BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Operational And Support Costs Of The Navy's F/A-18 Can Be Substantially Reduced

The Navy's logistics support planning for the F/A-18 aircraft is comprehensive; however, its operational and support costs could be substantially reduced if the Navy would adopt the following alternative concepts:

--Use multiport avionics test equipment.

--Consolidate avionics repair facilities.

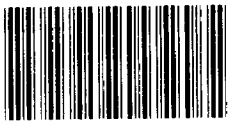
--Buy initial spares concurrently with aircraft installed units.

--Make more effective use of pilot simulators.

--Consolidate F/A-18 squadrons into larger size units.

--Use the reliability centered maintenance concept to determine the need for depot maintenance and pipeline aircraft.

--Eliminate unneeded facilities improvements.



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JUNE 6, 1980

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

IN REPLY
REFER TO:

B-195780

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

This report discusses the Navy's logistics support planning for the F/A-18 aircraft and how substantial reductions in its ownership costs can be achieved. It discusses a number of alternatives which, if adopted, could potentially reduce the F/A-18 operational and maintenance costs by as much as $4 billion.

We initiated this review in response to broad congressional interest in reducing life cycle costs of major weapon systems. This review is an important aspect of our continuing efforts to recommend logistics management improvements in the Department of Defense.

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

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

OPERATIONAL AND SUPPORT COSTS OF THE NAVY'S F/A-18 CAN BE SUBSTANTIALLY REDUCED

D I G E S T

The Navy's logistics support planning for the F/A-18 aircraft is comprehensive and should provide adequate support; however, like any new weapon system there are still unknowns which could affect the system's readiness and logistics support costs. Operational and support costs for the F/A-18 will be higher than expected and alternative concepts should be considered to reduce them.

The Navy is planning to buy 1,366 F/A-18s which are being developed to replace the Navy's F-4 and A-7 aircraft, the Marine Corps F-4 aircraft, and possibly the Marines' A-4 and AV-8A aircraft.

Introduction of this system and logistics support costs are highly dependent on the Navy receiving peculiar automatic test equipment on schedule. Any delays because of testing or the need to redesign this equipment will delay planned carrier deployment and introduction of the F/A-18 at east coast bases and cause support costs to rise.

The Navy was hoping that the comprehensive integrated logistics support plan developed for the F/A-18 would significantly reduce the aircraft's operational and support costs over its service life. However, it now appears that personnel and test equipment costs will be much higher than originally projected. Personnel requirements are now being based on the F/A-18 requiring 18 maintenance manhours per flight hour instead of the design goal of 11 hours. Providing the needed avionics test equipment will also cost much more than orginally expected. The Navy had planned to use existing standard versatile avionics shop test units; however, studies indicated the units could not be used for the F/A-18 without extensive modification. Development and procurement of new test equipment to support the F/A-18 force will cost approximately $450 million.

GAO and others have identified several alternatives which, if implemented, could substantially reduce the F/A-18 operational and support costs. These involve:

--Accepting a McDonnell-Douglas proposal to use dual or multiport avionics test equipment. (See p. 12.)

--Using test components from excess versatile avionics shop test stations instead of buying new components for the F/A-18 avionics test equipment. (See p. 16.)

--Consolidating avionics repairs for all stateside Navy and Marine Corps units at Lemoore and Cecil Naval Air Stations and establishing overseas repair facilities to support deployed Navy carriers and Marine Corps units. (See p. 17.)

--Buying initial spares and aircraft installed parts concurrently like the Air Force is doing. (See p. 23.)

--Using pilot training devices more effectively and substituting for or eliminating some devices planned for proficiency training. (See p. 28.)

--Consolidating F/A-18 units into larger size squadrons to achieve more efficient use of personnel and ground support equipment. (See p. 34.)

--Adopting the reliability centered maintenance concept to determine the need for F/A-18 depot maintenance and pipeline aircraft. (See p. 43.)

--Reducing the planned construction of certain maintenance facilities at Lemoore Naval Air Station and El Toro Marine Corps Air Station. (See p. 47.)

Savings from these proposals cannot be estimated precisely; however, the potential is great. For example, reducing the quantity of test equipment and pilot trainers and buying initial spares and installed components concurrently could save over $350 million.

Further, full implementation of the reliability centered maintenance concept could potentially save over $3.7 billion in depot maintenance and pipeline aircraft procurement costs. In addition, consolidating the F/A-18 squadrons could considerably reduce ground support equipment and annual personnel costs.

RECOMMENDATIONS

Because of the large potential savings possible, GAO recommends the Secretary of the Navy act upon the alternative operational and logistics support concepts discussed in this report before deploying the F/A-18. Specific recommendations appear on pages 21, 33, 39, 46 and 51.

GAO also recommends that the Secretary of Defense reevaluate the present Department of Defense (DOD) policy of not allowing long-lead funding for initial spares. The Navy should be allowed to use long-lead funding so that it can buy initial spares and aircraft installed parts concurrently and reduce the F/A-18 initial provisioning cost.

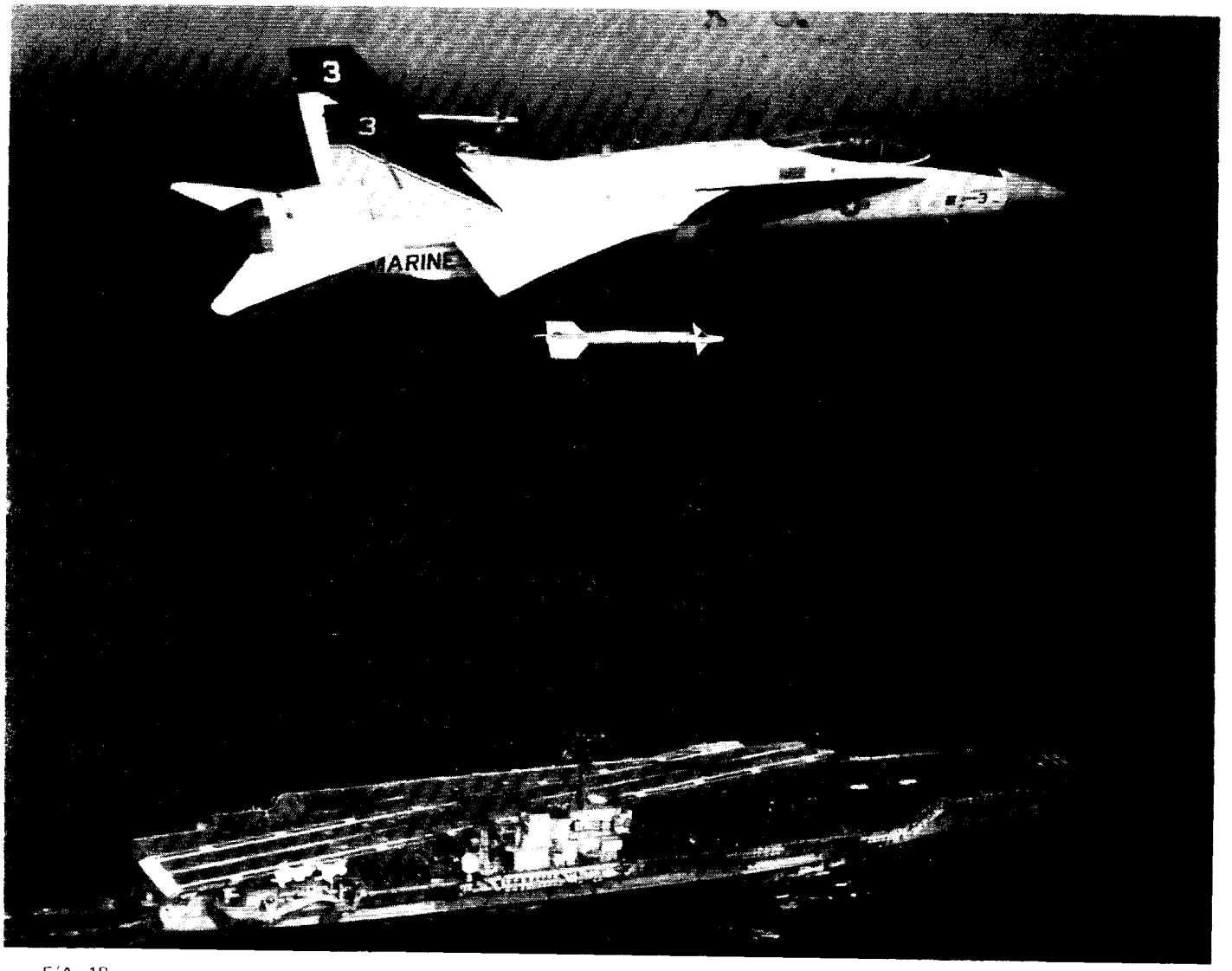
AGENCY COMMENTS

DOD commented (see app. I) that several of the recommendations (using multiport test equipment, consolidating avionics repair activities, and increasing the size of squadrons) are potentially beneficial and are already under review by the Navy. DOD took exception to GAO's remaining recommendations but GAO found DOD's arguments unconvincing. GAO's evaluation of DOD comments are included in report chapters 3 through 8.

Contents

ABBREVIATIONS

ATE	automatic test equipment
DOD	Department of Defense
GAO	General Accounting Office
ILASS	intermediate level avionics support system
ILS	integrated logistics support
OFT	operational flight trainer
RCM	reliability centered maintenance
RTS	radar test station
SAIP	spares acquisition integrated with production
VAST	versatile avionics shop test
WTT	weapons tactics trainer



F/A-18

PHOTO COURTESY OF MCDONNELL-DOUGLAS-- ST. LOUIS

CHAPTER 1

INTRODUCTION

In this period of austere funding, inflation, and complexity in new weapon systems design, the cost of logistics support for new systems has become a vital consideration in the acquisition process. The F/A-18 aircraft program is an excellent example of this concern. The Navy developed and implemented a comprehensive logistics support program as part of the aircraft development effort to ensure the effective and economical support of the aircraft for its life cycle.

The F/A-18 aircraft is being developed to replace the Navy's F-4 and A-7 aircraft, the Marine Corps F-4 aircraft, and possibly the Marines' A-4 and AV-8A aircraft. The Navy also plans to develop a reconnaissance version of the F/A-18. The McDonnell-Douglas Corporation is developing the aircraft and General Electric is developing the engines.

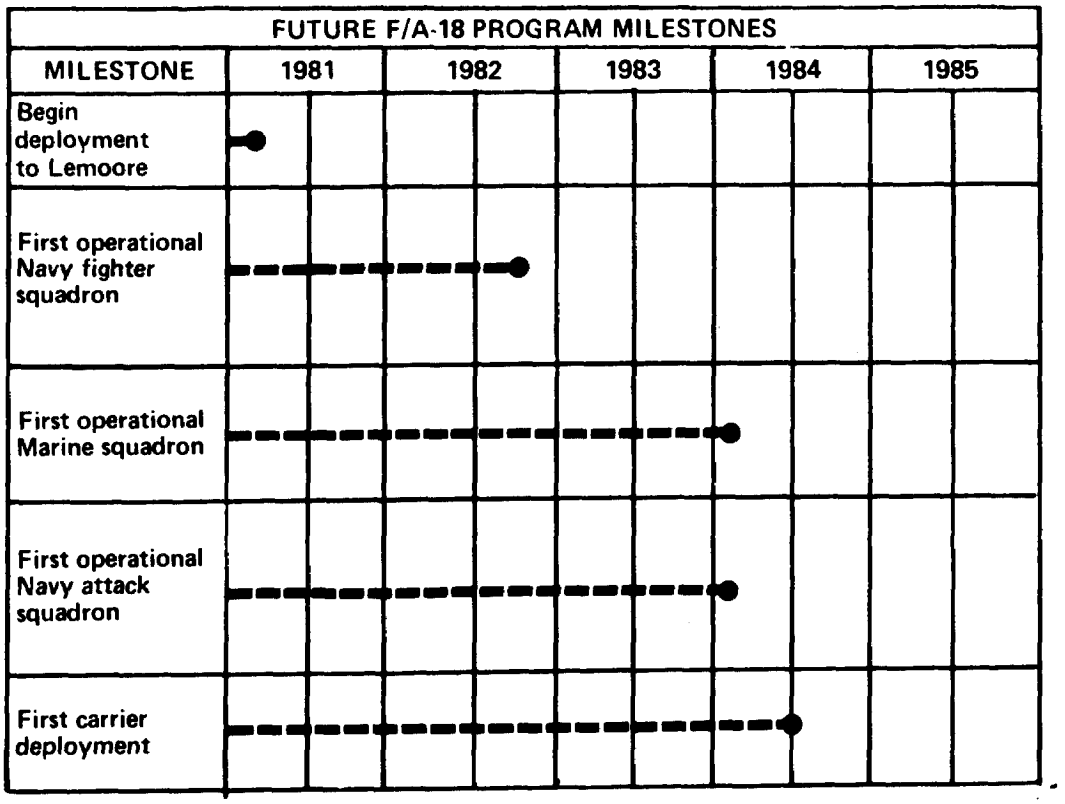
Development of the F/A-18 started in January 1976 and first flight occurred in November 1978. The first operational aircraft will be delivered in February 1981 to the fleet readiness squadron at Lemoore Naval Air Station in California. (See chart on p. 2 for the future F/A-18 program milestones.) Current program planning calls for the purchase of 1,366 1/ aircraft, in addition to 11 research and development aircraft. Estimated program costs exceed $29 billion.

The fighter and attack versions of the F/A-18 will be identical in all areas, including weapon systems software. At the squadron level, the F/A-18 can be reconfigured from the fighter to attack configuration or vice-versa in less than 1 hour by changing ancillary equipment.

The Navy and Marine Corps expect to achieve enormous benefits from the major emphasis on reliability and maintainability that has been applied to the F/A-18 design. They are expecting a sharp increase in fleet readiness and a sizable reduction in operational and support costs.

The F/A-18 mission capable rate is expected to be 80 to 85 percent. Existing fleet aircraft achieve less than 65

1/The Navy will buy only 1,044 F/A-18s if it decides to purchase the AV-8B for the Marine Corps light attack role.



percent. The Navy is projecting mean flight hours between failure for the F/A-18 aircraft at 2.4 1/ hours compared to the Navy's F-4 and A-7E aircraft which are experiencing only 0.7 and 1.1 hours between failure.

The Navy also expects significant benefits because of the commonality of the fighter and attack versions. McDonnell-Douglas estimates only 4,000 stock items will be needed to support both versions in an F/A-18 airwing versus the 12,500 stock items required for the F-4 and the 8,000 stock items required for the A-7. This commonality is also expected to greatly reduce or eliminate the need to cannibalize parts from other F/A-18s to meet operational requirements.

SCOPE OF REVIEW

We initiated our review of the Navy's logistics support planning for the F/A-18 aircraft in response to broad congressional interest in reducing life cycle costs of major weapon systems. Our prior reports, including the one issued

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1/This Navy estimate compares to a contractual goal of 3.7 flight hours between failure.

in February 1980, 1/ have dealt with the development and acquisition of the F/A-18.

We based the information in this report on interviews with Navy and contractor officials; reviews of records, regulations, and reports provided by those officials; research of published Department of Defense (DOD) studies and reports; and research of our previous studies. We made our review at the following locations:

--Office of the Chief of Naval Operations, Washington, D.C.

--Marine Corps, Headquarters, Washington, D.C.

--Naval Air Systems Command, Washington, D.C.

--Naval Aviation Supply Office, Philadelphia, Pennsylvania.

--El Toro Marine Corps Air Station, El Toro, California.

--Lemoore Naval Air Station, Lemoore, California.

--North Island Naval Air Rework Facility, San Deigo, California.

--General Electric Company, Lynn, Massachusetts.

--McDonnell-Douglas Corporation, St. Louis, Missouri.

1/"F/A-18 Naval Strike Fighter: Its Effectiveness is Uncertain" (PSAD-80-24, Feb. 14, 1980).

CHAPTER 2

LOGISTICS SUPPORT PLANNING IS COMPREHENSIVE BUT OWNERSHIP COSTS CAN BE REDUCED

The Navy's logistics support planning for the F/A-18 aircraft is comprehensive and conforms with DOD guidelines. The logistics support approach we examined should provide adequate support. However, like any new weapon system there are still unknowns which could affect the system's readiness and logistics support costs. Operational and support costs for the F/A-18 will be higher than expected and alternative concepts should be considered to reduce them.

EFFECTIVE LOGISTICS SUPPORT PLANNING IS NECESSARY

Since ownership costs of a system over its service life often exceed development and procurement costs, the need for effective logistics support planning for new weapon systems is crucial. Optimizing ownership costs through tradeoffs between reliability, maintainability, design, manning interfaces, and logistics support alternatives are key requirements of an effective integrated logistics support (ILS) program.

DOD policy requires an effective logistics support plan

To ensure efficient and effective support, DOD requires an ILS plan be developed for each major weapon system and made an integral part of the system acquisition and operation. The object of DOD's policy is to make sure that weapon systems are capable and available when needed. The ILS concept requires that support planning be considered at the earliest phases of overall planning to ensure that support costs are minimized throughout the system's service life.

ILS is necessary to ensure the effective and economical support of a system. The principal elements of a thorough ILS plan include

--maintenance planning;

--support and test equipment;

--supply support (including initial provisioning);

--manpower and personnel requirements;

--training and training devices needs;

--facilities needs;

--technical data;

--computer resources support; and

--packaging, handling, storage, and transportation.

LOGISTICS SUPPORT PLANNING SHOULD ADEQUATELY SUPPORT THE F/A-18

The Navy's logistics support planning for the F/A-18 aircraft is comprehensive. During the proposal evaluation, the Navy developed a complete ILS specification and negotiated its cost with McDonnell-Douglas and General Electric. The specification required:

--Management controls to ensure close coordination between the ILS, reliability and maintainability, and design groups.

--Major emphasis on reducing life cycle costs.

--The implementation of a phased support concept to provide an orderly and gradual transition of maintenance capability from the contractor to the Navy.

--The conduct of logistics support analysis, an analytical approach to maintenance and support planning, to provide alternative and ultimately, optimum maintenance/support plans, considering both economical and operational factors.

--The conduct of trade studies, as part of the logistics support analysis, to reduce life cycle costs.

--The use of simulation modeling to demonstrate how effectively the program objectives could be met within existing logistics planning levels.

The overall cost of the McDonnell-Douglas and General Electric ILS planning efforts is expected to exceed $104 million.

F/A-18 ILS milestones

The chart on page 7 shows the key ILS program milestones for the F/A-18. The ILS program is being closely managed and

is currently on schedule. However, the success of this program is still dependent on some unknowns. For example:

--Will the transition of support responsibilities from the contractor to the Navy be achieved on schedule?

--Will the new automatic test equipment be delivered on time to allow for training of Navy maintenance personnel before their support responsibilities are transferred?

--Will the F/A-18 aircraft delivery schedules be met?

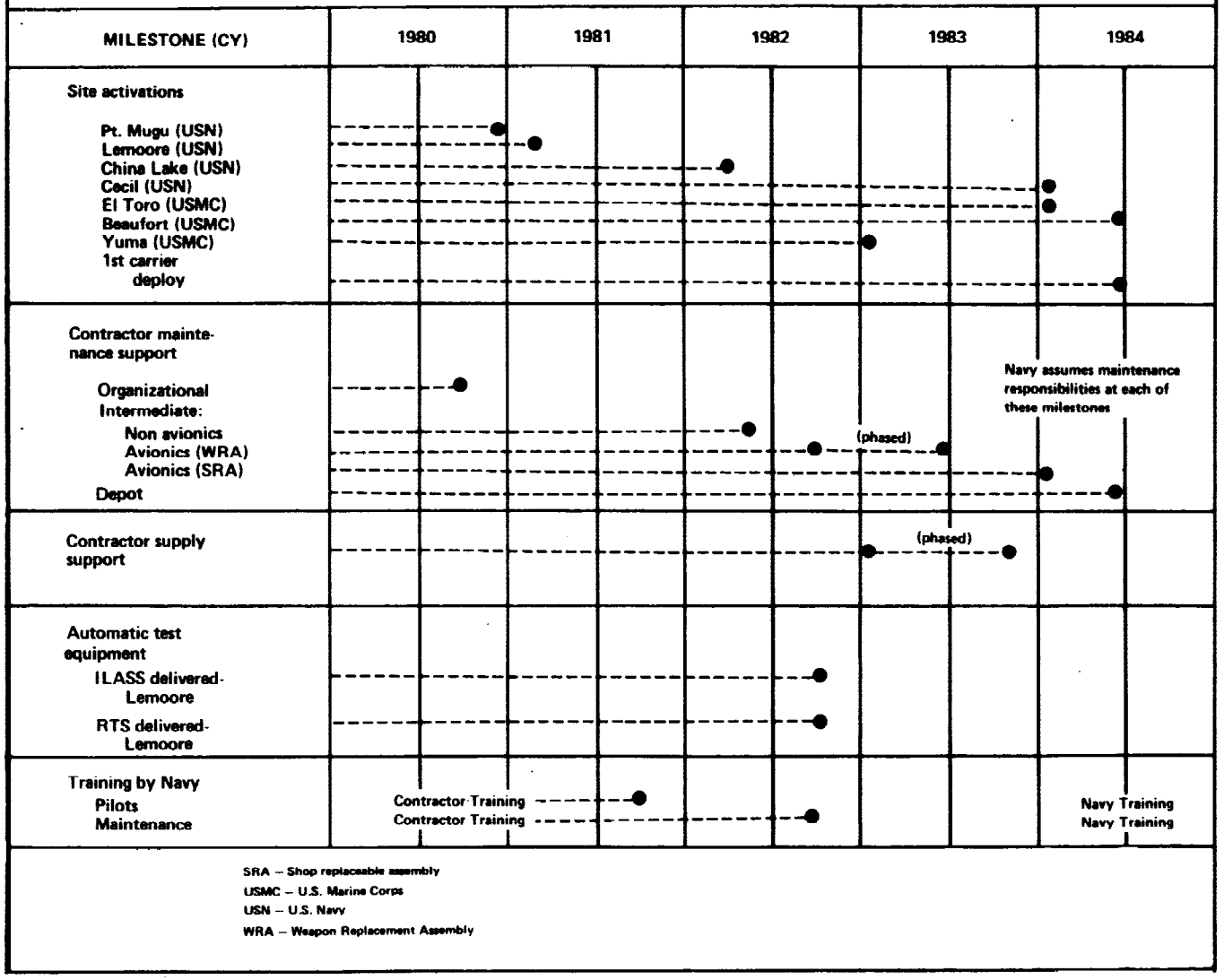
Successful development/debugging of the automatic test equipment and associated software needed to test the various avionics and radar components is crucial for meeting planned fleet introduction and carrier deployment dates. Transition of contractor maintenance and supply support will not start until this equipment is delivered to Lemoore Naval Air Station and personnel are trained to operate it. If the transition is delayed, the Navy will either have to (1) delay introduction of the F/A-18s on the east coast and deployment on the carriers, (2) incur further costs to provide added contractor support, or (3) greatly increase spare parts provisioning.

PHASED CONTRACTOR SUPPORT--A NEW CONCEPT TO BE PROVEN

The phased support concept in which the Navy will assume maintenance and supply support for the F/A-18 in a step-by-step manner, rather than establishing a single Navy support date, is a first for the Navy. Instead of maintaining and supporting the system as soon as the first unit becomes operational, the Navy plans to pay McDonnell-Douglas and General Electric over $30 million to support the aircraft during the early deployment years (1981-84).

Navy officials believe the higher contractor cost will be justified if the Navy is able to (1) achieve and sustain a high level of operational readiness during the F/A-18's early deployment years and (2) acquire the necessary skills and material resources to assume responsibility without degrading operational capability. In the past, the Navy assumed maintenance and support responsibility for a weapon system much earlier. Many of these systems have required design modifications to correct deficiencies discovered early in the operational phase which have caused maintenance and/or support problems. As a result, the systems are extremely hard to maintain and repair.

KEY F/A–18 ILS PROGRAM MILESTONES



The phased support concept shifts the risk of early maintenance and support problems from the Navy to the contractor. Ideally, the system and its support subsystems will be debugged before the Navy assumes responsibility. However, the Navy needs to address several unanswered questions:

--Is the phased support concept cost effective? How does the Navy plan to determine the cost effectiveness?

--What will be the disposition of the "Hot-Mock-up" 1/ avionics test benches and test equipment that the Navy has purchased for the contractor to use during the phased support period? Will this equipment be used to offset other Navy requirements?

--Will the contractor be able to support the larger number of F/A-18s if delivery of automatic test equipment is delayed a year or more?

--Will personnel costs be duplicated by the contractor and the Navy if the transition milestones are missed?

LOGISTICS SUPPORT COSTS WILL BE MUCH HIGHER THAN ORIGINALLY PROJECTED

Logistics support costs for the F/A-18 will be much higher than originally estimated in 1975. For example, Navy officials have stated in congressional testimony that preliminary estimates indicated the personnel requirements for a squadron of 12 F/A-18s would require 30 percent less personnel than an A-7E unit. Now, the Navy estimates that requirements will be less than 9 percent. Personnel requirements are being based on the F/A-18 requiring 18 maintenance man-hours per flight hour instead of 11, a design goal which the early estimates were based on. A comparison of the current F/A-18 personnel requirements versus A-7E squadron is as follows:

1/"Hot-Mock-up" avionics test benches will be used by contractor technicians to test and repair F/A-18 avionics until the peculiar designed automatic test equipment arrives. These benches use a lot of test equipment that the Navy can use in its depots or to support other systems.

	F/A-18	A-7E	Difference
Officers	21	21	0
Enlisted	208	229	21
Total	229	250	21 (8.4%)

Providing the needed avionics test equipment will also cost much more than originally planned. Development and procurement of new test equipment will cost over $449 million. The original plan to develop F/A-18 test program sets and use the standard VAST (versatile avionics shop test) stations, now in the fleet, proved impractical because of the complexity of certain F/A-18 systems. This complexity required the Navy to develop new automatic test equipment for the F/A-18 avionics and radar.

ALTERNATIVE OPERATIONAL AND SUPPORT CONCEPTS SHOULD BE CONSIDERED

One of the major objectives of the F/A-18 ILS program--reducing ownership costs--could be enhanced if the Navy would consider certain alternative operational and support concepts. According to a February 1979 Defense Resource Management Study (an organizational review of resource management in DOD prepared by the Rand Corporation), ownership costs are determined by three primary factors:

--The organizations and basing structure to be used for operating and supporting the system.

--Support policies that determine what types of support will be rendered, where, and how often.

--The characteristics of the system itself which determine how often it will fail and how difficult it is to maintain.

The Navy has placed great emphasis on the last factor; however, we believe that several options are available within the first two factors which can significantly reduce the F/A-18's operational and support costs. These options involve:

--Accepting a McDonnell-Douglas proposal to use dual or multiport avionics test equipment. (See p. 12.)

--Using test components from excess VAST stations instead of buying new components for the F/A-18 avionics automatic test equipment. (See p. 16.)

--Consolidating avionics repairs for stateside Navy and Marine Corps units at Lemoore and Cecil Naval Air Stations and establishing overseas repair facilities to support deployed Navy carriers and Marine Corps units. (See p. 17.)

--Buying initial spares and aircraft installed parts concurrently like the Air Force is doing. (See p. 23.)

--Using pilot training devices more effectively and substituting for or eliminating some devices planned for proficiency training. (See p. 28.)

--Consolidating F/A-18 units into larger size squadrons to achieve more efficient use of personnel and ground support equipment. (See p. 34.)

--Adopting the reliability centered maintenance concept to determine the need for F/A-18 depot maintenance and pipeline aircraft. (See p. 43.)

--Reducing the planned construction of certain maintenance facilities at Lemoore Naval Air Station and El Toro Marine Corps Air Station. (See p. 47.)

CONCLUSIONS

The Navy's logistics support planning for the F/A-18 should provide adequate support. However, operational and support costs will be higher than expected and alternative concepts should be considered to reduce them. Because of the large potential savings possible, the Secretary of the Navy should act upon the alternative operational and logistics support concepts discussed in this report before deploying the F/A-18 aircraft.

CHAPTER 3

AVIONICS TEST EQUIPMENT AND REPAIR COSTS CAN BE SUBSTANTIALLY REDUCED

Development and procurement of new test equipment needed for testing and repairing F/A-18 avionics will cost the Navy $449 million and may cost more if redesign of the equipment is required to correct test deficiencies. The Navy agreed to accept this risk to reduce initial cost. However, options are available which could reduce these costs by at least $83 million and perhaps by as much as $114.7 million. These options involve the Navy (1) accepting a McDonnell-Douglas proposal to use dual or multiport avionics test equipment rather than the single port currently planned and (2) using components from VAST stations, which we believe are excess, instead of buying new components.

Avionics repair costs could also be reduced through consolidation. Possible benefits from consolidation was cited in the Defense Resource Management Study. F/A-18 avionics repairs should be consolidated on the east and west coasts for Navy and Marine Corps units, and overseas facilities should be established to support deployed carriers and Marine Corps units.

PLANNED USAGE OF VAST STATIONS WAS FOUND UNSUITABLE

The Navy has authorized McDonnell-Douglas, the prime contractor, to design new test equipment to be used in place of unsuitable VAST. The VAST stations, currently being used to support other Navy aircraft, could not be used for the F/A-18 without extensive modification due to the large amount of computerized digital avionics used on the aircraft. VAST stations are used primarily to test analog and low-speed digital type avionics. McDonnell-Douglas conducted two studies to determine the most feasible type of equipment to be used to test F/A-18 avionics. On the basis of the studies, McDonnell-Douglas and Navy officials concluded that the least expensive and most feasible solution was to develop a new intermediate level avionics support system (ILASS) for testing avionics components and a new radar test station (RTS) for testing radar components rather than modifying VAST.

DEVELOPMENT RISKS WERE ACCEPTED TO REDUCE COSTS

The Navy has accepted a great deal of risk in developing the new test equipment to reduce costs. In July 1978

McDonnell-Douglas provided the Navy an estimate of $114.4 million to design, develop, and produce eight ILASSs and four RTSs, exclusive of test program sets. Test program sets are the software and connecting devices required to test avionics components. The $114.4 million estimate was higher than anticipated, so the Navy requested that McDonnell-Douglas revise its estimate to include test program sets only for critical components and to reduce the development effort scope. The revised estimate, amounting to $93 million to develop and produce five ILASSs and two RTSs, plus about $41 million for critical test program sets, was then accepted by the Navy. McDonnell-Douglas officials stated the primary reason for the decrease in the estimate was that the Navy decided to accept the ILASS and RTS at the subcontractors' plants after first-article-tests on the initial units. These tests will not include testing of the hardware with the test program sets, nor does the contract contain provisions for the contractor to modify the automatic test equipment because of changes to the avionics or changes resulting from integration testing.

McDonnell-Douglas officials stated that normally the automatic test equipment and the test program set would be furnished as an operationally ready unit free of defects. McDonnell-Douglas had included such correction of defects under its earlier cost estimate. A Navy official, responsible for logistics planning, said that the Navy "would have been much better off" funding the full McDonnell-Douglas proposal. He based his belief on the fact that operational testing of previous systems had required a number of avionics design changes which required redesigning the automatic test equipment. He stated that design changes would more than likely be necessary to integrate the multitude of test program sets. He felt the eventual development cost for the new test equipment would probably increase from $134 million to about $225 million. We agree that, under a total contractor support concept, the Navy should not accept such a risk on a key component. Especially since F/A-18 fleet introduction on the east coast and carrier deployment is dependent on this equipment being debugged and delivered on schedule. Navy officials commented they accepted this risk because they believed any required changes could be done by changing the software instead of the hardware.

USE OF DUAL OR MULTIPORT UNITS WOULD SIGNIFICANTLY REDUCE COSTS

The Navy could significantly reduce costs of automatic test equipment by accepting a McDonnell-Douglas proposal to use dual or multiport equipment. McDonnell-Douglas has proposed that the ILASS be developed with dual or multiport capability which would enable the Navy to test two or more

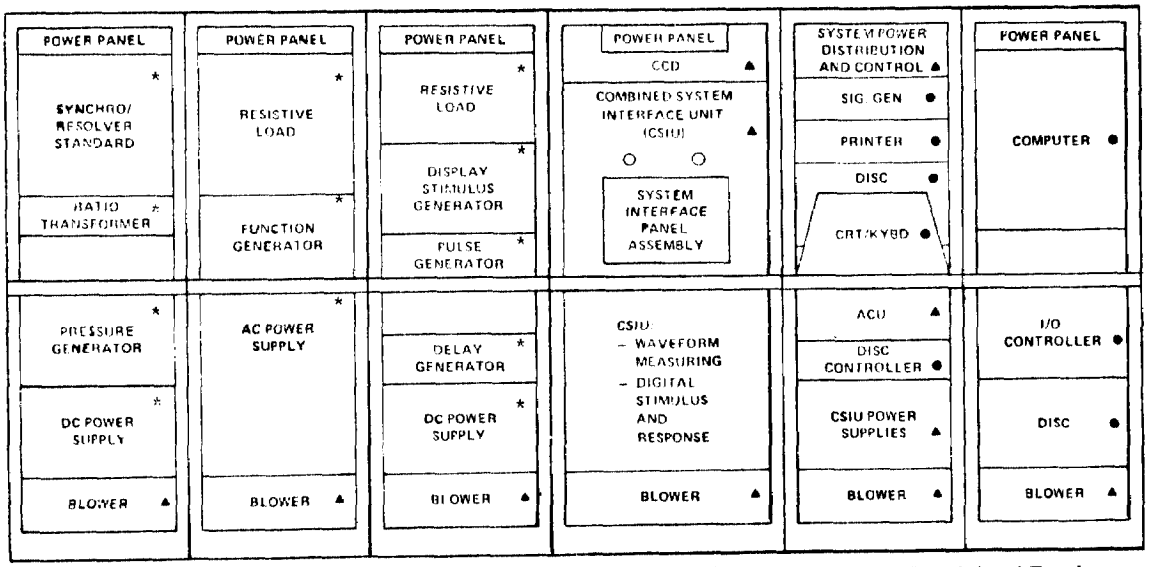
avionics components simultaneously and reduce hardware requirements. By purchasing dual port ILASS rather than single port, the Navy could reduce its planned buy from 48 to 25 units and save an estimated $45.5 million. At the time of our review, McDonnell-Douglas officials were reluctant to estimate savings for multiport RTS, but they believed the concept was feasible and had requested its subcontractor to provide a cost estimate for the additional capability.

Navy officials commented that the McDonnell-Douglas proposal is being evaluated as part of an automatic test equipment study. The study is addressing whether the avionics test set should be multiport and what test equipment will be used to repair avionics circuit cards.

The ILASS is composed of six racks of avionics test equipment. (See illustration below.) It includes a computer/controller, input and output devices, an interconnecting panel to attach the unit being tested, and 12 components that are common to components used in VAST.

F/A-18A Intermediate Level Avionics Support System (ILASS)

Main Station



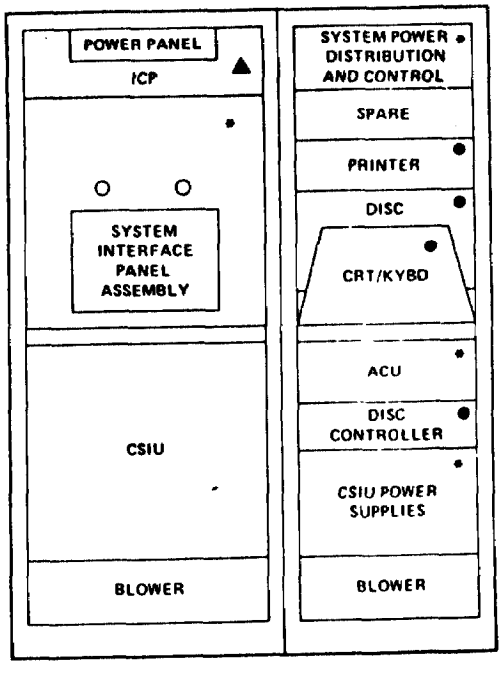
[●] Off the Shelf [▲] New Design [*] Government - Furnished Equipment

According to McDonnell-Douglas officials, one or two remote ports could be added to the ILASS by simply adding two racks for each remote port. (See illustration below.) A remote port would consist of a rack for input/output devices and a rack for the interconnecting panel. The main station and the remote port would be operated from a single computer/controller and a single set of testing components.

F/A-18A Intermediate Level Avionics Support System (ILASS)

Remote Port

[•] Off the Shelf
[▲] New Design
[•] Common Units with Main Station



McDonnell-Douglas officials estimated a single port ILASS would cost about $3.9 million, exclusive of development and test program set costs. This cost includes 12 VAST avionics testing components, common to ILASS, which the Navy will furnish at a cost of about $1.5 million per ILASS. Overall, the Navy plans to buy 48 ILASSs and 48 RTSs to support 1,044 F/A-18 aircraft. 1/ Development and procurement costs will amount to an estimated $449.5 million, as the following chart shows:

1/If the Navy decides not to buy the AV-8B for the Marine Corps and buys 1,366 F/A-18s instead, then the quantity of ILASSs and RTSs will be increased to 53.

	ILASS	RTS	Test program set (note a)	Total
	----------(millions)----------			
Development	$ 52.9	$ 41.2	$40.2	$134.3
Procurement	b/187.4	127.8	-	315.2
Total	$240.3	$169.0	$40.2	$449.5

a/Test program set costs include only development costs for certain high priority avionics and major radar components. Development costs of test program sets for other components, as well as development costs for subassemblies and procurement costs for test program sets, are not included.

b/Includes cost of 12 Government-furnished components.

McDonnell-Douglas officials estimated that a dual port ILASS would cost about $1.9 million more than a single port--$5.8 million for a dual port compared to $7.8 million for two single port ILASSs. Reducing the number of ILASSs would reduce costs by about $45.5 million, as the following chart shows:

ILASS Support for 1,044 Aircraft

Location	Single port requirements No.	Single port requirements Amount	Dual port requirements No.	Dual port requirements Amount	Total savings
		(millions)		(millions)	(millions)
Naval Air Station:					
Lemoore	5	$ 19.5	a/3	$ 15.6	$ 3.9
Cecil	4	15.6	2	11.7	3.9
Naval Air Rework Facility:					
North Island	4	15.6	2	11.7	3.9
Jacksonville	2	7.8	1	5.8	2.0
Marine Base:					
El Toro	2	7.8	1	5.8	2.0
Beaufort	3	11.7	a/2	9.7	2.0
Kaneohe	2	7.8	1	5.8	2.0
Iwakuni	2	7.8	1	5.8	2.0
Twelve naval aircraft carriers (6 Atlantic and 6 Pacific fleets)	24	93.7	12	69.9	23.8
Total	48	$187.3	25	$141.8	$45.5

a/Quantity and amount include one single port unit at $3.9 million; all other units are dual port.

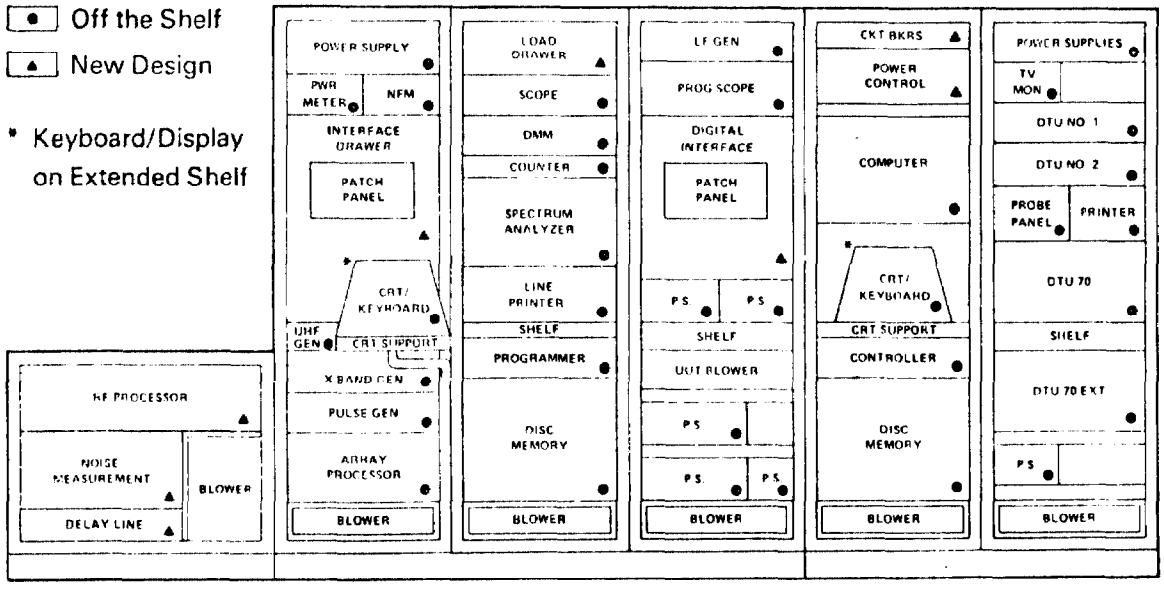
In addition, the Navy could save another $37.5 million if it would use testing components from unneeded VAST stations for the 25 ILASS units rather than buying new sets at $1.5 million per ILASS. The Navy has 96 VAST stations installed, or planned to be installed, at land-based maintenance units or on aircraft carriers. However, according to our analysis, 26 of these stations are excess to Navy needs.

For example, two VAST stations at Lemoore Naval Air Station will not be needed once the F/A-18s arrive and the aircraft supported are transferred. Furthermore, on the basis of the Navy's criteria that only one VAST station is needed to support 12 F-14, S-3, or E-2C aircraft and the quantities of aircraft to be supported, our calulations show 18 VAST stations

are excess to the Navy's needs on its 12 aircraft carriers, 2 are excess at the Miramar Naval Air Station, and 4 are excess at the North Island Naval Facility.

Savings may also be possible for the RTS if it is determined feasible to use multiport. (See illustration below.) McDonnell-Douglas is currently doing such a feasibility study. The Navy is planning to buy 48 RTSs with a dual port capability (one port analog and one port digital). By using multiport capability, the Navy may be able reduce the number of RTSs required to 25 and save approximately $31.7 million if the same ratio of savings are achieved for the RTS as for the ILASS.

F/A-18A Radar Test Station (RTS)



CONSOLIDATION OF AVIONICS REPAIRS AND ESTABLISHMENT OF OVERSEAS FACILITIES SHOULD BE CONSIDERED

The Navy could further reduce the cost of repairing F/A-18 avionics and radar components by consolidating all

avionics repairs at Lemoore and Cecil Air Stations intermediate maintenance facilities and by establishing overseas repair facilities to support deployed Navy carriers and Marine Corps units.

The February 1979 Defense Resource Management Study recommended that the Navy consider consolidating off-equipment maintenance at a level that permits capture of economies of scale and makes better use of support resources. The study cited the following benefits of consolidation:

--Significant reduction in components which are not serviceable because of lack of parts.

--Improved quality of component repair.

--Reduction of requirements for test equipment, especially on the carriers.

Navy officials commented they are now doing a follow-on study to validate or disprove the Defense Resource Management Study concepts.

We believe the Navy could achieve the benefits cited if it would consolidate F/A-18 avionics repairs. This consolidation would enable the Navy to better support the F/A-18 force and stock the "bit-and-piece" parts required to repair F/A-18 avionics and radar components. One of the major problems with the present Navy concept (that is, each intermediate maintenance facility being responsible for repairing both components and subcomponents) has been the Navy's inability to adequately stock needed bit-and-piece parts.

In our 1979 report, 1/ we recommended that the Secretary of the Air Force centralize F-15 and F-16 component repair overseas and in the United States to achieve significant savings in resources and operating and maintenance costs. For instance, as the number of aircraft to be supported increases, there is often less than a proportional increase in staffing, equipment, facilities, and spare parts. Furthermore, the centralized shop environment can lead to other benefits from higher specialization among the workforce.

We recognize that centralizing component repair at Lemoore and Cecil Air Stations will affect levels of spares

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1/"Centralizing Air Force Aircraft Component Repair in the Field Can Provide Significant Savings" (LCD-79-409, Mar. 28, 1979).

required to sustain operations for the Marine Corps units. However, the following factors should offset the added cost:

--Subcomponents used for repair would be managed at the central facility, and, because demand data and safety levels would be consolidated, the inventory levels would decrease.

--Increased proficiency through better production techniques and specialization could improve the quality of output, causing reduced spare component demand, and therefore, reduced component inventories.

--Increased proficiency could also reduce actual component repair time.

--Increased availability of critical personnel skills and specialized equipment could increase the proportion of the workload reparable below the depot level.

We also recognize that the Marine Corps units will need avionics repair support when they deploy. However, other options are available to the one being planned (i.e., each Marine base having automatic test equipment installed in vans to be deployed with the aircraft units). These options include

--increasing the quantity of avionics spares in the unit packup kits 1/ and using the proposed overseas avionics repair facilities or carrier capability to sustain operations or

--maintaining Marine Corps dedicated automatic test equipment at Lemoore and Cecil Air Stations which would be used to support the consolidated workload, but could be deployed if needed.

The Navy should consider establishing overseas intermediate maintenance facilities in the Pacific and the Atlantic to support deployed Navy carriers. Navy carriers have the same problem with not being able to stock the needed bit-and-piece parts for avionics repairs. These overseas facilities could also be used to support deployed Marine Corps F/A-18 units. Currently, the Marine Corps is planning to establish an intermediate maintenance capability at each overseas base to support only one or two squadrons.

1/Packup kits include enough spares to sustain 30 days of operation at a wartime flying rate.

Navy officials commented many cost and operational considerations must be fully analyzed to properly evaluate the recommendations for consolidating intermediate level repair. These considerations include construction funds for overseas facilities, additional transportation requirements and costs, the effect on required spares levels, access to overseas facilities during time of crisis or conflict, and the impact on Navy and Marine Corps operational flexibility. They commented the Rand Corporation is now performing this analysis for the Navy.

CONCLUSIONS

The Navy could reduce automatic test equipment costs by $77.2 million by using dual or multiport units. The Navy could also save $37.5 million by using testing components from excess VAST stations. The Navy could further reduce maintenance support costs by consolidating avionics component repairs for Navy and Marine Corps units at Lemoore Naval Air Station on the west coast and at Cecil Naval Air Station on the east coast and by establishing overseas repair facilities to support deployed Navy carriers and Marine Corps units.

We believe the Navy's decision to allow McDonnell-Douglas and its subcontractors to develop automatic test equipment without assurance that the equipment will operate with its related test program set should be reconsidered. The Navy's acceptance of this risk to reduce initial costs by $21 million appears questionable. Integration testing may require redesign of the automatic test equipment, which would increase costs significantly.

AGENCY COMMENTS AND OUR EVALUATION

DOD generally agreed with our conclusions on using multiport automatic test equipment. DOD stated that the McDonnell-Douglas proposal on dual port RTS had been accepted and the proposal on dual and multiport ILASS was being studied.

DOD did not agree with our analysis and conclusions that the Navy has excess VAST stations whose components could be used for the F/A-18 avionics tester or that the risk accepted in developing the F/A-18 automatic test equipment should be reduced or eliminated. DOD stated that all of the 96 VAST stations were needed and were being "heavily utilized" to meet F-14, S-3, and E-2C requirements. Our analysis shows otherwise. Each VAST is supposed to be able to support a minimum of 12 F-14s, S-3s, or E-2Cs or any combination thereof. Using this Navy criteria, our analysis shows the Navy

does indeed have at least 26 excess VAST stations. We based our analysis on the normal aircraft deployment on the east and west coast carriers and on the average number of F-14s, S-3s, and E-2Cs that are shore-based and supported by VAST stations. For example, once F/A-18s are introduced at the Lemoore Naval Air Station, the station will still have two VAST stations but no aircraft which use them.

DOD stated that the automatic test equipment development and procurement strategies were carefully evaluated considering use and risk along with other parameters. DOD anticipated any changes to be software intensive. On all previous automatic test equipment systems, hardware redesign has been required and there is nothing to indicate that the F/A-18 automatic test equipment will be different. Because of the potential for increased costs to the Government and the need, under the phased contractor support concept, for timely delivery of automatic test equipment, we believe the decision to accept the high development risks should be reconsidered.

Concerning the consolidation of F/A-18 avionics component repairs, DOD said that a follow-on study to the Defense Resource Management Study is being conducted with completion scheduled for late 1980. However, our conclusion is not based only on the Defense Resource Management Study. As pointed out, we did a detailed review of the consolidation concept in the Air Force and reported on it to the Congress in March 1979.

RECOMMENDATIONS

We recommend that the Secretary of the Navy

--adopt the McDonnell-Douglas proposal to use dual or multiport automatic test equipment for testing F/A-18 avionics components and use multiport radar test equipment if proven feasible,

--review the need for 96 VAST stations and use components from any excess units to satisfy the Government-furnished equipment requirement for the F/A-18 avionics tester,

--determine if it is still in the Government's interest to accept the high development risks now present in the contract for the F/A-18 automatic test equipment, and

--consolidate all F/A-18 avionics component repairs for Navy and Marine Corps units at Lemoore and Cecil Air Stations and establish overseas repair facilities to support deployed Navy carriers and Marine Corps units.

CHAPTER 4

CONCURRENT PURCHASE OF INITIAL SPARES WITH PRODUCTION UNITS OFFERS SIGNIFICANT SAVINGS

The Navy should take advantage of any procurement concept to reduce the high cost--over $1.4 billion--of initial spares provisioning being projected for the F/A-18 program. We estimate the Navy could save as much as $160 million by having the contractor order certain initial spare parts at the same time it orders parts for the production F/A-18 aircraft. The Navy supports this concept. However, it believes a DOD restriction on the use of long-lead funding for spare parts will limit the potential savings because most of the high-cost F/A-18 spares require leadtimes exceeding 24 months. We believe the DOD restriction should be re-evaluated.

THE AIR FORCE IS USING THE SPARES ACQUISITION INTEGRATED WITH PRODUCTION CONCEPT

Spares acquisition integrated with production (SAIP), a concept developed by the Air Force, requires that contractors and subcontractors combine orders for initial spares with aircraft installation requirements. Savings are achieved through economies of scale by avoiding costs associated with separate material orders and manufacturing actions when spares and installation parts are not ordered and managed together.

The Air Force believes parts and components selected for SAIP should comprise from 10 to 15 percent of total initial spares and should represent from 65 to 75 percent of the initial spares investment. Navy officials advised us that, during fiscal years 1974 to 1976, the Air Force documented savings of over $94 million in F-15 radar spares costs alone. In fiscal year 1977, the Air Force conducted a test on 32 items and documented savings of 23 percent by using the concurrent method of buying spares. The Air Force has also used this concept to buy certain F-15 replenishment spares. During fiscal years 1975 through 1977, the Air Force documented savings of $66.3 million.

DOD officials commented that savings of this magnitude might not be achievable on the F/A-18 program. They said the spares savings on the F-15 may have occurred without SAIP due to an unique combination of circumstances that was present during the 1974-78 time frame. DOD officials also commented

that the Air Force has not been able to document any savings using SAIP for F-16 spares procurement; however, they are estimating a 14-percent savings using SAIP to buy A-10 spares.

SAIP offers many benefits in addition to cost savings

Cost avoidance is not the only benefit of SAIP. Early assurance of spares availability enhances the weapons system's introduction into the fleet. Traditionally, spares orders are placed 4 to 6 months after the prime contractor submits its order for production parts, and vendors are frequently tardy in deliveries because the spares order is not a significant part of the larger production commitment. SAIP overcomes this problem by providing the vendor a single coordinated order for spares and the installation parts. SAIP also provides configuration control by ensuring that spares are delivered in the same configuration as the installation parts. Another nonfinancial advantage is the administrative simplicity of dealing only with the prime contractor during the early phases of aircraft acquisition compared to multiple contracts with many vendors.

DOD officials commented there is a potential risk in using SAIP. This risk involves the possible overprocurement of spares due to inaccuracies in early predictions of demand rates. However, they commented this risk would be low in a large, multiyear production program like the F/A-18, since any early procurement of spares could be compensated by reduced procurement later in production or, if necessary, could be used for production installation.

LONG-LEAD FUNDING POSES A PROBLEM

Navy officials told us that they support the SAIP concept. They believed, however, that the restriction on usage of long-lead funding would limit the potential savings that could be realized from concurrent procurement because most of the high-cost spares are long-lead items. Funding for long-lead items is particularly important for F/A-18 avionics and radar components, special metals, and landing gear because of expanding leadtimes. For example, spares for the Hughes radar requires 36 months leadtime and may increase to 42 months. Navy officials stated DOD Directive 7200.4, which discusses full-funding requirements, precludes the obligation of long-lead funding of initial spare parts and components until the program buy has been approved and funded by the Congress. However, DOD advised us that this restriction does not prevent the services from requesting full funding for long-lead spares or from using the SAIP concept. This restriction

has not been a problem for the Air Force because most of the F-15 or F-16 initial spares require only 9 to 21 months for delivery.

ADOPTION OF SAIP FOR THE F/A-18 PROGRAM COULD SAVE MILLIONS

Navy officials stated that savings of at least 15 percent could be achieved by using the SAIP concept for F/A-18 initial spares and that savings on the F/A-18 radar could equal savings achieved by the Air Force on the F-15 radar. The Navy plans to spend over $1.4 billion for F/A-18 spares beginning in fiscal year 1981 and ending with the completion of the program. If SAIP procedures were used to buy spares, representing 75 percent of the initial spares investment, and savings of 15 percent were achieved, the Navy would save about $160 million on initial spare parts for the F/A-18 program. Although DOD believed this potential savings may be overstated, a 1978 Navy audit of SAIP supports our estimate. 1/

CONCLUSIONS

SAIP has saved the Air Force substantial amounts of funds for initial spares provisioning for the F-15 program. We believe that the Navy could save as much as $160 million if it would implement the procedure early in the F/A-18 program. However, the Navy's concern over the DOD restriction on usage of long-lead funding for initial spares needs to be resolved. It seems somewhat illogical to permit the services to commit substantial amounts for long-lead-time parts and components for installation in the aircraft but disallow commitment of a lessor amount of funds for initial spares.

A better allocation of resources would be achieved if advance spares acquisition were treated in a similar manner to the advance buys of installation parts for the aircraft.

RECOMMENDATION

We recommend that the Secretary of Defense reevaluate the present DOD policy of not allowing long-lead funding for initial spares given the Navy problem of using SAIP. The Navy should be allowed to use long-lead funding so that it can buy initial spares and aircraft installed parts concurrently and reduce the F/A-18 initial provisioning cost.

1/"F/A-18 Aircraft Acquisition Program of the Naval Air System Command" (Audit Report K30018, Sept. 13, 1978).

AGENCY COMMENTS

DOD generally agreed that savings in spares procurement could be realized by placing orders for spares concurrent with orders for production items. However, DOD was concerned about the risk of overprocurement based on inaccurate forecasts of demand and the risk of procuring spares that would become obsolete before they were used. DOD believes that the Navy has the opportunity now to use SAIP without being in conflict with DOD policies and encourages the Navy to do so where it is cost effective. However, DOD said it will continue to review SAIP experience and reevaluate present DOD policies based on its review results.

CHAPTER 5

PILOT TRAINER REQUIREMENTS CAN BE REDUCED THROUGH BETTER UTILIZATION

The Navy is planning to spend over $255 million for F/A-18 pilot simulators to be used for initial and follow-on proficiency training. We believe the Navy could save approximately $85 million if it made better use of this training equipment, substituted less sophisticated and expensive trainers for some proficiency training needs, and eliminated trainers from one overseas location.

QUANTITIES AND TYPES OF PILOT TRAINERS WERE ESTABLISHED THROUGH A SYSTEMATIC PROCESS

McDonnell-Douglas developed training methods and requirements through a process known as instructional systems development. It is a systematic process which involves developing learning objectives and determining the most effective learning methods and devices to achieve the objectives. As a result of this process, the Navy selected three pilot training devices--a parts task trainer, an operational flight trainer (OFT), and a weapons tactics trainer (WTT).

The parts task trainer is designed to orient the student pilot to the controls and to limited radar intercept geometry. The OFT will provide training in development of pilot skills, including cockpit preflight, takeoff and landing, navigational flight, shutdown procedures, and normal and emergency operation of the aircraft. The WTT consists of two training stations and will provide training similiar to the OFT, with the additional capability of simulating air-to-air and air-to-ground combat and weapons delivery. This training is accomplished by using a visual computer-generated image within a domed structure. Because of its large twin-domed structure, the WTT will require a special facility costing approximately $2.5 million.

Through the instructional systems design approach, McDonnell-Douglas and the Navy determined the types and quantities of trainers needed for fleet readiness training (initial F/A-18 pilot training). These quantities, along with those the Navy estimated it would need for proficiency training (follow-on training for operational pilots), are as follows:

Location	Fleet readiness training			Proficiency training	
	Parts task	OFT	WTT	OFT	WTT
Lemoore	1	3	2	-	2
Cecil	1	2	2	-	2
Beaufort	-	-	-	-	1
Iwakuni	-	-	-	1	-
Kaneohe	-	-	-	1	-
El Toro	-	-	-	-	1
Yuma (note a)	1	2	2	-	-

a/These trainers will be needed for a fleet readiness squadron at Yuma if the F/A-18 program is expanded and the Marines' AV-8B program is terminated. If this happens, Navy officials commented the OFT and WTT requirements at Lemoore and Cecil may be reduced.

The Navy has awarded contracts for the initial purchases of each type of trainer. The parts tasks trainer contract was awarded in July 1979 at $2.3 million; the OFT contract was awarded August 31, 1979, at $9.6 million; and the WTT contract was awarded September 20, 1979, at $18.7 million.

We believe the $18.7 million cost for the first WTT may be low compared to future unit costs. Original proposals by the two competing contractors for the WTT were more than $30 million. The $18.7 million bid was made after the Navy asked the competing contractors to restudy their proposals to reduce the cost. Future WTT buys may be much more costly. If the WTT cost does increase, the Navy should buy only WTTs for fleet readiness training, use OFTs for instrument and emergency procedures proficiency training, and adjust the flying program to accomplish weapons delivery training. The Navy had considered this option when it thought the cost of a WTT would exceed $25 million.

EFFECTIVE USE OF TRAINERS WOULD REDUCE QUANTITIES NEEDED

By combining fleet readiness and proficiency training requirements and adopting a 6-day week for trainer usage, the Navy could eliminate planned purchases of two WTTs and one OFT for a total equipment savings of $47 million and $5 million for facilities. In our 1979 report, 1/ we recommended

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1/"The Services Can Further Refine Management of Flying Hour Programs" (LCD-79-401, Mar. 27, 1979).

that the Secretary of the Navy increase simulator operations to a 6- or 7-day workweek and determine the extent to which flying hours could be displaced by these devices. The Navy is planning to operate F/A-18 simulators only 16 hours per day, 5 days per week, primarily because Navy officials believe personnel onshore should be given weekends off to be with their families. We believe other days off could be provided to those who train or work over weekends.

Fleet readiness training

We estimate the requirement for OFTs and WTTs, considering maximum student loading, could be reduced as follows if these devices were operated 6 days per week.

	Lemoore		Cecil	
	5-day week	6-day week	5-day week	6-day week
Operational flight trainers	2.3	1.9	1.9	1.6
Weapons tactics trainers	1.5	1.3	1.3	1.0

Navy officials commented that trainer availability time would be less than what we used in this analysis. They estimated that trainer time available, based on a 16-hours-per-day, 5-days-per-week schedule would be only 3,400 hours per year (65 to 66 hours per week instead of 80) because of trainer turnaround time and unscheduled maintenance. Our analysis, however, was based on the Navy's instructional system development criteria that the trainers would be operated 80 hours per week.

Proficiency training

To meet primary mission readiness requirements, each F/A-18 pilot will be required to fly 25 to 30 hours per month in the aircraft and complete 4 hours of training in the WTT or OFT or both. The Navy did not analyze the proficiency trainer requirements as it did through the instructional systems development process for fleet readiness training. Therefore, we used the following assumptions to estimate this requirement:

--Trainer hours available based on 5- and 6-day week alternatives for equipment use and a two-shift training day, with allowance for equipment downtime.

--Pilot proficiency training requirements of 4 hours per month.

--Average number of squadrons at trainer sites based on 1,044 aircraft buy.

Using these factors, we determined WTT requirements for proficiency training would be as follows:

	Weapons tactics trainers	
	5-day week	6-day week
Lemoore	1.7	1.4
Cecil	1.3	1.1
El Toro	.3	.3
Beaufort	.5	.4

Combined training requirements at Lemoore and Cecil

Navy officials stated that fleet readiness squadron trainers and proficiency trainers would not be dedicated, but rather each WTT would be available to all types of users. If the Navy uses our assumptions; that is, combine requirements and use the OFTs and WTTs 6 days per week, it could save $47 million, as shown below:

	Lemoore		Cecil		
	WTT	OFT	WTT	OFT	Total
Fleet readiness requirement	1.3	1.9	1.0	1.6	-
Proficiency requirement	1.4	-	1.1	-	-
Total	2.7	1.9	2.1	1.6	-
Required trainers (note a)	3	2	3	2	10
Planned trainers	4	3	4	2	13
Reduction	1	1	1	-	3
Savings (note b)	$18.7	$9.6	$18.7	-	$47.0

a/Figures rounded off.

b/In millions.

As the analysis shows, the three WTTs and two OFTs at Lemoore and Cecil would have unused capacity. We believe the Navy should use this capacity by increasing the monthly proficiency training in the simulators and by reducing the planned flying hours in the aircraft. Navy officials commented that they considered simulator training as complementary, not as a substitute for flight training.

Facilities savings at Lemoore and Cecil

Eliminating a WTT at Lemoore and Cecil would also save the Navy $5 million in facilities costs in addition to the equipment costs previously discussed. Each WTT will require a special facility costing approximately $2.5 million.

USE OF SMALLER, LESS EXPENSIVE TRAINERS AT EL TORO AND BEAUFORT SHOULD BE CONSIDERED

In addition to the trainer reductions at Lemoore and Cecil Air Stations, we believe the Navy should substitute the less expensive OFTs for WTTs at El Toro and Beaufort. Our analysis indicates the WTTs planned for each of these locations will be used 30 to 40 percent of the time. We believe it would be more economical to use an OFT, which has only one student cockpit, instead of a WTT which has two cockpits. By using two well-utilized OFTs for proficiency training in place of WTTs, the Navy would save $18.2 million in equipment costs and $5 million in facilities costs at El Toro and Beaufort. Navy officials stated that they were seriously considering using only OFTs for proficiency training (instrument and emergency procedures) instead of WTTs if their costs exceeded $25 million. This idea, however, was dropped after a revised cost proposal of $18.7 million for the first WTT was accepted by the Navy.

NEED FOR PILOT TRAINERS AT OVERSEAS BASE SHOULD BE RECONSIDERED

The Navy should not purchase an OFT for the Iwakuni overseas base because Marine Corps rotation periods of 12 months, on which the OFT need was based, have been reduced to 6 months, the same as a Navy carrier which has no trainer. The need for an OFT for proficiency training is questionable, especially since Navy officials do not regard this type of training as a substitute for aircraft flying hours. Eliminating this OFT would result in savings of $9.6 million.

CONCLUSIONS

The Navy could achieve significant savings by combining fleet readiness and proficiency training requirements and by using pilot trainers 6 days per week. The Navy could eliminate two WTTs with related facilities and one OFT at a total cost of $52 million. Further, the Navy could save $23 million by substituting less costly OFTs for underused WTTs at El Toro

and Beaufort. The Navy should also reconsider using OFTs for most proficiency training if the WTT unit costs increase.

In addition, we believe the Navy should delete the requirements for an OFT at the Iwakuni overseas base due to the shortened 6-month overseas rotation periods. This would result in a further savings of $9.6 million.

AGENCY COMMENTS AND OUR EVALUATION

DOD stated that the number and types of trainers planned were determined to achieve training objectives in the most effective manner. DOD disagreed that trainers should be used 6 days per week. The Navy stated that uncertainties in trainer workload, unscheduled maintenance, and personnel morale were reasons for limiting planned trainer time to 5 days per week. We do not believe that the Navy's reasons for a 5-day-per-week schedule are valid because (1) the F/A-18 trainers are expected to have a longer service life and be more reliable than previous trainers and (2) the potential morale problems appear solvable--it should be noted that the Air Force is planning for a 6-day week training device program for its newest aircraft system, the F-16.

DOD disagreed that WTTs should be eliminated from El Toro and Beaufort. It said that without the WTTs, the OFT would have to be modified (at a cost comparable to the WTT) to provide needed training. We do not believe that the WTT utilization rate at these two locations warrant the additional $25.6 million cost. Alternatives, such as flying additional weapons delivery missions or using the WTTs at other locations, should be considered. Furthermore, fleet personnel told us that they doubted weapons delivery training in a simulator would be required once the pilot was graduated from fleet readiness school.

DOD stated that it needed an OFT at Iwakuni as a cost-effective complement to flight training and that carriers did not have them because of space limitations. We still believe that for rotational units--at a base or on a carrier--training can be accomplished at the units home base rather than spending $9.6 million for a trainer.

DOD stated that to modify OFTs to meet the training objectives of WTTs would significantly increase OFT costs. It was not our intention that OFTs be modified. Rather, we believe OFTs should be used, possibly in conjunction with other alternatives, to provide needed training if WTT costs rise. DOD did agree that if WTT costs increase substantially, alternative training devices will have to be evaluated regarding both their cost and capability to meet training objectives.

RECOMMENDATIONS

We recommend that the Secretary of the Navy

--combine fleet readiness and proficiency training requirements and use the pilot trainers 6 days per week,

--use the OFT in place of the more expensive WTT for proficiency training at El Toro and Beaufort,

--cancel the planned purchase of an OFT for the overseas base of Iwakuni, and

--reconsider using OFTs for proficiency training if WTT unit costs increase.

CHAPTER 6

PERSONNEL AND SUPPORT EQUIPMENT REQUIREMENTS CAN BE REDUCED BY CONSOLIDATING UNITS

Since the Navy considers personnel and support equipment costs to be among the most significant contributors to an aircraft's life cycle costs, it should consider consolidating the F/A-18 squadrons into larger size units. For example, by consolidating the planned 24 F/A-18 attack squadrons, each with 12 aircraft, into 12 squadrons, each with 24 aircraft, the Navy could eliminate up to 598 enlisted personnel positions and thus save approximately $9.5 million annually. This consolidation would also reduce initial organizational ground support equipment costs. Furthermore, it may enhance the carrier airwing mission capability.

CONSOLIDATION WOULD SIGNIFICANTLY REDUCE PERSONNEL COSTS

Enlisted personnel cost savings of at least 17 percent could be achieved if the Navy would consolidate its planned F/A-18 units. The Navy's traditional approach of manning and equipping small units 1/ to operate independently needs to be reappraised, especially given current and probable future problems in recruiting and retaining highly trained maintenance personnel.

The February 1979 Defense Resource Management Study suggested the Navy study the feasibility of consolidating its carrier-based fighter and attack squadrons as a means to overcome small-scale inefficiencies and reduce ownership costs.

Our analysis of this suggestion indicates the Navy could save approximately $9.5 million annually in enlisted personnel costs by consolidating the planned 24 F/A-18 attack squadrons, each with 12 aircraft, into 12 squadrons, each with 24 aircraft. The Navy could achieve savings by reducing the number of personnel needed for maintenance overhead, temporary duty intermediate level maintenance, and direct organizational level maintenance.

1/Navy squadrons assigned to a carrier airwing have only 4 to 12 aircraft assigned. Planned F/A-18 squadrons will be assigned 12 aircraft.

Navy officials commented that this proposal is now being studied by the Center of Naval Analysis. They commented other consequences, such as loss of command positions and its effect on officer retention and possible management problems of larger squadrons, must be examined before it can be determined that there would be a savings to the Navy.

Maintenance overhead personnel

Each squadron is assigned personnel to staff overhead work centers, such as material control, maintenance administration, quality assurance, and data analysis. Staffing for many overhead work centers has no relation to the number of aircraft or personnel assigned to a squadron. For example, 6 of the 10 overhead work centers have a fixed staffing of one person, regardless of whether the squadron consists of 12 or 24 aircraft. Thus, the number of aircraft assigned to a squadron can increase without a proportionate increase in maintenance overhead staff.

The Defense Resource Management Study discussed consolidation of two Navy A-7E squadrons. 1/ The study concluded that consolidating the two squadrons into one 24-aircraft squadron would reduce maintenance overhead staff by about 44 percent (from 52 to 29).

A Navy official, responsible for F/A-18 staffing, stated that F/A-18 and A-7E squadrons maintenance overhead personnel requirements were almost identical. He concluded that combining two F/A-18 squadrons, each with 12 aircraft, would also achieve about a 44-percent reduction in overhead staff. Therefore, we project the Navy could eliminate up to 286 maintenance overhead positions and thus save $4.5 million annually by consolidating the planned 24 F/A-18 attack squadrons. Navy officials commented that actual savings would be less because of the Navy's inability to fully man its current squadrons to authorized levels.

Temporary duty intermediate maintenance personnel

Unlike organizational maintenance in which each squadron is manned and equipped to operate independently, the Navy has centralized intermediate maintenance aboard aircraft carriers and at naval air stations. The intermediate maintenance departments, with only administrative, planning, and

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1/The squadrons each contain 12 A-7E aircraft which will be replaced by the newer F/A-18.

support equipment maintenance personnel permanently assigned, are augmented by intermediate maintenance technicians who are temporarily assigned from the individual squadrons that the department supports. Although the personnel belong to a particular squadron, they lose their squadron identity and perform maintenance on components from any squadron. Squadron commanders negotiate which people will actually be temporarily assigned to the intermediate maintenance department, and personnel not required for this assignment often remain with the squadron to perform organizational level maintenance or are left ashore. The full complement of maintenance technicians are seldom assigned.

The Defense Resource Management Study concluded that consolidating two A-7E or F-14A squadrons, each with 12 aircraft, would reduce intermediate maintenance personnel requirements by 25 and 44 percent, respectively. Navy officials commented these fiqures may be high because the methodology used in this study has been changed.

Navy maintenance officials did concur that consolidation would reduce F/A-18 squadron intermediate maintenance personnel requirements. To illustrate, one official estimated consolidation would reduce temporarily assigned intermediate maintenance personnel requirements by approximately 20 percent.

On the basis of this more conservative 20-percent estimate, we project that combining the planned 24 F/A-18 attack squadrons will eliminate up to 96 positions and thus save the Navy approximately $1.5 million annually.

Direct organizational maintenance personnel

Direct organizational maintenance work center staffing is determined through a complex set of mathematical equations. These equations include considerations for the number of aircraft assigned, planned monthly flight hours, and organizational maintenance hours per flight hour.

Although direct maintenance staffing is determined scientifically, the Navy could improve productivity and achieve substantial personnel reductions by consolidating squadrons. For example, we used the Navy's formulas to compute the staffing requirements of two 12-aircraft squadrons and one 24-aircraft squadron. The following chart presents our analysis.

Comparison of Direct Organizational Maintenance Work Center Staffing

Work center	Two 12-aircraft squadrons	One 24-aircraft squadron	Potential staff reductions
Powerplants	20	18	2
Airtrames	34	32	2
Corrosion	10	10	0
Aviation equipment	4	3	1
Safety equipment	8	8	0
Electrical	10	7	3
Fire control	12	10	2
Integrated weapons	14	12	2
Electronic instruments	14	13	1
Armament	46	41	5
Total	172	154	18

As indicated, combining squadrons would reduce direct squadron maintenance requirements around 10 percent (from 172 to 154). Therefore, by consolidating the planned 24 F/A-18 attack squadrons, we estimate the Navy could eliminate up to 216 organizational maintenance positions and thus save approximately $3.5 million annually in personnel costs.

CONSOLIDATION WOULD REDUCE MAINTENANCE EQUIPMENT COSTS

Consolidating F/A-18 squadrons will also reduce maintenance equipment costs. Each squadron is provided tools and equipment to perform its organizational maintenance functions. The Navy attempts to decrease the cost of this provisioning by having squadrons share some tools and pieces of equipment that are seldom used. Consolidation would aid in this attempt by further reducing maintenance tool and equipment requirements.

To quantify the equipment savings that could be achieved through consolidation, we compared organizational equipment allowances, contained in the June 1979 F/A-18 consolidated ground support equipment list, 1/ for two 12-aircraft squadrons versus one 24-aircraft squadron. We found that, in many cases, the quantities of equipment needed were cut in half. For example, a 12- or 24-aircraft squadron needs only one $4,900 rigging set. The following chart shows the potential savings--by consolidating two 12-aircraft squadrons--on 78 items 2/ of organizational equipment identified in the June 1979 consolidated ground support equipment list.

Comparison of Organizational Equipment Allowances

	Different items of equipment	Total items allowed	Cost of allowances
Two 12-aircraft squadrons	78	348	$1,684,100
One 24-aircraft squadron	78	289	1,266,000
Potential reduction	0	59	$ 418,100

Our projections indicate that, if the Navy consolidated the planned 24 F/A-18 attack squadrons, it would eliminate the need for 708 pieces of equipment and thus save at least $5 million.

The potential for savings increases as the Navy identifies additional allowance items. For example, after our analysis, the November 1979 F/A-18 equipment list, although incomplete, contained 253 different equipment items compared to the 78 on which our $5-million savings was projected.

Navy officials commented that potential savings may not be this high.

1/The consolidated ground support equipment list, recommended by McDonnell-Douglas, contains support equipment allowances for various quantities of aircraft, such as 9-12, 13-16, 17-24, and 25-32.

2/The June 1979 consolidated ground support equipment list contained only 78 organization equipment items with sufficient information (allowances and cost) for our analysis.

CARRIER AIRWING MISSION CAPABILITY MAY BE ENHANCED

In addition to reducing squadron personnel and equipment costs, we believe consolidation may also enhance carrier airwing mission capability. Navy aircraft squadrons generally operate independently from a carrier deck or naval air station and are equipped and staffed to meet a specific role. A fighter squadron's role is fighter escort and fleet air defense. In contrast, an attack squadron's role is interdiction and close air support. The commonality and ability of the F/A-18 to be quickly configured--changing external equipment within one hour--to perform either the fighter or attack roles provide the opportunity to consolidate aircraft squadrons. Consolidation may increase airwing flexibility and the number of aircraft available for either mission and thus enhance mission capability.

CONCLUSIONS

Consolidating F/A-18 aircraft squadrons is a viable alternative for reducing support costs. As the number of aircraft supported increases, there is often less than a proportional increase in support staff and equipment. According to our analysis, consolidating the planned 24 F/A-18 squadrons, each with 12 aircraft, into 12 squadrons, each with 24 aircraft, would save up to $9.5 million annually in personnel costs and would reduce initial organizational ground support equipment costs. Furthermore, consolidating F/A-18 squadrons may enhance carrier airwing mission capability.

RECOMMENDATION

We recommend that the Secretary of the Navy reassess present deployment plans for the F/A-18 and evaluate the merits of consolidation as a means to overcome small-scale inefficiencies and reduce ownership costs.

AGENCY COMMENTS

DOD said that, in response to the Defense Resource Management Study, the Center of Naval Analysis, is studying squadron consolidation. The study is scheduled for completion in late 1980.

CHAPTER 7

DEPOT MAINTENANCE AND AIRCRAFT PROCUREMENT

COSTS MAY BE SUBSTANTIALLY REDUCED

Depot level maintenance should be scheduled not on the basis of calendar intervals, but on the material condition of the aircraft. The high cost--over $250 million annually--of periodic depot level maintenance in the Navy is due to short intervals and the tendency of personnel at all levels to do too much work when the aircraft may not need it. The Navy urgently needs to shift its maintenance planning and budgeting to the logic-based reliability system for maintenance which is being used by the Air Force and most commercial airlines. Use of this concept should reduce needed depot maintenance and its cost and reduce or cancel the planned purchase of pipeline aircraft for replacements for those undergoing depot work. Adoption of the concept should also reduce the need to construct or expand 20 facilities at the depot level.

RELIABILITY CENTERED MAINTENANCE WAS DEVELOPED BY THE AIRLINES

The reliability centered maintenance (RCM) concept limits aircraft maintenance to that which is needed for safety, reliability, and economics. By analysis and data surveillance, unnecessary organizational and depot maintenance tasks are eliminated, thus reducing costs and improving safety by minimizing human error or part failure. RCM is based on a maintenance concept developed for commercial aircraft, known as Maintenance Steering Group-2, which is approved by the Federal Aviation Administration. Members of the Air Transport Association and Aerospace Manufacturers Association promulgated significant portions of this program for public use.

In formulating scheduled maintenance programs for new aircraft, commercial airline operators and aircraft manufacturers believed the programs could be developed more efficiently and economically through decision logic processes. RCM ensures that each task is generated by an evaluation of failure consequences, followed by an examination of the relationship between that task and the equipment's reliability characteristics. The concept uses on-condition 1/ maintenance

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1/On-condition involves determining whether an item is in, and will remain in, a satisfactory condition until the next scheduled inspection.

tasks to prevent functional failures. This results in few tasks requiring items to be removed and either reworked or retired from service at fixed time limits. This approach proved so successful in its initial application that some airlines have applied the RCM concept rigorously to both new and existing aircraft. For example, on an older aircraft, such as the Boeing 707, use of the RCM concept changed 60 percent of hard time (scheduled) maintenance actions to on-condition. For the newer Boeing 747, all maintenance actions are on-condition.

By applying RCM, the airlines have reaped considerable savings in maintenance man-hours and costs. A November 1974 Center of Naval Analysis study on the RCM concept stated that airframe maintenance for the Boeing 707, which averaged $56 per flight hour in 1963, averaged only $40 in 1971, even though labor pay scales and material costs had increased substantially. During the same period, the Boeing 707's fatality and accident rates decreased.

THE NAVY HAS NOT FULLY IMPLEMENTED THE RCM CONCEPT

The Secretary of Defense endorsed the RCM concept in 1976 and directed the services to apply this concept to military aircraft. However, the services were allowed to implement the concept as part of their individual program of developing and maintaining the equipment necessary to fulfill their assigned missions. To implement the RCM concept, the Navy modified its analytical maintenance program and developed the naval aviation maintenance program for depot level maintenance. The program specifies the Navy policy upon which the performance of all depot level maintenance is based, the responsibilities assigned to ensure compliance with established policy, and the organization to implement and operate a depot level maintenance program.

The naval aviation maintenance program includes the following aspects of the RCM concept:

- --Selecting significant operational items in naval aircraft and identifying the consequences of functional failures of these items.
- --Examining the failure modes of these items and identifying those that cause critical secondary damage.
- --Identifying inspection or removal tasks (tasks that must either reduce failure consequences or reduce the likelihood of failures) that are applicable and effective for the items.

The program, however, does not establish a specific data surveillance and analysis program that can be used effectively to monitor the types, frequencies, and consequences of failure experienced by naval aircraft. Thus, the naval aviation maintenance program still requires that scheduled depot maintenance be accomplished at specific periods during the service life of an aircraft. This service period is to be based on operating service months or flight hours or both.

The Navy commented that it is fully implementing the RCM concept for the F/A-18. The Navy commented this is being accomplished by (1) observing vendor tests of major components, (2) retrieving data from the Air Force YF-17 fly-off, and (3) analyzing F/A-18 flight test data. The Navy said that the 48-month depot maintenance interval planned for the F/A-18 was based primarily on environment and predicted aircraft employment. It said the 48-month interval was a minimum planning estimate; the desired interval is 72 months. The Navy commented inservice data analysis is continuing and adjustments to the 48-month cycle is anticipated.

SIGNIFICANCE OF F/A-18 RELIABILITY AND MAINTAINABILITY FEATURES MAKES IT AN IDEAL SYSTEM FOR RCM

The F/A-18 has reliability and maintainability characteristics designed into the aircraft which should reduce its depot maintenance needs and eliminate the periodic scheduling for depot maintenance. Two major characteristics of the aircraft are the corrosion prevention design features and the fault isolation and detection system.

Corrosion prevention design features

According to the branch head of the F/A-18 maintenance engineering/logistics support team, the prime cause for practically all Navy depot maintenance relates to the generic problem of corrosion in the saltwater environment. The Navy has minimized this problem for the F/A-18, however, by using ion-vapor-deposit technology for coating metal alloys. This aluminum coating replaces the marginally effective cadmium plating used on other naval aircraft. In addition, the contractor is extensively using corrosion resistant material (graphite-epoxy composites and titanium) in the aircraft. In fact, 35 percent of the F/A-18 airframe surface is made of graphite-epoxy composites.

Fault isolation and detection system

Built-in test circuits are required in all avionics systems and many nonavionics systems in the F/A-18. Performance

specifications require a guaranteed fault isolation time of 5 minutes or less for 95 percent of the equipment and 10 minutes or less for the remaining 5 percent. Furthermore, 90 percent of the avionics circuits are automatic and are used inflight to assess functional performance, identify failed modes, and perform operational readiness system checks. Ninety-eight percent of the avionics system is covered by a combination of automatic and operator-initiated test circuits which are used at the organizational level to assist the technician in failure detection and isolation.

USE OF THE RCM CONCEPT MAY RESULT IN SUBSTANTIAL SAVINGS

We believe that, if the Navy fully adopted the RCM concept, it could achieve significant savings in the following areas:

--Depot maintenance.

--Procurement of pipeline aircraft.

--Facility expansion at the depot level.

Depot maintenance

Use of RCM should significantly reduce needed depot maintenance and its cost. On the basis of the planned 48-month cycle, an F/A-18, over its 15-year service life, will receive three depot maintenance visits, costing approximately $572,000 (in 1975 dollars). What the savings would be is difficult to estimate, but as we reported in our 1976 report, 1/ DOD and airline industry representatives have estimated that maintenance costs may be reduced by about 20 percent using the RCM concept. Accordingly, savings could total as much as $156 million for the planned buy of 1,366 aircraft.

Pipeline aircraft

Use of RCM should also drastically reduce or eliminate the need for the planned purchase of 185 F/A-18s for pipeline replacements for those operational aircraft undergoing depot maintenance or modifications at any given time. As reported in our 1976 report, applying the RCM concept to the

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1/"Management Action Needed in the Department of Defense to Realize Benefits from a New System of Aircraft Maintenance" (LCD-76-443, Nov. 10, 1976).

P-3 aircraft program reduced the time to complete needed depot work approximately 47 percent. Assuming the RCM concept does the same for the F/A-18, the planned 6.4-month estimate to overhaul an F/A-18 would be reduced to 3.4 months. The 6.4-month estimate is based on the depot operating on a 1-shift, 5-days-per-week schedule.

Under a wartime maintenance program (three 8-hour shifts, 7-days-per-week) processing time would be drastically reduced. As discussed in our 1979 report 1/ on A-10 aircraft pipeline needs, under a wartime schedule, all A-10s in the depot could be buttoned-up and made ready for operational deployment in 1 to 20 days. Since it would take the Navy at least 3 months to button-up and make ready for deployment the two or three carriers that are normally in the yards being modified and/or repaired, the need for any F/A-18 pipeline aircraft is highly questionable. We believe all F/A-18s assigned to the carriers or Marine Corps units could be buttoned-up at the depot and made ready for deployment in a matter of days like the A-10. With this in mind, we believe the need for pipeline aircraft could be greatly reduced or eliminated. Currently, the Navy plans to buy 185 pipeline aircraft at a cost of over $3.6 billion.

Facility expansion

The Navy could also reduce the extent of facility expansion and modifications if it fully adopted the RCM concept for the F/A-18.

To provide adequate depot support for the new aircraft, North Island Naval Air Station officials are projecting a need to expand or construct 20 facilities at a cost of approximately $132 million. The estimate is based on three scheduled depot visits of the F/A-18 and a maximum induction of 330 aircraft in 1998.

CONCLUSIONS

We believe significant savings are possible in the F/A-18 program if the Navy fully adopted the RCM concept which has worked so successfully for the airlines. Reliability and maintainability features designed into the F/A-18 should reduce the Navy's depot maintenance needs and eliminate the need for periodic scheduling for depot maintenance.

1/"Unnecessary Procurement of A-10 Aircraft for Depot Maintenance Floats" (LCD-79-431, Sept. 6, 1979).

Full implementation of the RCM concept should reduce depot maintenance costs and reduce or cancel the planned procurement of 185 F/A-18s as pipeline replacements for operational units undergoing depot work. What the savings would be cannot be estimated precisely, but there is a potential for saving over $3.7 billion.

In addition to the depot maintenance and pipeline aircraft savings, adoption of the RCM concept should reduce the need to expand or modify the North Island depot facility to accommodate the planned F/A-18 inductions.

AGENCY COMMENTS AND OUR EVALUATION

DOD stated that the Navy is in compliance with DOD's RCM strategies and is implementing the full RCM concept for the F/A-18. It stated the established depot level maintenance interval of 48 months was based on logistics support analysis and was needed for long-range workload planning and budget requirements. According to DOD, as the RCM data base expands, the interval will be modified or eliminated as needed.

DOD's statement that the 48-month interval was established based on logistics support analysis conflicts with the Navy's statement that 48 months is the minimum, with a desired interval of 72 months. Furthermore, the 48-month interval was established at the start of the F/A-18 development program--more than 1 year before the logistics support analysis process was started.

The point is, no cyclical depot maintenance should be planned or budgeted for under the RCM concept. Otherwise, depot facilities may be funded and established before a need is established. The Air Force, in fully implementing RCM for its F-16 aircraft, will budget for F-16 depot maintenance as the requirement is determined.

Concerning pipeline aircraft, DOD said the allocation of pipeline aircraft is based on the estimated 48-month depot maintenance cycle, but will be adjusted as the Navy refines its depot maintenance requirements. DOD also said that pipeline aircraft are necessary to ensure sufficient aircraft are available in operational and training units to support deployed and shore-based flying programs, in peacetime as well as in wartime. DOD believes our analysis overlooked this peacetime need.

We believe that the need for pipeline aircraft, if any, should be based on only wartime needs and consider reduced depot maintenance achievable by the RCM concept. Weapon systems, such as the F/A-18, are obtained to meet a wartime

requirement. Pipeline aircraft should not be required to sustain peacetime maintenance and operational workloads. For the F/A-18, as currently planned, this pipeline aircraft requirement will cost over $3.6 billion. During peacetime, aircraft are flown fewer hours than those in a wartime environment. Therefore, to sustain peacetime operations, while some aircraft are undergoing depot repair, other aircraft could fly more hours.

DOD also stated that only one of the facilities being considered for construction at North Island is peculiar to the F/A-18. DOD stated the other facilities were required for modernization and to support the total depot workload. Since North Island will be a dedicated F/A-18 repair facility, we question DOD's statement. We found that many projects pertain to additions or modifications to meet the planned F/A-18 maintenance inductions. Therefore, on the basis of the RCM concept, we believe our analysis on reduced facilities is accurate. Nevertheless, DOD said the North Island facility requirements will be validated before budget submissions for military construction.

RECOMMENDATIONS

We recommend that the Secretary of the Navy

--require the full implementation of the RCM concept for the F/A-18 and cancel plans for depot overhauls on a cyclical basis,

--reassess the need for pipeline aircraft considering the expected higher operational-available time of the F/A-18 and reduce depot turnarounds, and

--review planned depot expansion and modifications at North Island.

CHAPTER 8

MAINTENANCE FACILITY EXPANSION CAN BE CURTAILED

The Navy can reduce planned F/A-18 maintenance facility expansion without jeopardizing mission capability or readiness. To provide maintenance support for the F/A-18, a number of facility expansions are being planned for Lemoore Naval Air Station and El Toro Marine Corps Air Station. We believe the Navy can save at least $17.3 million by reducing Lemoore Naval Air Station accoustical enclosure and engine test cell construction projects. Furthermore, the mobile maintenance van pad construction planned for El Toro Marine Corps Air Station may be excessive.

ACCOUSTICAL ENCLOSURES NEEDS HAVE BEEN OVERSTATED

The Navy can save approximately $14.3 million by reducing the number of accoustical enclosures to be built at Lemoore Naval Air Station. To reduce noise levels and to comply with DOD noise abatement instructions, Lemoore officials have begun paperwork to build five accoustical enclosures costing approximately $17.9 million. However, a subsequent Navy analysis, based on current aircraft reliability, indicates only two or three enclosures are needed. But, the F/A-18 is expected to be more reliable than current aircraft, thus, we believe one enclosure will satisfy Lemoore requirements once the F/A-18s are introduced there.

Accoustical enclosures are not currently used for the aircraft at Lemoore. However, officials have complained that the noise levels generated from full-power runups--operating an engine at full power--have adversely affected working efficiency in the administration and maintenance operations areas. Furthermore, when the wind changes from its normal course and blows toward the control tower all scheduled full-power runups on test pads one and two must be canceled.

The F/A-18 twin-engined noise levels are significantly higher than the single engine aircraft currently stationed at Lemoore. Therefore, McDonnell-Douglas, responsible for identifying F/A-18 facility requirements, recommended building five accoustical enclosures (one for each hanger turnup test pad).

An accoustical enclosure is a structure built around a high-power turnup test pad that houses an entire aircraft during engine testing and trimming. The purpose of an enclosure is to reduce engine operating noise levels to 85 decibels

within a 250-foot radius. Navy officials stated DOD Instruction 6055.3, regarding noise abatement, sets 8 hours as the maximum length of time a person may be exposed to an 85-decibel noise level. Thus, they believe using accoustical enclosures and restricting workshifts to 8 hours, assures compliance with the DOD Instruction.

The Navy's F/A-18 fleet introduction team believes accoustical enclosures are needed. However, on the basis of its analysis, the team believes two or three enclosures will sufficiently meet Lemoore's requirements. To illustrate, one official estimated the average enclosure use during a 16-hour day operating schedule would range from approximately 59 percent for one enclosure to 6.5 percent for three. This official used the average monthly turnups of current Navy and Marine aircraft, such as A-4s and F-14s, to determine requirements.

The F/A-18 engine, however, is projected to be more reliable, requiring fewer maintenance actions than current aircraft. As maintenance actions decrease, engine runups to verify performance also decrease. Therefore, we have projected F/A-18 engine turnup requirements, using current engine failure rates experienced after 8,765 hours of contractor testing, to be as follows:

	Number of enclosures				
	One	Two	Three	Four	Five
Enclosure hours available (note a)	347	694	1,041	1,388	1,735
Enclosure hours required	48	48	48	48	48
Percent of use	13.8	6.9	4.6	3.5	2.8

a/Per month average based on two 8-hour shifts, 5 days per week.

On the basis of F/A-18 engine reliability currently being experienced, we believe one enclosure has the capacity to meet all of Lemoore's projected F/A-18 high-power engine turnup requirements. The need for a backup was not considered. If the Navy believes a backup is needed to meet simultaneous aircraft needs or to replace a damaged unit, then a cost analysis should be done.

ENGINE TEST CELL REQUIREMENTS CAN BE REDUCED

The Navy can save approximately $3 million by reducing engine test cell construction at Lemoore Naval Air Station. The Navy plans to test all F/A-18 engines which have been removed for immediate maintenance before reinstalling them in the aircraft. These tests are performed in air-cooled, noise-suppressed facilities called engine test cells.

Navy analysis indicates three test cells are needed to support Lemoore's F/A-18 future baseload. At present, Lemoore has two test cells but they are badly deteriorated, and the instrumentation systems are not compatible with F/A-18 engines. Therefore, the Navy has begun the paperwork to upgrade and modify the current test cells at $550,000 each and to build a new test cell for $3 million, equaling a total cost of $4.1 million.

Similar to projections for accoustical enclosures, the Navy based test cell requirements on current Lemoore aircraft engine failure rates. Again, because the F/A-18 engine was designed to be more reliable and maintainable, it should require fewer maintenance actions than the engines in the A-7E aircraft currently stationed at Lemoore.

Therefore, using the F/A-18 engine failure rates experienced after 8,765 hours of contractor testing, we project test cell requirements at Lemoore will be as follows for one, two, and three engine test cells.

	Number of test cells		
	One	Two	Three
Test cell hours available (note a)	174	348	522
Test cell hours required	244	244	244
Percent of use	140	70	47

a/Based on present Lemoore Naval Air Station test cell operating schedule of one 8-hour shift, 5 days per week.

Two cells more than adequately meet projected requirements and also provide backup capability to ensure mission capability. Therefore, by modifying and upgrading the two existing cells and by eliminating the construction of the new cell, the Navy could save approximately $3 million.

MAINTENANCE VAN PADS APPEAR EXCESSIVE

Although the Navy is still studying the number and types of maintenance vans the Marine Corps will need to support its F/A-18 units, a fiscal year 1982 military construction proposal for 239 van pads 1/ has been submitted for the El Toro Marine Corps Air Station. The estimated cost for this proposal is $1.25 million. We believe this proposal should not be acted upon until the Navy has completed its study. Officials of the Third Marine Air Wing at El Toro advised us that only 87 vans would be needed to support their F/A-18 squadrons and that only 17 new pads would be needed because they had 70 pads.

CONCLUSIONS

Because the F/A-18 is designed to be more reliable and maintainable than previous systems, the need for certain support facilities can be reduced. We estimate the Navy can save $17.3 million by reducing planned construction of accoustical enclosures and engine cells at Lemoore Naval Air Station. In addition, the planned construction of mobile maintenance van pads appears to be excessive and should be reevaluated.

AGENCY COMMENTS AND OUR EVALUATION

The Navy said that the requirements for accoustical enclosures and engine test cells at the Lemoore Naval Air Station were independent of the F/A-18 aircraft. As part of its comments (see app. I), the Navy stated, "It is true that the F/A-18 aircraft will utilize them [accoustical enclosures and engine test cells]; but, the requirement was established on the basis of the total NAS [naval air station] Lemoore mission vice the requirements of the F/A-18 aircraft."

We question this since the Lemoore Naval Air Station is to be a dedicated F/A-18 base with over 275 F/A-18s and about 30 other aircraft. Although DOD stated that the reliability and maintainability of the F/A-18 were considered in determining the requirement, we could find no support for its statement. Therefore, we believe our analysis and conclusions accurately reflect the F/A-18's characteristics and reduced need for acoustical enclosures and engine test cells.

1/Van pads are constructed of 6-inch reinforced concrete. The pads have input power, telephone lines, water supply, and drainage systems to house an 8 ft. x 20 ft. maintenance van.

Concerning the requirement for mobile maintenance van pads at El Toro Marine Corps Air Station, DOD said that requirements will be validated before the fiscal year 1982 budget is submitted.

RECOMMENDATIONS

We recommend that the Secretary of the Navy

--determine the number of accoustical enclosures and engine test cells needed for the Lemoore Naval Air Station, considering the higher reliability and maintainability aspects of the F/A-18, and

--reevaluate the number of mobile maintenance van pads planned for El Toro Marine Corps Air Station.

APPENDIX I

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

MANPOWER
RESERVE AFFAIRS
AND LOGISTICS

Apr. 29, 1980

Mr. R. W. Gutmann
Director, Logistics and Communications Division
U. S. General Accounting Office
Washington, DC 20548

Dear Mr. Gutmann:

This is in response to your March 5, 1980, letter to the Secretary of Defense forwarding copies of your draft report on "Operating and Support Costs of the Navy's F/A-18 Can be Substantially Reduced" (GAO Code 947370) (OSD Case #5394).

The report has been carefully reviewed for factual errors and the GAO recommendations have been evaluated. Comments on the recommendations for the Secretary of Defense and the Secretary of the Navy are attached (enclosure 1). Also attached are detailed comments and recommended corrections to the text of the draft report (enclosure 2).

Several of the recommendations (use of multi-port test equipment, consolidation of avionics repair activities, and increasing the size of squadrons) are already under review by the Navy. These recommendations are potentially beneficial, but require further evaluation before implementation of any major changes. The remaining GAO findings and recommendations (use of "surplus" VAST stations, reassessment of test equipment risk, changes in allocation and use of training devices, revisions of depot maintenance plans, reduction of facilities requirements and reassessment of pipeline aircraft requirements) appear to be based upon some erroneous information and assumptions. Incorporation of the changes suggested in enclosure 2 would correct factual errors in the draft report and significantly alter the findings and recommendations.

Sincerely,

Richard Danzig

Richard Danzig
Acting Assistant Secretary of Defense
(Manpower, Reserve Affairs, and Logistics)

Enclosures 2

GAO note:
Detailed Navy comments (encl. II) were removed because they were too voluminous. Navy comments have been incorporated as appropriate. Changes made did not significantly alter our findings and recommendations.

APPENDIX I

Comments on GAO Recommendations
Draft GAO Report "Operating and Support Costs of the
Navy's F/A-18 Can Be Substantially Reduced" (GAO Code 947379)
(OSD Case #5394)

1. The following comments are made regarding each of the GAO recommendations for the Secretary of Defense and the Secretary of the Navy.

a. Recommendation for the Secretary of Defense.

(1) Recommendation: "We recommend that the Secretary of Defense reevaluate the present DOD policy of not allowing long lead funding for initial spares given the Navy problem of using SAIP (Spares Acquisition Integrated with Production). The Navy should be allowed to use long lead funding so as they can procure initial spares and aircraft installed parts concurrently and reduce the F/A-18 initial provisioning cost."

Comment: Current DOD spares provisioning policies, as reflected in DOD Directive 4140.40 and DOD Instruction 4140.42, require that initial spares be procured lead time away from the need date in the minimum range and depth necessary to sustain operations until normal replenishment can be effected. These policies are intended to reduce the risk of overprocurement based on inaccurate forecasts of demand, and the risk of procuring spares that will become obsolete before they are used.

The SAIP concept, as implemented in some carefully selected cases by the Air Force, shows promise that these risks can be held to acceptable levels and that savings in spares procurement can be realized by placing orders for spares concurrent with orders for production items. It should be pointed out, however, that the Air Force restricts SAIP to a relatively small number of high costs items, and that the potential cost savings due to SAIP are still uncertain. Preliminary indications are that SAIP can save on the order of 10-15% in initial procurement of those selected items to which it is applied, but that the percentage of the total spares buy for which SAIP can be applied has, to date, been much lower than the Air Force originally projected. The GAO's estimate of potential F/A-18 savings ($150 million), which is based on this early Air Force projection, appears to be overstated.

The SAIP approach comes into conflict with current DOD policies only in those instances where spares are procured far in advance of their need date in order make spares buys concurrent with production. In a multi-lot production program like F/A-18, there are opportunities to place spares orders for selected long lead time and normal lead time items concurrent with a production lot without requiring funding any earlier than non-SAIP procurements. To the extent that spares requirements are computed under the approved DOD procedures (i.e., minimum range and depth), such a limited application of SAIP does not conflict with DOD policies. The Navy is encouraged to apply SAIP in this manner where it is cost effective.

ENCLOSURE (1)

OSD will continue to review SAIP experience to date, considering both the potential cost savings or other advantages of SAIP and the potential risks introduced by earlier-than normal procurement of spares under SAIP, and will re-evaluate present DOD policies based upon the results.

b. Recommendations for the Secretary of the Navy.

(1) Recommendation: Adopt the McDonnell-Douglas proposal to use dual and/or multi-port ATE for testing F/A-18 avionics and radar components.

Comment: The McDonnell-Douglas proposal for the multi port radar test station has been accepted. The proposal for multi port ILASS is under evaluation by the F/A-18 program management office as part of an overall ATE alternatives study. This study is weighing the technical risks and effectiveness considerations as well as the potential cost benefits of multi-port ILASS. A final decision is expected by May 1980.

(2) Recommendation: Review the need for 96 VAST stations and use components from any surplus units to satisfy the government furnished equipment requirement for the F/A-18 avionics tester,

Comment: The F/A-18 does not replace any of the aircraft supported by VAST. The VAST stations identified as "surplus" by GAO are being heavily utilized to meet current F-14, S-3 and E-2C requirements, and will continue to be used for that purpose after introduction of the F/A-18.

(3) Recommendation: Determine if it is still in the government interest to accept the high development risks now present in the contract for the F/A-18 ATE equipment.

Comment: The ATE development and procurement strategies were carefully evaluated considering cost and risk along with other parameters. Although integration testing is not included in the contractual ATE acceptance procedures, it is anticipated that any changes needed after initial acceptance will be software intensive. The acceptance testing of individual test program sets (TPS's) will include testing of software and TPS integration with the ATE. Risk is considered well within prudent bounds.

(4) Recommendation: Consolidate all F/A-18 avionics component repair, for Navy and Marine Corps units, at Lemoore and Cecil Field and establishing overseas repair facilities to support deployed carriers and Marine Corps units.

Comment: The DRMS study, on which this recommendation is based, acknowledged that insufficient analysis had been performed to warrant immediate recommendations for change. The DRMS suggested sufficient savings and readiness implications existed to merit further Navy analysis. A follow-up study is now being conducted for the Navy by the RAND Corporation. The study is scheduled for completion late this year.

(5) Recommendation: Combine fleet readiness and proficiency training requirements and utilize the pilot trainers 6 days per week.

APPENDIX I

Comment: The Navy's Analytical Maintenance Program (AMP) embodies the Department of Defense RCM strategies. The Navy has been conducting in depth analysis of aircraft and systems in accordance with an airline/FAA developed logic known as MSG-2. The AMP identifies the frequency and activity level for performing required maintenance actions. Navy aircraft are inducted in the depot, not for overhaul, but to accomplish those required tasks which cannot be done at a lower level. It has been Navy's experience that the depot maintenance interval has increased for those aircraft which have completed analysis.

The Navy is implementing the full RCM concept for the F/A-18. Aircraft systems such as the Maintenance Signal Data Recorder Set were specifically designed for this purpose. MCAIR is under contract to develop the F/A-18 Logistics Support System employing the RCM concept at all maintenance levels. Logistics Support Analysis is being performed by MCAIR. Navy RCM data is resident in the Analytical Maintenance Program Analysis System. An initial data base was established using YF-17 flight experience. Vendor tests of components and F/A-18 FSD flight experience are adding to the data. The cognizant field activity for collecting and analyzing F/A-18 RCM data is the NAVAIR Engineering Support Activity at NARF North Island.

Through Logistics Support Analysis, an estimated depot level maintenance interval of 48 months was established as the basis for long range planning of NARF workload and budget requirements. As the RCM data base expands, this interval will be modified and/or eliminated in accordance with the Analytical Maintenance Program.

(11) Recommendation: Reassess the need for pipeline aircraft considering the higher expected operational-available time of the F/A-18 and reduced depot turn-arounds.

Comment: The allocation of aircraft for the pipeline are based on the current planning estimates for F/A-18 depot level maintenance. This allocation is necessary to ensure sufficient aircraft are available in operational and training units to support deployed and shorebased flying programs, in peacetime as well as wartime. This point was apparently overlooked in GAO's suggestion that the need for pipeline aircraft could be completely eliminated by planning to quickly "button up" aircraft in the depot to meet wartime deployment requirements. The number of aircraft planned for pipeline allocation will be adjusted as necessary based on refined requirements for the frequency and duration of F/A-18 depot maintenance that will be developed through the RCM analysis process.

(12) Recommendation: Review planned depot expansion/improvements at North Island.

Comment: At this time, only one of the facilities being considered for construction at NARF North Island is peculiar to the F/A-18 introduction. The remaining facilities are required to support the total NARF workload and for modernization. These facility requirements will be validated prior to MILCON budget submissions.

APPENDIX I

Comment: The requirements for pilot training devices were determined through the highly structured instructional systems development methodology. The numbers and types of devices are intended to achieve both FRS and fleet training objectives in the most effective manner. In consideration of uncertainties in weekly trainer workload and unscheduled maintenance, 6 day per week utilization is not considered a sound planning assumption. F/A-18 training devices will, like current fleet trainers, be utilized 6 days per week when necessary to accommodate training overloads.

(6) Recommendation: Use the operational flight trainer in lieu of the more expensive weapons tactics trainer for proficiency training at El Toro and Beaufort.

Comment: The OFT does not have the wide angle visual and weapons delivery modes necessary to provide required training at El Toro and Beaufort. To add this capability to the OFT would increase cost to levels comparable to the WTT.

(7) Recommendation: Cancel the planned procurement of operational flight trainers for the overseas bases of Kaneohe and Iwakuni.

Comment: The recommendation is not applicable to Kaneohe since it is the home base for three squadrons and not a rotational site. The OFT planned for Iwakuni is intended as a cost effective complement to flight training. A valid requirement exists for training devices for deployed squadrons, both at rotational sites and aboard carriers. OFT's are not installed on carriers because of space limitations.

(8) Recommendation: Reconsider the use of OFT's for proficiency training if the WTT unit cost rises.

Comment: The wide angle visual system and weapons delivery modes which are incorporated in the WTT, but not the OFT, are necessary to meet required training objectives. To incorporate these capabilities in the OFT would significantly increase its cost. If WTT cost increases substantially, alternative training devices will have to be evaluated with regard to both cost and their capability to meet required training objectives.

(9) Recommendation: We recommend that the Secretary of the Navy reassess present deployment plans for the F/A-18 and evaluate the merits of consolidation as a means to overcome small scale inefficiencies and reduce ownership costs.

Comment: Squadron consolidation was developed as an alternative by the DRMS, which recognized insufficient analysis had been completed to warrant recommendations for immediate organizational changes. The DRMS, rather, stated that the potential for savings and increased efficiency merits further study by the Navy. Such a study is being conducted by the Center for Naval Analyses, and is scheduled for completion late this year.

(10) Recommendation: Require the full implementation of the RCM concept for the F/A-18 and cancel plans for depot overhauls on a cyclical basis.

APPENDIX I

(13) Recommendation: Determine the number of acoustical enclosures and engine test cells needed for Lemoore Naval Air Station considering the higher reliability and maintainability aspects of the F/A-18.

Comment: Aircraft acoustical enclosures and engine test cell requirements for Lemoore were calculated to support the entire base aircraft population. Needs were based on the reliability and maintainability aspects of all aircraft to be supported, including the F/A-18.

(14) Recommendation: Reevaluate the number of mobile maintenance van pads planned for El Toro Marine Corps Air Station.

Comment: Some of the mobile maintenance van pads planned for El Toro are for the F/A-18. The requirements were submitted by the USMC in consideration of the total base loading of all aircraft to be supported. Requirements will be validated prior to submission of the FY 82 budget.

APPENDIX II

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON D C 20301

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RESERVE AFFAIRS
AND LOGISTICS

May 7, 1980

Mr. R. W. Gutmann
Director, Logistics and Communications Division
U.S. General Accounting Office
Washington, D. C . 20548

Dear Mr. Gutmann,

This is in reference to our letter of April 29, 1980 forwarding comments on GAO's draft report, "Operating and Support Costs of the Navy's F/A-18 Can Be Substantially Reduced." (GAO Code 947370) (OSD Case #5394).

In response to the GAO recommendation that the Navy "Adopt the McDonnell-Douglas proposal to use dual and/or multi-port ATE for testing F/A-18 avionics and radar components," we stated that the proposal for the multi-port radar test station has been accepted. Discussions with your staff indicate some confusion regarding interpretation of the term "multi-port." In fact, the radar test station has only two ports. To avoid any further confusion on this point, please make the following correction to our response:

Erratum

Enclosure (1) Comment 1.b.(1). Change "multi-port radar test station" to "dual port radar test station."

Sincerely,

Russell R. Shorey
Special Assistant for Weapons Support

(947370)

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