirements determinations, we plan to incorporate improved means of verification and justification of the requirement.

GAO Recommendation: Direct the Services to use the phased provisioning concept as was recommended by the Defense Audit Service.

DoD Comment: Concur in principle. Phased provisioning would not be appropriate for every item in every contract. Also, the contractor involved would have to agree to enter into the necessary contractual arrangement. To the extent that phased provisioning is applicable, it has already been directed. Military Standard 1517, "Phased Provisioning," is mandatory for use by all Departments and Agencies of the Department of Defense. The GAO Draft Report states: "However, current DoD guidance only require the Services to include phased provisioning as an option in all production contract for complex weapon systems and other high cost items. It does not require the Services to use the technique." The following sentence is quoted from Military Standard 1517: "The decision to exercise the option will be made whenever the potential exists for the contractor to maintain buffer stocks."

COMMENTS ON PORTIONS OF THE TEXT OF THE REPORT

Page 1, third paragraph: This paragraph redefines the provisioning process and infers a misunderstanding of basic provisioning principles. The provisioning process deals only with an initial support period. The reason for the current aberration involving initial and replenishment spares is explained in the DoD comment on the second GAO recommendation.

Page 3, second paragraph: Change line 12 to read "Naval Air Systems Command Headquarters, Washington, D.C.."

Page 7. The statement is made that shortages of Black Hawk spares and lower than desired readiness rates are due to failure on the part of the contractor to make an adequate analysis of support or to use an optimization model. This was not the principal cause for shortages. When the Black Hawk helicopter was first deployed, because of an operational exercise requirement, nearly one half of the inventory was exercised far more extensively than planned. This greatly increased flying hours and caused helicopters to be operated at maximum gross weights and at the outer limits of allowable flight envelopes. Accordingly, shortages of spares cannot be credited to overly optimistic demand rates alone. Sophisticated optimization techniques are now being used to provision spares for new aviation systems being procured. For example, spares planning for the CH-47D heavy lift helicopter modernization program is based on a mathematical model.

Page 8. Subparagraph starting with: "In the Navy, the contractor for the F/A-18 aircraft . ." This paragraph is not correct as written. The F/A-18 contractor utilized Logistics Support Analyses (LSA) and experience data to project early provisioning requirements. As LSA data is computed, the information will be input to the Navy J-14 optimization model for analysis by McDonnell and the Navy. As experience data for F/A-18 is developed, the early projections will be replaced by these data in the J-14 model in the continuing analysis to assure that the range and depth of spares will support F/A-18 operations consistent with funds availability. Delivery of the first pilot production F/A-18 to the Navy was made 31 May 1980.

Page 9. The statement is made that essentiality coding is not being used in the computation of spares requirements. This statement is incorrect. With regard to range determinations, the basis for stockage of non-demand based items, i.e., Insurance and Numeric Stockage Objective items, is essentiality.

Page 13. The first paragraph indicates that only repairable parts, not consumables, are considered as initial spares. This is not true; the term "initial spare and repair parts" encompasses both repairable parts and consumables. The Services' stock fund budgets provide separate identification of consumables that are part of the provisioning process.

Page 15. Change line 5 to read "was delivered to the fleet in February 1981."

Pages 24, 27 and 29. It is incorrectly implied that the DoD policy on "long-lead funding" precludes combining the requirements for initial or replenishment spares in the same production lot as production spares. These portions of the Report should be rewritten in accordance with the DoD comment on the third GAO recommendation.

Page 38. The sentence at the top of the page is presented as an established starting point and definition of the Demand Development Period (DDP) in either DoD Directive 4140.40, "Basic Objectives and Policies on Provisioning of End Items of Materiel" or DoD Instruction 4140.42, "Determination of Initial Requirements for Secondary Item Spare and Repair Parts." In fact, this is not presented in either the Directive or Instruction as the starting point or definition of the DDP. It is possible the DDP has been confused with the Program Forecast Period. Both terms are defined in Enclosure 6 of DoD Instruction 4140.42.

Also on this page, the report states that the demand history for the Black Hawk has been lost because of contractor support during the first four years. The contract requires the contractor to provide demand data to the Army. The contractor has preserved all demands for the Black Hawk since the first day of operation of the first aircraft and provided them to the Army. These are complete and accurate demand data. Further, as indicated above, they cover a time when these helicopters have been subjected to highly intense operational usage very early in their life cycle. These demand data should provide an excellent base for the future as more aircraft are fielded.

On pages 38 and 39 the report states that the Navy does not plan to start the DDP for the F/A-18 aircraft until after the Navy assumes support responsibilities from the contractor in October 1983, approximately 2 1/2 years after the F/A-18 aircraft began operations at LeMoore Naval Air Station in California. The report states further that, as a result, operational demand estimates will not be used to compute investment spares requirements for up to four years after initial deployment. This is not correct. The Navy has started using F/A-18 actual spares usage data to assess the impact on spares procurements, and to evaluate the degree that projected spares procurements will support readiness objectives. Initial analyses, in readiness simulation models, have been completed, and updated analyses are scheduled to start in July 1981, more than two years prior to the Navy Support Date (NSD).

Page 41. The last full sentence on this page states that Services' requests for replenishment spares funding are constantly reduced by DoD before submitted to Congress, and then are not fully funded. We do not

know the basis for this statement. We believe that, for the past several years, the requirement for both initial and replenishment spares has been close to fully funded at the time of budget submission. Unfunded requirements can, however, arise between the time of budget submission and budget execution. This can be caused by a number of factors, the most common being greater than anticipated price and procurement leadtime increases. We have requested the Defense Audit Service to review this area to document what has actually happened in the past with regard to spares funding.

Page 42. After the first sentence of the conclusions paragraph, insert "The Navy's F/A-18 program is complying with this guidance." Delete the second sentence.

Although the Military Departments and Defense Agencies have already been directed to utilize phased procurement, we recognize that there has been very little actual application of the concept. For that reason, we intend to initiate a review of previous applications of phased provisioning, problems that have been encountered, and the potential for expansion of the concept.

GAO Recommendation: Review and revise DoD guidance on using operational demand data to (1) clarify any discussion that could result in differing interpretations and (2) require that the Services establish demand development periods as early as possible and start using operational demand data after six months to adjust requirement computations.

DoD Comment: Part (1)-Concur. This area will be addressed in our efforts to redefine the term "initial spares" as discussed in our comment on the second recommendation.

Part (2)-Nonconcur. The Demand Development Period (DDP) should be established as early as possible; however, it must be representative of actual operational requirement. Six months experience may not be sufficient time to allow for full development of demand data to reflect a full aircraft carrier deployment or land site operational impact. The present policy allows for the transition to use of actual experience in the requirements computation to be made as soon as possible, with a maximum allowable time of two years.

A six-month DDP normally would provide inadequate demand data to forecast requirements realistically because of the following factors:

1. There would be a limited number of installations, which could skew demand adversely with local variations.
2. Limited operation and technical experience could produce unreliable usage data.
3. Limited hours of operation would not be conducive to reasonable requirements forecasting.

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