

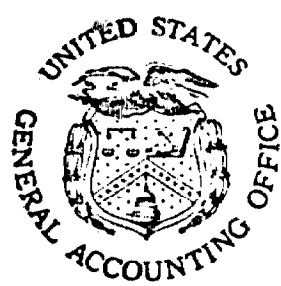
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BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

An Unclassified Version Of  
A Classified Report Entitled  
"Need To Demonstrate F-18 Naval  
Strike Fighter Weapon System  
Effectiveness Before  
Large-Scale Production"



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PSAD-79-25

2/27/79



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20543

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

This report presents our views on the major issues concerning the F-18 Naval Strike Fighter weapon system. A draft of this report was reviewed by agency officials associated with the program, and their comments are incorporated as appropriate.

For the past several years, we have annually reported to the Congress on the status of selected major weapon systems. This report is one of a series that is being furnished to the Congress for its use in reviewing fiscal year 1980 requests for funds.

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

James B. Stock

Comptroller General  
of the United States

COMPTROLLER GENERAL'S  
REPORT TO THE CONGRESS

NEED TO DEMONSTRATE F-18 NAVAL  
STRIKE FIGHTER WEAPON SYSTEM  
EFFECTIVENESS BEFORE  
LARGE-SCALE PRODUCTION

D I G E S T

The F-18 Naval Strike Fighter is a new tactical aircraft designed to meet Navy fighter and light-attack requirements. The aircraft has been designed to perform four missions: (1) fighter escort, (2) fleet air defense, (3) interdiction, and (4) close-air support. The F-18 will also be used by the Marine Corps. The total cost of developing and procuring 811 aircraft is estimated to be about \$14.3 billion.

*Navy & Marine*

*ACC 0000*

According to the Navy, F-18 aircraft weight has increased, and degradation may occur in single engine rate-of-climb, acceleration speed, combat ceilings, and minimum landing speed. If this degradation continues, the F-18's ability to achieve its specified objectives will be reduced. (See pp. 4 and 5.)

*FIND/CON*

A number of ordnance items planned for use on the F-18 aircraft have known performance deficiencies. These include the Sparrow AIM-7F missile and the Sidewinder AIM-9L missile. In addition, it is questionable whether the GBU-15, to be used as a stand-off weapon, will go into production. Present programs are ongoing to correct Sparrow and Sidewinder performance limitations/deficiencies. However, these improvement programs will not be completed for several years. Since the purpose of the F-18 weapon system is to destroy enemy air and ground targets, weaknesses in these weapon systems will reduce the F-18's effectiveness in performing its missions. (See pp. 5 to 8.)

GAO believes that there is a large degree of planned concurrent development and production present in the F-18 program. The program is in full-scale development. Development flight testing began in November 1978, and operational evaluation is expected to be completed in October 1980. However, the Navy plans to contract for 2 lots of production aircraft, which could consist of from 24 to 39 airplanes and long-lead production items, before completion of operational test and evaluation. Program cost would go as high as about \$1.5 billion before completion of operational evaluation. The tightly scheduled flight test program is highly optimistic and leaves little time to correct deficiencies identified during testing.

In the past on other programs, where risks were high, concurrency was frequently demonstrated to be a costly procedure because it usually resulted in either the system's performance being degraded and/or the incurring of additional costs to bring the system to the required level of performance. (See pp. 11 to 13.) In GAO's opinion, the risk of problems arising during the development of this weapon system is high because the airframe, engine, and radar are new.

In view of the past problems the Department of Defense has had with concurrency in high risk situations, the degradation in performance of the F-18 aircraft, and the performance deficiencies of certain F-18 weapons, GAO believes that it would be desirable to practice concurrency with caution and accelerate efforts to solving performance and weapon system problems. GAO further believes that it would be desirable to restructure the test program to allow sufficient time to determine and resolve risks.

F-18 selected acquisition reports did not explicitly set forth changes in the performance of the F-18. (See p. 14.)

Consequently, GAO recommends that the Secretary of Defense *should*

- Restructure the test program to insure complete testing and evaluation of F-18 effectiveness and suitability before approving full production of F-18 fighter aircraft.
- Conduct an analysis of F-18 performance degradations to evaluate the effect these problems will have on the ability of the F-18 to accomplish its missions.
- Insure that the F-18 operational test and evaluation program will give sufficient emphasis to fully disclosing capabilities and limitations of existing weapon systems which the F-18 will use, and the impact identified problems will have on F-18's ability to perform its missions.
- Accurately disclose the performance changes in the F-18 selected acquisition reports.

A draft of this report was reviewed by agency officials and their comments were incorporated as appropriate.

C o n t e n t s

		<u>Page</u>
DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	F-18 program management	2
	Status of foreign military sales	2
	Scope of review	3
2	SHORTCOMINGS ASSOCIATED WITH PERFORMANCE OF AIRCRAFT AND WEAPON SYSTEMS	4
	Degradation in F-18 characteristics	4
	Planned F-18 ordnance has shown deficient performance	5
	Sparrow AIM-7 missile	6
	Sidewinder AIM-9L missile	7
	High-speed antiradiation missile	8
	GBU-15 modular guided bomb	8
3	SIGNIFICANT DEGREE OF CONCURRENCY IN THE F-18 PROGRAM	9
	Extensive F-18 production before approval for service use	9
	Potential for increased concurrency on F-18 program	10
	Adverse effects of concurrency on other defense programs	11
4	F-18 SELECTED ACQUISITION REPORTING OF PERFORMANCE NEEDS IMPROVEMENT	14
	Degradation in performance not clearly stated in selected acquisition reports	14
5	CONCLUSIONS AND RECOMMENDATIONS	16
	Conclusions	16
	Recommendations	16
APPENDIX		
I	Cost estimates of F-18 program	18
II	F-18 program schedule estimates	19

ABBREVIATIONS

DOD                    Department of Defense  
GAO                    General Accounting Office  
HARM                   High Speed Antiradiation Missile

## CHAPTER 1

### INTRODUCTION

The F-18 Naval Strike Fighter is a twin engine, carrier suitable aircraft designed to meet Navy and Marine Corps needs. The total cost of developing and procuring 811 aircraft is estimated to be about \$14.3 billion. The program is in full-scale development. The Department of the Navy anticipates full production beginning in 1980, with the first squadrons to be deployed in early 1983.

The F-18 is a multimission aircraft which may be used to perform either fighter or attack missions, such as fighter escort, fleet air defense, interdiction, and close-air support. Aircraft to be used for the two missions will be identical. Selection of external equipment or ordnance and ancillary equipment is the distinguishing difference between aircraft used for different missions.

The approved F-18 program is for 811 aircraft, consisting of 11 development aircraft and 800 production aircraft. The Navy plans to use 430 production F-18s in the fighter configuration to replace Navy and Marine Corps F-4s. Of the remainder, 310 F-18s will be used in the attack configuration to replace Navy A-7 light-attack aircraft, and 60 will be two-seat trainers.

The missions for which the fighter configuration of the F-18 was designed are fighter escort and fleet air defense. In the latter role, the F-18 will complement the F-14A/Phoenix systems. The fighter configuration normally has two to four Sparrow missiles, two Sidewinder missiles, and an internal 20 mm gun.

The missions for which the light-attack version was designed are interdiction and close-air support. The attack configuration has the 20 mm gun; two wingtip Sidewinder missiles; a forward looking infrared and laser spot tracker; a strike camera on the Sparrow missile fuselage stations; a loading of guided and unguided munition, including Maverick, Walleye, and High Speed Antiradiation missiles (HARMs); rockets; cluster and laser-guided bombs; and the MK-80 series bombs.



## F-18 PROGRAM MANAGEMENT

The F-18 Project Manager, Naval Air Systems Command, Washington, D.C., is responsible for all management and technical aspects of the program.

The McDonnell Douglas Corporation, St. Louis, Missouri, is the airframe prime contractor for the F-18. McDonnell has overall weapon system performance and technical management responsibility. It will design and build the forward fuselage, wings, and stabilizer subassemblies, and will be responsible for the landing gear, arresting gear, crew station, and avionics integration. To assist in the management of the F-18 contract, a Project Office representative is located at the airframe prime contractor's facilities.

Northrop Corporation, Hawthorne, California, a major McDonnell subcontractor, will design and build the center and aft fuselage, the vertical fins, environmental control system, hydraulics, secondary power and starting unit, and several other F-18 systems. Northrop designed the YF-17 aircraft, the prototype of the F-18.

The F-18 radar is being developed by Hughes Aircraft Company, Culver City, California, under subcontract with McDonnell. This radar incorporates technological advances in a radar smaller and lighter than those produced by Hughes for other Air Force and Navy aircraft.

The General Electric Company, Lynn, Massachusetts, is developing the F404-GE-400 engine which will be used on the F-18 aircraft. The development is being performed under a Navy contract. An associate contractor's agreement between McDonnell and General Electric provides for engine and airframe interface. Final assembly of the F-18 aircraft will be at McDonnell's St. Louis facility.

## STATUS OF FOREIGN MILITARY SALES

Both McDonnell and Northrop expect to sell the F-18 to foreign nations. McDonnell plans to sell the Navy version of the F-18, while Northrop intends to sell a land-based version, designated the F-18L. The F-18L is expected to have 85- to 90-percent high value/high usage parts commonality with the Navy F-18.

Both McDonnell and Northrop have held technical discussions with a number of foreign governments. Also, both have

submitted proposals to the Australian and Canadian Governments for their new fighter programs. On October 30, 1978, the Australian Government announced its list of competitors for its fighter program, which included both the F-18A and F-18L among the four finalists. Continuing negotiations are underway, with possible final selection by mid-1979.

On November 23, 1978, the Canadian Government announced its list of two finalists, which were the F-16 and F-18A. Four other competitors, including the F-18L were eliminated. Negotiations are underway, with final selection probable during the spring of 1979.

Foreign sales of the F-18 could be economically beneficial to the United States, since a portion of the Navy's \$2 billion development cost could be recovered. At the present time, the F-18 development recoupment surcharge has been calculated at \$1.3 million per foreign sale aircraft. Also, depending on sales arrangements, production of F-18 components for foreign sales by Navy F-18 contractors could reduce Navy F-18 production costs.

#### SCOPE OF REVIEW

In our review of the F-18 weapon system, we performed field audit work at the F-18 Project Office and related Naval Air Systems Command activities. We also conducted field audit work at the McDonnell Douglas Corporation, Northrop Corporation, Hughes Aircraft Company, and General Electric Company.

Our primary objective was to evaluate progress in developing the F-18 weapon system and, where problems were found, to evaluate their future effect on program cost, schedule, and/or weapon system performance.

## CHAPTER 2

### SHORTCOMINGS ASSOCIATED WITH PERFORMANCE

#### OF AIRCRAFT AND WEAPON SYSTEMS

F-18 performance has not been demonstrated yet, but the Navy is predicting an increase in the weight of the aircraft; decrease in the single engine rate of climb, acceleration, and combat ceilings; and an increase in the minimum landing speed. Furthermore, problems with the ordnance carried by the F-18 could further degrade its capability to perform its capability to perform its mission.

#### DEGRADATION IN F-18 CHARACTERISTICS

Navy reporting of F-18 performance showed various characteristics where less favorable results are anticipated than originally estimated. F-18 aircraft weight is higher than planned, and single engine rate of climb is below expectations.

In September 1978 the Navy estimated the empty weight of the F-18 fighter at 21,649 lbs.; 1,503 lbs. over the current target weight. In August 1978 the Navy estimated the take-off gross weight of the last development aircraft at 35,399 lbs., 1,745 lbs. over contract specification.

Weight increases occurred throughout the F-18 aircraft, with the exception of the radar. The largest weight increase is in the center fuselage area, where most of the F-18 subsystems (environmental control system, auxiliary power system, etc.) increased in weight along with structural weight increases. Contractors attribute a major part of the higher weight to the Navy's emphasis on high reliability and maintainability.

Single engine rate-of-climb is the capability of the aircraft to gain altitude when operating with only one of its two engines. In March 1977 the Navy estimated F-18 single engine rate-of-climb to be Deleted feet per minute (ft/min). The Navy now estimates that it will be Deleted Deleted ft/min, a 20-percent reduction.

The Navy revised its estimates for several other F-18 operational characteristics as a result of the weight increase. Coincidental with the reported weight growth, the F-18's time to accelerate from mach .8 to mach 1.6 increased from 98 seconds to 109 seconds, 1 second less than the acceleration threshold of 110 seconds. Also, the minimum carrier landing speed increased from 125 knots to 131 knots, 1 knot below the 132-knot threshold. Also, the combat radius for the F-18 strike mission decreased from 614 nautical miles to 580 nautical miles. If these degradations continue, the ability of the F-18 to perform its missions will be reduced.

PLANNED F-18 ORDNANCE HAS  
SHOWN DEFICIENT PERFORMANCE

Accomplishing F-18 missions requires good performance not only from the F-18 aircraft but also from the ordnance systems it will carry. A function of the F-18 is to destroy enemy assets in the air or on the ground. Regardless of how well the F-18 airframe and engines perform, ordnance systems problems could seriously affect the ability of the F-18 system to perform its mission. Such problems in several of the F-18 ordnance systems have been identified in our prior reports.

Current plans call for the F-18 to be equipped with a variety of sophisticated missiles and bombs, including the Sidewinder, Sparrow, Maverick, and HARM missiles, and GBU-15 guided bombs. Mission performance deficiencies have been noted in some of these ordnance systems.

In a recent report, we discussed the impact degraded ordnance performance can have on an aircraft fulfilling assigned missions. The report, on the F-15 aircraft, showed how deficiencies in the Sidewinder and Sparrow systems degraded the mission performance capability of the aircraft. 1/ We also reported on weaknesses in HARM, which is in full-scale development. 2/ Technical problems with the GBU-15, which showed it had not demonstrated needed performance before

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1/"Effectiveness of the F-15 Aircraft" (PSAD-78-93),  
June 23, 1978.

2/"Status of the Navy's High Speed Antiradiation Missile (HARM) Program" (PSAD-78-26), March 23, 1978.

production, were discussed in another of our reports. <sup>1/</sup>  
Those same weapon systems are planned for use on the F-18  
and, unless corrected, the same problems will exist.

Sparrow AIM-7 missile

The medium-range missile, the Sparrow AIM-7F is

Deleted

The AIM-7F's capability to kill a target

Deleted

According to Department of Defense (DOD) officials, the  
Advanced Monopulse missile, the AIM-7M, which has been in  
engineering development since April 1978, should help resolve  
the Deleted problems.

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DOD officials said that the new Advanced Medium Range  
Air-to-Air missile program should offset some of these prob-  
lems. This program, which has completed concept definition,

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<sup>1/</sup>"Issues to Be Resolved Before Continuing the Air Force  
GBU-15 Program" (PSAD-78-49), August 24, 1978.

takes advantage of recent technology to develop a lighter weight, higher speed missile that will allow launch of multiple missiles from a single aircraft at multiple targets. The Advanced Medium Range Air-to-Air missile's initial operational capability is planned for fiscal year Deleted years after the initial deployment of the F-18.

Sidewinder AIM-9L missile

The Sidewinder missile AIM-9L, is a short-range, infrared guided missile and was deployed in May 1978.

The Navy's operational evaluation report on the AIM-9L showed that the missile's effectiveness Deleted

**Deleted**

Air Intercept Missile Evaluation data showed Deleted

**Deleted**

DOD officials said that an improved AIM-9L, the AIM-9M, is under development. It will improve the AIM-9L in two major areas. Deleted

**Deleted**

AIM-9 Sidewinder missiles have historically experienced structural problems, which the severe flight environment during air combat maneuvers accentuates. The AIM-9L was not expected to have these problems because of airframe design modifications. During testing, however, similar problems (e.g., loosening of coupling rings used to assemble major mission sections) were identified. Because of these problems,

the Air Force's evaluation concluded that the prototype AIM-9L was not operationally suitable.

#### High Speed Antiradiation missile

The High Speed Antiradiation missile 1/ is an air-to-surface guided missile to be used by the Navy and Air Force for destroying or suppressing the radar of enemy air defense artillery and surface-to-air missile systems. The system includes an air-to-surface missile, and equipment on the aircraft to interface with onboard avionics and to provide guidance data to the missile.

The missile's design has been improved to counter Soviet air defense radar systems operating in higher frequencies. However, according to DOD officials, it will still be performance limited, because of

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#### GBU-15 modular guided bomb

The GBU-15 was designed as an air-to ground glide bomb to be used by aircraft such as the F-18 to attack high-value targets beyond the battle area. However, it is questionable whether this weapon will ever go into production. Consequently, the F-18 may not have a standoff air-to-ground weapon.

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1/An antiradiation missile homes Deleted on a radiation source.

### CHAPTER 3

#### SIGNIFICANT DEGREE OF CONCURRENCY

##### IN THE F-18 PROGRAM

Although successful demonstration of program objectives should be the pacing activity for a development program, the Navy plans 1/ to begin F-18 production before this has been demonstrated. As a result of this and the ordering of long-leadtime production items, the Government plans to commit about \$1.5 billion before the completion of testing and assurance that the F-18 will be operationally effective and suitable in its intended environment. The absence of a time margin for delays in the flight test schedule, plus potential delays in development aircraft deliveries and in the time needed to correct defects found during testing, could increase the extent of concurrent development and production risk. From examinations of other programs where production was started before the systems demonstrated that they could perform their missions, we found numerous instances of deficient equipment being accepted or costs increased to correct deficiencies in production hardware. In view of the decline in the predicted performance of the F-18 aircraft and the weaknesses in its weapon systems, it appears to us that a great deal of concurrency would be of questionable value.

##### EXTENSIVE F-18 PRODUCTION BEFORE APPROVAL FOR SERVICE USE

Concurrency, in our earlier work on this subject, was defined as production before completion of development and approval for service use. 2/ Based on this definition, we believe there will be substantial concurrency in the F-18 program. In fact, the decision to release long-lead funds and the full funding release for the first nine (pilot production) F-18s will take place before the first Navy preliminary evaluation of the aircraft. Later, in March 1979, the

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1/The Navy plan was approved by the Secretary of Defense and has congressional concurrence.

2/Under Navy acquisition procedures a determination that a new system is operational, effective, suitable, and logistically supportable is a prerequisite to the decision to begin production.



Navy plans to release long-lead funds for 15 to 30 limited production aircraft, with their full-production release in March 1980. Again, in March 1980, while testing continues, the Navy expects to release long-lead funding for the next production lot of 72 aircraft. Operational evaluation will not be completed and the F-18 will not be approved for service use until October 1980. Thus, production release for 24 to 39 aircraft and funding releases amounting to about \$1.5 billion will occur before F-18 tests have been completed and evaluated by the Navy's independent test agency--the Operational Test and Evaluation Force.

Not only are production decisions planned before testing and evaluation are completed, but also the schedule for testing is tight, with little, if any, time to correct and retest performance deficiencies that normally occur. The tight timing of the test program is illustrated by the scheduling of the 72 aircraft full-production release only 1 month after operational testing is completed, as contrasted to the 3-month interval specified in Navy regulations.

While not a part of the concurrency criteria, the timing of the Board of Inspection and Surveys testing, relative to the production approval, is also indicative of the time restrictions in the flight test program. This testing is performed mainly to verify that the aircraft meets design specifications. In accordance with the current F-18 schedule, the Board of Inspection and Surveys testing for the fighter configuration will occur after the operational evaluation has been completed, the F-18 has been approved for service use, and production has been approved for 96 to 111 aircraft.

POTENTIAL FOR INCREASED  
CONCURRENCY ON F-18 PROGRAM

Onschedule delivery of development aircraft is critical to complete flight testing as scheduled. Deliveries of the first F-18s were several months late, and we believe future deliveries may also be late. Consequently, a potential exists for additional aircraft production before planned testing can be completed.

The time to flight test the F-18 aircraft in support of production decisions does not allow for substantial delays in delivery of development aircraft or in the time needed to correct deficiencies discovered from testing. To fulfill testing requirements, each of the F-18 development aircraft has

been designated and instrumented for specific testing. In turn, the testing has been scheduled to meet test requirements for the different production decisions. Since a large amount of testing must take place during a limited time period, extensive delays in aircraft deliveries and time needed to correct defects previously noted could directly affect the flight test program.

Delay in delivering the first development F-18 and a revised delivery schedule for the second development F-18 have reduced the time available for testing these aircraft before operational evaluation. The Navy had planned to begin testing F-18 flying qualities with first aircraft delivery about October 1, 1978. Propulsion performance testing had been planned with delivery of the second aircraft about December 1, 1978. Each of these aircraft was delivered about 2 months late. As a result, the time available for testing these two aircraft before the beginning of operational evaluation has been reduced. Originally, the Navy had about 40 months of aircraft time before operational evaluation to test these two major aircraft performance areas. Now, the Navy has about 36 months, a 10-percent reduction. We could not determine whether all the planned tests could be conducted in 36 months. If less tests are conducted there should be a lower confidence in production system performance.

#### ADVERSE EFFECTS OF CONCURRENCY ON OTHER DEFENSE PROGRAMS

In the past, we reviewed several programs where DOD engaged in concurrent development and production in acquiring major weapon systems.

We discovered that concurrency where risks were high was a costly procedure because it usually resulted in either the system's performance being degraded and/or the incurring of additional costs to bring the system to the required level of performance.

In 1972 we reported on test and evaluation of major weapon systems. <sup>1/</sup> Notable examples of situations where production was approved in the absence of or consideration of development testing included the C-5A aircraft and the B-1 aircraft. Costs to correct structural deficiencies and inoperable or unreliable subsystems for these two aircraft are well known.

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<sup>1/</sup>"The Importance of Testing and Evaluation in the Acquisition Process For Major Weapon Systems" (B-163058), August 7, 1972.

In a more recent review, we again encountered a situation in which concurrency was present. <sup>1/</sup> When the S-3A program began, operational testing was generally conducted concurrent with the introduction of new systems into the fleet. The S-3A program was initiated before current DOD, fly-before-buy policies governing major weapon system acquisitions became effective. Accordingly, production decisions were based on contractor achievement of fixed milestones.

Results of Navy operational tests and evaluations conducted in 1974 and 1975 showed that although the S-3A demonstrated adequate aircraft performance characteristics (such as maintaining an antisubmarine warfare search area), it was neither operationally effective nor suitable. Results of testing and fleet exercises have raised serious questions about the ability of the S-3A

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Thus, through the practice of concurrency, the Government is committed to a system costing about \$3.4 billion, and about which there are serious doubts concerning its ability to perform its mission. Further, the Government is committed to a program to improve performance.

Another example of concurrency is the F-14A/Phoenix weapon system, which went into production before testing was completed. Recent operational test results seriously question whether the system can perform its mission. Also, there have been 38 accidents of the aircraft to date or more than 12 percent of the aircraft inventory. The current unit procurement replacement cost of an F-14A aircraft is over \$22 million.

DOD officials said that although there is concurrency in the F-18 program, it is not considered excessive. Technical and cost risks were identified and analyzed, development tests were designed to address these risks, achievement-oriented milestones were defined, and the progressive commitment of funds were tied to successful completion of these milestones. Moreover, the development program built upon the extensive YF-17 (prototype for the F-18) flight testing and YJ-101 (prototype for the F404) engine testing. Additionally, the pilot production lot of aircraft was reduced from 15 to 9 to minimize cost exposure, and a radar test bed was included in the flight test program to reduce

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<sup>1/</sup>"The Effectiveness and Readiness of the S-3A Aircraft Needs Improvement" (PSAD-78-89), May 5, 1978.

the risk associated with the development of a new radar and the integration of that radar into the avionics suite of the F-18 aircraft.

DOD officials also pointed out that neither this study, nor studies of other programs, demonstrated that the costs associated with correcting equipment deficiencies found during concurrency exceeded the cost of delaying production. They believe that it is entirely possible that the business costs of production delays (e.g., underutilizing a plant while waiting production), in combination with inflationary effects, may be far larger than the costs associated with retrofitted fixes required to correct equipment deficiencies discovered late in development.

It is difficult to estimate what the costs would have been if the alternative of delaying a production decision until the required performance was demonstrated had been followed. However, had this been done, the United States would not have spent billions in acquiring and deploying weapon systems whose ability to perform their missions is very doubtful.

In our opinion, the risks of problems occurring on this program are great since the airframe, engine, and radar are new.

CHAPTER 4

F-18 SELECTED ACQUISITION REPORTING

OF PERFORMANCE NEEDS IMPROVEMENT

The selected acquisition reports furnished by DOD to the Congress did not explicitly set forth changes anticipated in the performance of the F-18.

DEGRADATION IN PERFORMANCE  
NOT CLEARLY STATED IN  
SELECTED ACQUISITION REPORTS

The empty weight of the F-18 fighter aircraft increased by 1,503 lbs.; from 20,146 lbs. to 21,649 lbs. Further, the single engine rate of climb Deleted

Deleted the combat ceiling Deleted  
Deleted and the speed  
at altitude at combat weight Deleted

The September 30, 1978, selected acquisition report does not adequately reflect expected performance degradation. For selected performance characteristics the report shows:

	<u>Plan/ development estimate</u>	<u>Approved program</u>	<u>Demon- strated perform- ance</u>	<u>Current estimate</u>
Empty weight	21,649 lbs.	21,649 lbs.	-	21,649 lbs.
Single engine rate-of-climb	<b>Deleted</b>			
Combat ceiling (maximum thrust)				
Speed at altitude (combat weight)				

It would appear from these figures that the aircraft is estimated to perform just about the way it had been originally planned and everything is on target. This is clearly misleading, since the reader would not know, without going back to some of the earlier selection acquisition reports for the

F-18 and making a comparison, that there were degradations from the planning estimate. For example, the March 31, 1976, report shows:

	<u>Plan/ development estimate</u>	<u>Approved program</u>	<u>Demon- strated perform- ance</u>	<u>Current estimate</u>
Empty weight Single engine rate-of- climb	20,146 lbs.	-	-	20,146 lbs.
Combat ceil- ing (maxi- mum thrust)	<b>Deleted</b>			
Speed at al- titude (com- bat weight)				

Navy officials said that estimates for a number of performance characteristics, which were not firm when F-18 full-scale development was approved, were continued as planning estimates. Starting with the September 1977 report, the Program Manager identified some changes in performance characteristics due to weight and drag increase, and indicated that that they would be fully presented in the December 1977 report. This was judged to be an appropriate time to convert the planning estimates to development estimates. However, in the December 1977 report, the designation "Planning Estimate" was not removed and the one-time reconciliations from planning to development estimates were not included. DOD officials said that those oversights would be corrected in a subsequent F-18 selected acquisition report.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

#### CONCLUSIONS

The high cost and waste of concurrent development and production have been demonstrated many times in the past. The risks associated with concurrency appear to increase when time does not permit complete and adequate testing. Major programs appear to develop a momentum of their own, where definable costs of delaying a program to complete testing override potential, but usually real and very large costs which result from inadequate or incomplete testing before going into production.

In view of the time limitations on testing the F-18 weapon system before major decisions, the potential for delays in performing planned tests, and the lack of time for testing corrections to problems identified during testing, we believe the extent of concurrency may be even greater than what appears now.

F-18 aircraft performance degradation has been estimated to have occurred, and this adversely affects the ability of the system to perform its mission. Also, problems with the ordnance systems to be used on the F-18 will have a further degrading effect on its ability to perform its mission.

In view of these factors, we believe that it would be desirable to proceed into production with caution and accelerate efforts to solving performance problems. We further believe that it would be desirable to restructure the test program to allow sufficient time to determine and resolve risks.

Selected acquisition reporting is intended to inform the Congress and DOD officials of the status of major weapon programs. Timely reporting of program changes is essential for the report to be useful. The usefulness of the F-18 selected acquisition reports has been reduced by not clearly showing that changes in performance characteristics that have taken place.

#### RECOMMENDATIONS

We recommend that the Secretary of Defense:

--Restructure the test program to insure complete testing

and evaluation of F-18 effectiveness and suitability before approving full production of F-18 fighter aircraft.

- Conduct an analysis of F-18 performance degradations to evaluate the effect these problems will have on the ability of the F-18 to accomplish its missions.
- Insure that the F-18 operational test and evaluation program will give sufficient emphasis to fully disclosing capabilities and limitations of existing weapon systems which the F-18 will use, and the impact the identified problems will have on the F-18s ability to perform its mission.
- Accurately disclose the performance changes in the F-18 selected acquisition reports.



COST ESTIMATES OF F-18 PROGRAM (note a)

	<u>December 1975</u>	<u>September 1977</u>	<u>September 1978</u>
Program cost:			
Development	\$ 1,834.4	\$ 1,967.9	\$ 2,047.8
Procurement	11,012.6	10,813.1	12,240.0
Military construction	<u>28.3</u>	<u>28.5</u>	<u>33.5</u>
Total	<u>\$12,875.3</u>	<u>\$12,809.5</u>	<u>\$14,321.3</u>
Unit costs:			
Program	\$15.876	\$15.795	\$17.659
Procurement	\$13.766	\$13.516	\$15.300

a/In millions, then-year dollars.

F-18 PROGRAM SCHEDULE ESTIMATES

	Development estimates <u>12/22/75</u>	Current estimates <u>9/30/78</u>
Full-scale development approval	12/75	<u>a/12/75</u>
Development contracts awarded		
General Electric	11/75	<u>b/11/75</u>
McDonnell Douglas	1/76	<u>b/ 1/76</u>
First F-404 engine to test	2/77	<u>a/ 1/77</u>
First flight	7/78	<u>a/11/78</u>
Fighter version pilot production approval (nine aircraft)	11/78	11/78
Complete fighter version initial operational test and evaluation	2/80	2/80
Fighter version limited production approval (30 aircraft)	3/80	3/80
Fighter version approval for service use	10/80	10/80
Fighter version full production (72 aircraft) attack version low rate production approval	11/80	11/80
Attack version approval for service use	12/81	12/81
Attack version full production approval	1/82	1/82
Fighter version initial operational capability	9/82	5/83

a/Actual dates.

b/Dates of award of letter contracts. The General Electric contract was definitized December 10, 1976, and the McDonnell contract on December 30, 1976.

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