

COSTS OF EXPANDING AND MODERNIZING  
THE NAVY'S CARRIER-BASED AIR FORCES

The Congress of the United States  
Congressional Budget Office

---



---

PREFACE

---

The Administration's defense program includes a major expansion of the Navy. This program would involve substantial expenditures not only for additional ships but also for naval aircraft, both to establish new carrier-based air wings and to complete the modernization of the 12 existing wings.

This report, prepared at the request of the House Committee on Armed Services, estimates the cost of adding new Navy air wings and modernizing the Navy's fighter and attack forces. It also examines alternative approaches to Navy aircraft force modernization. A companion paper, Building a 600-Ship Navy: Costs, Timing, and Alternative Approaches, examines shipbuilding issues, while a forthcoming Congressional Budget Office (CBO) paper will address manpower concerns. In accordance with CBO's mandate to provide objective and impartial analysis, the paper offers no recommendations.

This study was prepared by Alan H. Shaw of CBO's National Security and International Affairs Division, under the general supervision of Robert F. Hale and John J. Hamre. Patrick Haar of CBO's Budget Analysis Division reviewed the cost estimates. Robert L. Vogel assisted in preparing the paper. Discussions with Peter T. Tarpgaard and Edward A. Swoboda of CBO were useful in preparing this paper. It was reviewed at various stages by Alfred B. Fitt of CBO and by Dr. John Transue. The cooperation of the U.S. Navy in providing data is gratefully acknowledged. The assistance of external reviewers and of the Navy implies no responsibility for the final product, which rests solely with CBO. Francis Pierce and Robert L. Faherty edited the manuscript; Janet Stafford prepared it for publication.

Alice M. Rivlin  
Director

May 1982



---

CONTENTS

---

	<u>Page</u>
SUMMARY . . . . .	xiii
CHAPTER I. INTRODUCTION . . . . .	1
Background . . . . .	1
Carrier Aircraft . . . . .	3
Issues Facing the Congress . . . . .	6
Scope of the Paper . . . . .	7
CHAPTER II. THE COSTS OF THE NAVY'S EXPANSION AND MODERNIZATION PLAN . . . . .	9
Long-Run Costs of Expansion and Modernization . . . . .	9
Five-Year Costs . . . . .	13
The Impact of Production Rates on the Rate of Expansion . . . . .	14
CHAPTER III. ANALYSIS OF ALTERNATIVE APPROACHES TO MODERNIZING FIGHTER AND ATTACK FORCES . . . . .	17
The F/A-18 Program . . . . .	17
Alternative Attack Aircraft . . . . .	20
Alternative Fighter Aircraft . . . . .	35
APPENDIX A. A CALCULATION OF THE EFFECTIVENESS OF CARRIER-BASED ATTACK FORCES . . . . .	43
APPENDIX B. COSTS . . . . .	47
APPENDIX C. EXPANSION OF THE CARRIER FORCE AT CURRENT AIRCRAFT PRODUCTION RATES . . . . .	63



---

TABLES

---

		<u>Page</u>
TABLE 1.	COMPOSITION OF A TYPICAL CARRIER AIR WING IN 1982 . . . . .	4
TABLE 2.	COMPOSITION OF AN EXPANSION AIR WING . . . . .	10
TABLE 3.	COSTS OF PROCURING AND OPERATING ONE CARRIER AIR WING . . . . .	11
TABLE 4.	ADMINISTRATION REQUEST FOR CARRIER AIRCRAFT PROCUREMENT . . . . .	13
TABLE 5.	COSTS OF CARRIER AIRCRAFT PROCUREMENT . . . . .	14
TABLE 6.	PROCUREMENT COSTS OF ALTERNATIVE ATTACK AIRCRAFT FORCES . . . . .	29
TABLE 7.	FIFTEEN-YEAR TOTAL COSTS OF ALTERNATIVE ATTACK AIRCRAFT FORCES . . . . .	31



---

APPENDIX TABLES

---

	<u>Page</u>
TABLE A-1. RANGE TO WHICH SPECIFIC LOADS CAN BE CARRIED BY AIRCRAFT FLYING A HIGH-LOW-HIGH MISSION PROFILE . . . . .	43
TABLE B-1. AIRCRAFT REQUIREMENTS FOR ONE CARRIER AIR WING . . . . .	48
TABLE B-2. AIRCRAFT UNIT COSTS . . . . .	49
TABLE B-3. COST OF PROCURING ONE CARRIER AIR WING . . . . .	50
TABLE B-4. COST OF AIRCRAFT, INCLUDING ATTRITION AIRCRAFT, FOR ONE CARRIER AIR WING . . . . .	51
TABLE B-5. PERSONNEL NEEDED FOR ONE CARRIER AIR WING . . . . .	52
TABLE B-6. OPERATION COSTS FOR ONE CARRIER AIR WING FOR ONE YEAR . . . . .	53
TABLE B-7. NUMBER OF F-14s OR F/A-18s REQUIRED FOR TEN SQUADRONS . . . . .	54
TABLE B-8. PROCUREMENT SCHEDULE FOR TEN SQUADRONS OF F-14s . . . . .	54
TABLE B-9. SAVINGS ARISING FROM BUYING TEN SQUADRONS OF F/A-18s RATHER THAN TEN SQUADRONS OF F-14s . . . . .	55
TABLE B-10. A-6E PROCUREMENT SCHEDULE . . . . .	56
TABLE B-11. FIFTEEN-YEAR TOTAL COST COMPARISON OF ATTACK AIRCRAFT ALTERNATIVES . . . . .	60
TABLE B-12. COST COMPARISON OF ATTACK AIRCRAFT ALTERNATIVES . . . . .	61



---

FIGURES

---

	<u>Page</u>
FIGURE 1. CAPABILITES OF ALTERNATIVE ATTACK FORCES . . . . .	23
FIGURE 2. RATIOS OF BOMB DELIVERY CAPACITIES OF ALTERNATIVE FORCES TO THAT OF NAVY'S PREFERRED FORCE . . . . .	24
FIGURE 3. HOW A THREE-TO-ONE ADVANTAGE IN ATTRITION RATES WOULD AFFECT THE RATIO OF SORTIES BY F/A-18s TO SORTIES BY A-7Es OVER THE COURSE OF A CAMPAIGN . . . . .	27
FIGURE 4. RANGE OF IMPROVEMENT IN BOMB DELIVERY CAPACITY FROM ADDING 24 F/A-18s TO A CARRIER AIR WING, AT VARIOUS DISTANCES TO TARGET . . . . .	39
FIGURE A-1. RANGE/PAYLOAD COMPARISON OF FOUR ATTACK AIRCRAFT FORCES . . . . .	44



---

## SUMMARY

---

To counter the growing threat of the Soviet navy, the Administration has announced its intention to reverse the long-term decline in the size of the U.S. Navy and otherwise improve Navy capabilities. It proposes to expand the U.S. fleet from the current 535 ships to roughly 600 and to increase the number of carrier-based air wings from 12 to 14. In addition to expanding, the Navy plans to modernize the existing carrier air forces, replacing 360 aircraft with more recent types, notably the F/A-18. This paper estimates the cost of the Navy's plan to expand and modernize its carrier air forces and examines alternatives to parts of that plan, while a companion Congressional Budget Office paper analyzes the shipbuilding issue.

### BACKGROUND: CARRIER-BASED AIR FORCES

The Navy's general purpose forces are structured primarily around aircraft carrier battle groups. A carrier battle group consists of one or two carriers, escorting surface combatants (cruisers, destroyers, and frigates), and various logistics and support ships. Some aircraft on the carrier provide the ability to attack targets ashore and afloat at ranges up to more than 1,000 nautical miles, while other aircraft and the escorting combatants control the sea around the battle group, protecting it from surface ships, submarines, and aircraft.

The Navy currently has 14 carriers, not including one used solely for training. These range in size from two built at the end of World War II, which displace about 60,000 tons each, to four nuclear-powered carriers displacing about 90,000 tons at full load. One carrier is currently undergoing service life extension, a major overhaul lasting about two years, and is not counted as deployable. When the process is complete, that carrier will be followed by another, and so on. Thirteen carriers are currently deployable. There is one air wing for each deployable carrier except the Vinson, which was commissioned in 1982 and for which a wing has not yet been established.

A typical air wing consists of about 90 aircraft of different types: 34 attack aircraft, which are used to deliver bombs and

missiles against surface targets; 24 fighters, which protect the battle group against enemy aircraft and escort the attack aircraft; 16 antisubmarine warfare aircraft; and 16 other aircraft for early warning, reconnaissance, electronic warfare, in-flight refueling, and cargo delivery or utility work.

Attack Aircraft. At present, each air wing has one squadron of 10 A-6E medium-attack aircraft and two squadrons of 12 A-7E light-attack aircraft. The A-6E can carry more bombs farther than the A-7E can, under a greater range of weather conditions. It is also more costly than the A-7E, and larger; it carries a crew of two, while the A-7E is a single-seat aircraft.

Fighters. Each wing has two squadrons of 12 fighters. Currently, nine wings have F-14s while three still have the older F-4 aircraft. The F-14 is a variable-geometry, two-seat interceptor with a top speed in excess of Mach two. It was designed to carry the long-range Phoenix air-to-air missile, which gives it the unique capability to engage several enemy aircraft simultaneously at long range. It also carries shorter-range weapons. The F-4 is being phased out.

The F/A-18. The F/A-18 is a multimission aircraft that is being procured both as a light-attack aircraft and as a fighter. It is currently in production but has not yet entered the fleet except in a training squadron. It is a single-seat airplane with a top speed of about Mach 1.8. It is a major component of the Navy's modernization program, intended as a replacement for the A-7E. It has been the subject of much discussion in the Defense Department, the Congress, and the press, and its ultimate role in the fleet still remains somewhat unclear.

#### THE NAVY PLAN FOR EXPANSION AND MODERNIZATION

The Navy will establish one new air wing in 1983 for the carrier Vinson, which entered the fleet in 1982. This will require the creation of the squadrons in that wing and the procurement of enough aircraft to equip and support those squadrons. According to current plans, that air wing will have F-14 fighters and F/A-18 light-attack aircraft.

The Navy anticipates delivery of the carrier Roosevelt, currently under construction, in December 1986. Two other carriers, for which funding has been requested in fiscal year 1983, would be delivered in December 1989 and December 1991. Retirement

of the two oldest carriers, the Coral Sea and the Midway, would result in a net increase of one carrier and the introduction of one additional air wing with the same composition as the wing being created for the Vinson.

Until 1981, the F-14 procurement program was to terminate in fiscal year 1983 with the completion of a sufficient inventory to maintain 18 squadrons of 12 F-14s each. The other 6 fighter squadrons were to be equipped with F/A-18s. The Navy now seeks to equip 10 more squadrons with F-14s--the 6 previously scheduled to receive F/A-18s and the 4 assigned to the two new wings.

The A-7E has been in the fleet since 1970, and will begin reaching the end of its service life in the mid-1980s. The shortfall in inventory that will occur as the A-7Es begin to be retired will have to be filled either by building more A-7Es or by replacing the A-7E as the Navy's light-attack aircraft. The Navy has decided to replace it with the F/A-18. In order to accomplish this, the Navy will have to buy enough F/A-18s to equip 28 squadrons, including the 4 assigned to the two new wings. This decision was based in part on the Navy's view that the A-7E, a subsonic aircraft with relatively sluggish performance, is becoming too vulnerable to Soviet fighters. Replacing it with the F/A-18, which has the aerodynamic performance of a fighter, would redress the problem in the Navy's view.

Furthermore, the fact that the F/A-18 can be flown as a fighter by loading it with air-to-air missiles rather than air-to-surface weapons imparts what the Navy views as valuable flexibility. F/A-18s can fly escort for other F/A-18s, freeing F-14s for fleet air defense, and F/A-18s can also be used to augment F-14s in fleet air defense.

## COSTS OF THE NAVY'S MODERNIZATION AND EXPANSION PLAN

### Long-Term Costs

The costs beyond 1982 of the Navy plan--that is, to add two new wings and to replace all the remaining F-4s with F-14s and the A-7Es with F/A-18s--will amount to \$30 billion. (Except where noted all costs are in constant 1983 dollars.) This includes the cost of aircraft assigned to squadrons, of aircraft added to training squadrons and the repair pipeline, and of aircraft purchased in advance to replace peacetime losses (advance attrition aircraft) for 15 years.

Each new air wing will cost \$5.6 billion, if all the required aircraft are procured. The production lines are currently closed, however, for both types of antisubmarine warfare (ASW) aircraft deployed in carrier air wings--the S-3 fixed-wing aircraft and the SH-3 helicopter. The \$5.6 billion total includes reopening the S-3 line and replacing the SH-3 with the SH-60 helicopter. Were the Navy not to buy any more ASW aircraft, about \$850 million would be saved, but the number of ASW aircraft deployed per carrier would have to be reduced both to accommodate the new carriers and to make up for peacetime attrition. Under these circumstances, ASW operations would eventually become impossible.

In addition to the procurement costs, each air wing would cost about \$200 million per year to operate and support.

Ten squadrons of F-14s would cost \$11.2 billion. This includes the four squadrons in the new wings and the six that are to replace the older F-4s.

Equipping 28 light-attack squadrons with F/A-18s would cost \$13.9 billion, charging these aircraft at the average unit cost of the number remaining to be procured beyond 1982. That number might, however, be changed, with an accompanying change in average unit costs. The current F/A-18 program is expected to produce about twice as many aircraft as are needed to equip the carrier attack squadrons; the remaining aircraft are being procured for other purposes. Furthermore, since the list of applications for the F/A-18 has undergone extensive alteration since the current production goal of 1,366 was arrived at, it is possible that the goal will be revised in the near future. Finally, the Administration has already indicated that it will seek yearly production rates that are significantly different from those previously planned; this would also cause changes in unit costs.

#### Five-Year Costs

The costs of expansion and modernization will not all be incurred over the next five years. During that period, however, the Navy plans to procure 936 aircraft of types deployed on aircraft carriers at a total cost of \$25.6 billion (see Summary Tables 1 and 2).

Some of these aircraft are not for expansion and modernization but to fill shortfalls in existing inventories, while others

SUMMARY TABLE 1. ADMINISTRATION REQUEST FOR CARRIER AIRCRAFT  
PROCUREMENT (By fiscal year)

Aircraft	1983	1984	1985	1986	1987
A-6E	8	8	12	12	12
F/A-18	84	96	108	132	132
F-14	24	30	30	30	30
E-2C <u>a/</u>	6	6	6	6	6
EA-6B <u>b/</u>	6	6	6	6	6
SH-60 <u>c/</u>	--	--	--	64	64

a/ Airborne early warning.

b/ Electronic warfare aircraft.

c/ Antisubmarine warfare helicopter.

are for the Marine Corps. The F/A-18 is being procured for several purposes. The costs shown in Summary Table 2 are thus the anticipated total expenditures on all carrier aircraft in 1983-1987, not just the costs of expansion and modernization.

#### ALTERNATIVE MODERNIZATION PLANS

Several alternative approaches could achieve the Navy's goal of equipping 10 fighter squadrons and 28 attack squadrons. These consist of using the F/A-18 as a lower-cost Navy fighter to complement the F-14 and modernizing the attack force with something other than the F/A-18. Since the F/A-18 figures in all of the alternatives, the following section describes it more fully.

#### The F/A-18

The high cost of the F-14/Phoenix system being procured in the 1970s led to the development of the F-18 as a less expensive complement. The F-18 does not carry the long-range Phoenix missile, although like the F-14 it carries short-range Sidewinder missiles and medium-range Sparrow air intercept missiles.

SUMMARY TABLE 2. COSTS OF CARRIER AIRCRAFT PROCUREMENT (By fiscal year; in millions of 1983 dollars)

Aircraft	1983	1984	1985	1986	1987	Total
A-6E	271	271	320	320	320	1,502
F/A-18	2,429	2,358	2,468	2,800	2,800	12,855
F-14	1,157	1,300	1,300	1,300	1,300	6,357
E-2C	323	323	323	323	323	1,615
EA-6B	328	328	328	328	328	1,640
SH-60	--	--	--	858	858	1,716
Total	4,508	4,580	4,739	5,929	5,929	25,685

The F-18 evolved into the multimission F/A-18, which can be rapidly reconfigured from an attack aircraft to a fighter or vice versa, basically in the time required to arm it with the proper ordnance. This adds flexibility to an air wing, although critics maintain that an airplane designed for two missions will do neither mission as well as an aircraft designed for one or the other. The Navy considers it attractive as an attack aircraft because it will be more survivable than the A-7E if attacked by enemy fighters. Finally, the Navy has invested significant sums of money in designing the F/A-18 for high reliability, availability, and maintainability, an investment the Navy sees as paying off in lower maintenance costs and more available flight hours, especially in wartime.

Both its supporters and its critics have been concerned over the cost of the F/A-18. While it is a low-cost fighter, it is much more expensive than the A-7E attack aircraft it would replace. But it is not as expensive relative to other aircraft as some critics maintain. In this respect, it is most often compared with the F-14. The F/A-18s procured in fiscal year 1982 will cost \$41 million each (in 1983 dollars) including initial spare parts, while the F-14s procured over the past several years have cost about \$43 million each including initial spare parts. (A reduction in the number procured has raised the fiscal year 1983 unit cost to \$50 million.) However, the F-14 is nearing completion of its original procurement program, and the Navy is therefore buying the least expensive F-14s, while procurement of the

F/A-18 is just beginning; those F/A-18s remaining to be bought will average \$20.0 million each in 1983 dollars, with unit costs decreasing as time goes on. <sup>1/</sup> Therefore, despite perceptions to the contrary, the F/A-18 will be substantially less costly than the F-14 (if the program outlined in the most recent Selected Acquisition Report is actually followed) but about twice as much per unit as the A-7E it is intended to replace.

The Navy has already made a substantial investment in the F/A-18. By the end of fiscal year 1982, 34 percent of the total estimated program cost will have been spent, and the Navy will have procured 157 production aircraft and 11 research and development (R&D) aircraft. The fact that a substantial amount of money has already been invested in the F/A-18 argues against canceling the program. On the other hand, since about 90 percent of the aircraft are still to be bought, the question of its place in the future Navy is relevant.

#### Alternatives for Modernizing Attack Forces

Four alternative ways of replacing the two squadrons of A-7E light-attack aircraft in each air wing are analyzed here. Each attack force would also include a squadron of ten A-6E medium-attack aircraft.

##### Option 1: The Navy's Preferred Force

- o 24 F/A-18s per air wing;
- o Total cost of \$12.1-13.3 billion in 1983 dollars.

##### Option 2: Current Force of A-7Es

- o 24 A-7Es per air wing, replacing old A-7Es as they retire with new A-7Es;
- o Total cost of \$5.5-7.6 billion in 1983 dollars.

---

<sup>1/</sup> This is based upon the program described in the F/A-18 December 1981 Selected Acquisition Report. Slowing down procurement would increase unit costs.

Option 3: Re-engined A-7 Force

- o 24 A-7Xs per air wing;
- o Total cost of \$8.2-10.3 billion in 1983 dollars.

Option 4: All A-6E Force

- o 20 additional A-6Es per air wing;
- o Total cost of \$8.8-12.5 billion in 1983 dollars.

The estimated costs are in ranges because different cost estimation methodologies have been used.

The primary factor in choosing an attack force ought to be how well it can carry bombs. Other important considerations are the force's ability to survive in a hostile environment and its reliability and maintainability, since those govern the force's long-term capacity to deliver ordnance. The unique multimission capability of the F/A-18 is also an important consideration in deciding which attack aircraft to procure. Of these factors, the ability to carry bombs is the most amenable to credible quantification.

The Navy's Preferred Force. The Navy's preferred light-attack force would consist of F/A-18s. This option would provide good bombing capability at short ranges. Moreover, the F/A-18 has high survivability and can double as a fighter. On the other hand, it has less capability at long bombing ranges than any of the other alternatives. This option would be relatively expensive. Over the next decade, the procurement cost of equipping all light-attack squadrons with F/A-18s would range from \$12.1 billion to \$13.3 billion in 1983 dollars.

A force equipped with F/A-18s would have a 20 percent greater capacity to deliver bombs (measured in pounds per day) than the current force at ranges up to 500 nautical miles from the carrier. These are the ranges at which the Navy has typically operated in the past. However, improving Soviet capabilities, especially in the form of land-based aircraft and missile-equipped coastal craft may force the Navy to "stand off" and operate at greater ranges. In this case, the Navy's preferred force would be less capable than today's force. Beyond 800 miles, the F/A-18s would have no capability (unrefueled), and all the ordnance would have to be delivered by the A-6Es. At those ranges, the Navy's

preferred force would be about 60 percent as capable as the current force.

In the long term, the F/A-18 would have an advantage if F/A-18 wartime attrition, failure, and repair rates are better than those of the other alternatives. During a campaign, the capability of the Navy's preferred force would increase over time relative to the others. If the differences were large enough and the engagement long enough, this could be the determining factor. The advantage would be of little value, however, if operations were conducted at long ranges where the F/A-18s cannot operate.

An added advantage of the Navy's preferred force is that F/A-18s can be flown as fighters. If used to escort an attack, they would free F-14s for fleet air defense. Alternatively, they could augment F-14s in fleet air defense.

A-7E Current Force. The present force of A-7Es could be replaced with new A-7Es. This is by far the cheapest option and would provide better capability than the Navy's preferred force at long bombing ranges. But the A-7E has less capability at short ranges, lacks the F/A-18's ability to double as a fighter, and might be more vulnerable to Soviet fighters. This option would be cheaper than the Navy's preferred force over the next ten years by from \$4.5 billion to \$7.8 billion, depending upon assumptions about the costs of A-7Es, which are not currently being produced.

While the A-7E force would provide better bombing capability than the Navy option at longer ranges, it would be 20 percent less capable at shorter bombing ranges. The A-7E is a relatively sluggish attack aircraft. In combat, the Navy believes its sluggishness would lead to unacceptable losses from modern Soviet fighters.

Re-engined A-7 Force. The Vought Corporation, which manufactures the A-7E, has defined a re-engined A-7E called the A-7X. This would be supersonic and have other aerodynamic characteristics, especially thrust-to-weight ratio, similar to those of the F/A-18. It would, in Vought's view, be about as survivable in a hostile environment as the F/A-18 is. The A-7X exists only on paper, although it is a marriage of an existing airframe and an existing engine. Buying the A-7X rather than the Navy's preferred F/A-18 would save \$1.8 billion to \$5.1 billion in procurement costs over the next decade. But the A-7X would still lack the flexibility to double as a fighter and would have less bombing capability at short ranges than the F/A-18.

At target ranges of less than 400 nautical miles, the re-engined option would be about 10 percent less capable than the Navy's preferred option. At longer ranges, however, it would be up to 2.3 times more capable. Compared with the current force, it would be about 15 percent more capable at all ranges.

All A-6E Force. The all A-6E option would replace the A-7E light-attack aircraft with the A-6E, which is currently the Navy's medium-attack aircraft. This approach would provide much better bombing capability at most ranges and might also reduce costs. But the A-6E could not double as a fighter; nor would the all A-6E option be as survivable as the Navy option.

The all A-6E force would provide the air wings with a homogeneous force of medium-attack aircraft able to carry much greater payloads to longer ranges than any light-attack aircraft, and able to attack targets obscured by weather or darkness. Since the A-6E is much larger than the A-7E, only ten are in each squadron. The all A-6E force would be more capable than the Navy's preferred force at all ranges beyond 300 nautical miles, and only slightly less capable at shorter ranges. Beyond 800 nautical miles it would be three times as capable as the Navy's preferred option, and twice as capable as the current force.

The procurement cost of the all A-6E force could be as much as \$4.5 billion less than the Navy's preferred force, or it could be slightly higher. This wide range of estimates arises primarily because two different methodologies were applied to estimate the costs at yearly procurement rates about ten times those of recent years. On the other hand, life-cycle costs, which include operating as well as procurement costs, would be about 10 percent less for this option than for the Navy's.

Costs for all four approaches have been stated in terms of procurement costs over the next decade. Over the next five years, however, there would be little, if any, difference among them, and in 1983 probably none at all. Even if an alternative other than the Navy's was selected, procurement of F/A-18s for the Marine Corps would probably continue for at least the next several years, while procurement of alternative attack aircraft would probably be delayed until the mid-1980s to avoid increasing near-term budgets. Thus, while the F/A-18 could be introduced in Navy forces about 1984, the other alternatives would not be available until about three years later.

## Alternatives for Modernizing Fighter Forces

Although the F/A-18 was originally designed to be a Navy fighter, and until 1981 the Navy planned to deploy it as such in all air wings except the nine with F-14s, the Navy now wants to put F-14s in all wings on all large-deck carriers. (The Coral Sea and the Midway may receive F/A-18s, but when those ships are retired and replaced by new large-deck carriers the F/A-18s would presumably be replaced with F-14s.) This is based on the argument that the F/A-18 is not the equal of the F-14/Phoenix system in fleet air defense--that is, defending carriers against incoming bombers and their missiles--and that carriers without F-14s would therefore be much less capable of self-defense against a high air threat than those with F-14s. The F/A-18 is thought to be the equal of the F-14 in the role of escorting attack aircraft.

By returning to a plan to equip only 18 fighter squadrons with F-14s and the rest with F/A-18s, the Navy could save a total of \$5.8 billion in 1983 dollars over the next five years; eventually, savings would total \$7.1 billion. In the Navy's view, this option would result in less overall ability to perform fleet air defense, and therefore less capability to deploy in areas of high air threat.

While this is certainly true, operating policies and distribution of aircraft could be changed so as to minimize the effect of the reduced capability in fleet air defense. Carriers, which often operate in pairs, could be teamed up so that one always had F-14s. Alternatively, ten carriers could be deployed with one squadron of F-14s and one squadron of F/A-18s while each of the remaining four had two squadrons of F-14s. If the F/A-18 were not the light-attack aircraft, those carriers that had a mixture of F-14s and F/A-18s would face more difficult maintenance problems. While either of these changes would provide some F-14 defense against a threat consisting of small numbers of capable aircraft, it would degrade the capability to deal with a Soviet threat consisting of relatively large numbers of such aircraft. Overall fleet air defense, as measured in F-14 flight hours per month, would be degraded.

Carriers equipped with F/A-18s would be able to use them to enhance their attack forces, if air defense requirements permitted. This could increase the weight of bombs delivered to targets at ranges up to 600 nautical miles by about 50 to 75 percent.



---

## CHAPTER I. INTRODUCTION

---

The Administration has embarked upon a program of expansion and modernization to reverse the long-term decline in the size of the U.S. Navy and to counter the rapidly growing threat posed by the Soviet navy. This program carries forward some elements of the Navy's preexisting modernization program, alters other elements of that program, and adds some new elements. Most notable in the last category are an increase in the number of ships from the current fleet of 535 to about 600 and an increase in the number of deployable aircraft carriers from 12 to 14, with 15 as the Navy's longer-term goal. Accompanying the increase in the number of ships will be the addition of two more carrier "air wings," the replacement of the F-4 fighters remaining in six carrier-based squadrons with the newer F-14, and the replacement of the A-7E light-attack aircraft currently in all air wings with the F/A-18 fighter/attack aircraft. This paper discusses the nature and costs of the Navy's plan for expanding and modernizing its carrier air forces, and possible alternative plans. A companion CBO paper discusses shipbuilding issues in detail. 1/

### BACKGROUND

The Navy is structured to a large extent around the deployment of carrier battle groups. While their organization is by no means rigid, a typical battle group consists of two aircraft carriers, several escorting surface combatants (that is, cruisers and destroyers), and logistics ships. In wartime, the missions of carrier battle groups fall in the general categories of power projection, sea control, and sea denial. Briefly, power projection missions involve attacking enemy assets ashore or afloat; sea control and sea denial involve, respectively, keeping a section of ocean safe for U.S. use and making a section of ocean unsafe for enemy use. While these missions differ in purpose, they include many common tasks. For example, in order to project power, a battle group must control a section of ocean from which it can operate in relative safety.

---

1/ Congressional Budget Office, Building a 600-Ship Navy: Costs, Timing, and Alternative Approaches (March 1982).

Since the end of World War II, the size of the Navy has decreased steadily and dramatically. Its 12 deployable aircraft carriers today are about half the number the Navy had just two decades ago. 2/ Most carriers in 1962 were significantly smaller than those currently in the fleet. Nevertheless, fewer carriers mean fewer simultaneous deployments, and fewer available ship-days at sea.

During this same period, the Soviet navy has grown from a defensive force mainly operating in contiguous waters to a "blue-water" navy able to deploy worldwide. It may soon acquire aircraft carriers. The U.S. Navy's expansion and modernization program is intended to counter this growing threat. Recently, the Navy has argued that, in order to counter effectively the growing Soviet threat to U.S. shipping, it would have to "bring the war to the Soviets" by using carrier battle groups to attack Soviet ports and bases rather than hunting or countering units on patrol. This would require operating in areas where the threat is most severe.

The expansion would also relieve some of the strain the Navy has encountered in maintaining its peacetime deployment commitments. Until the 1979 Iranian crisis, the Navy maintained four peacetime carrier deployments more or less continuously: two in the Pacific and two in the Atlantic and Mediterranean. These deployments were supported by 13 carriers, each of which spent about one-third of its time on deployment and the remaining time in maintenance and training. In the wake of the Iranian seizure of U.S. hostages, however, routine deployments were begun in the Indian Ocean and the Arabian Sea. Continuing turmoil and U.S. interest in those areas have led to the continuation of these deployments, straining the ability of the Navy to maintain its peacetime commitments with a force that was reduced to 12 deployable carriers when the Service Life Extension program was begun.

---

2/ Altogether, the Navy has 14 carriers, not including those in "moth balls." The Lexington is used for training only and is not counted as a deployable asset. Of the remaining 13, one is currently undergoing a major overhaul called the Service Life Extension Program (SLEP). When it leaves SLEP, another will begin the program. It is anticipated that one carrier will be in SLEP throughout the 1980s.

In response to these factors, the Administration seeks to expand the fleet to 14 deployable carriers and 14 air wings by the late 1980s. The carrier Vinson entered the fleet in 1982. The Roosevelt is expected to follow at the end of 1986. The introduction of two more carriers, for which funding is requested in the 1983 budget, would allow the retirement of the Midway and the Coral Sea, both of which were laid down during World War II, while maintaining 14 deployable carriers.

Although the Navy has set 15 deployable carriers as a desirable goal, the Administration's five-year shipbuilding plan for 1983-1987 does not support an expansion beyond 14 before the 1990s, unless the Navy decides to retain either the Coral Sea or the Midway. This paper therefore considers the costs of expanding by two carrier air wings. 3/

CARRIER AIRCRAFT

The increase to 14 deployable carriers will require the introduction of one air wing in 1983 and another about 1987. An air wing, or the complement of aircraft assigned to a carrier, includes:

- o Attack aircraft for attacking targets ashore and afloat with bombs and missiles;
- o Fighters to defend the battle group and its aircraft from air attack;
- o Aircraft to hunt submarines;
- o Early warning, reconnaissance, and electronic warfare aircraft; and
- o Tankers to refuel other aircraft in flight.

---

3/ The companion study on Navy shipbuilding examines various options to reach the Navy's goal of about 600 ships including 15 carriers; see Congressional Budget Office, Building a 600-Ship Navy. The cost of expanding to 15 air wings can be directly obtained from the analysis presented here.

The composition of a typical air wing is shown in Table 1. Many of its functions are shared by surface combatants, submarines, and land-based aircraft assigned to the battle group.

TABLE 1. COMPOSITION OF A TYPICAL CARRIER AIR WING IN 1982

Aircraft Type	Aircraft	Number of Squadrons	Aircraft per Squadron	Total Aircraft
Medium Attack	A-6E	1	10	10
Light Attack	A-7E	2	12	24
Fighter	F-14 or F-4	2	12	24
Airborne Early Warning	E-2B or E-2C	1	4	4
Electronic Warfare	EA-6B	1	4	4
Tanker	KA-6D	<u>a/</u>	4	4
Reconnaissance	RF-8	1	3	3
Antisubmarine Warfare	S-3A	1	10	10
Antisubmarine Warfare Helicopter	SH-3	1	6	<u>6</u>
Total				89

a/ Part of the A-6E squadron.

Attack Aircraft. The A-6E is a two-seat, twin-engine, subsonic bomber with the unique ability to attack targets obscured by weather and darkness. In addition to bombs and other ordnance for attacking land targets, it carries the Harpoon antiship missile.

The A-7E is a single-seat, subsonic attack airplane with less bomb-carrying capacity than the A-6E. It is more restricted by environmental conditions than the A-6E is. It is also smaller and less costly than the A-6E.

Fighter Aircraft. The F-4 and the F-14 are two-seat, twin-engine fighter-interceptors with top speeds in excess of Mach two. The F-4 was once deployed in all air wings, but the Navy has now replaced the F-4s in all but three wings with F-14s. The F-14 was designed to be the Navy's primary asset for countering high-speed Soviet bombers carrying long-range antiship missiles. It has the unique capability to carry the long-range Phoenix air intercept missile, and the ability to engage several targets simultaneously.

Other Aircraft. The E-2 is a propeller-driven airplane that carries a large radar, similar in appearance to the Air Force airborne warning and control system (AWACS) radar. It performs the same general long-distance air search function that the AWACS does, and also observes the ocean surface.

The EA-6B and the KA-6D aircraft are built on the A-6 airframe and are configured, respectively, for electronic warfare and tanker tasks. The RF-8, a variant of a 1960s Navy fighter, the F-8, is being phased out. Its function will be assumed by three F-14s in each wing equipped with the Tactical Airborne Reconnaissance Pod System (TARPS). The S-3A, no longer in production, is a long-endurance subsonic patrol aircraft that searches for submarines at distances up to several hundred miles from the carrier, while the SH-3 performs a similar function at close range. The Navy plans to replace the SH-3 with the SH-60, not shown in the table.

A New Aircraft--the F/A-18. The F/A-18 is a multimission fighter and attack aircraft, which is now in production but so far deployed only with training squadrons. It is a single-pilot, twin-engine airplane with a top speed of about Mach 1.5. As a fighter, it would carry the medium-range Sparrow and short-range Sidewinder missiles, but not the long-range Phoenix missile carried by the F-14. The F/A-18, which plays a central role in the modernization plans of both the Navy and the Marine Corps, is not included in Table 1, since it has not yet been deployed.

The Navy modernization program that predated the current Administration included equipping nine air wings (18 squadrons) with F-14s; that part of the program is now essentially complete. The other 6 fighter squadrons were to be equipped with F/A-18s. The Navy now plans to buy 10 more squadrons of F-14s, 4 for the two expansion wings and 6 to replace the remaining F-4s. The Navy also plans to establish 28 F/A-18 light-attack squadrons, 4 to equip the new wings and the remaining 24 to replace the A-7Es currently in all wings. The Navy still wants to replace the F-4s on the Coral Sea and the Midway with F/A-18s since these ships are not equipped to handle F-14s. However, if the Navy is to reach its goal of F-14s on all large-deck carriers, these four squadrons would have to be replaced with F-14s when the Coral Sea and the Midway are retired and replaced with two new Nimitz-class carriers in the late 1980s or early 1990s.

#### ISSUES FACING THE CONGRESS

The largest single DoD procurement issue facing the Congress in fiscal year 1983 is whether or not to fund two more carriers. In deciding this issue, the Congress will be deciding on the number of carriers and the number of air wings in the Navy. Although the Congress would have to approve funding for the aircraft for these wings separately, by approving expansion to 13 or 14 carriers it would be accepting a requirement for that many air wings. It would not be asked to approve funding for each new air wing all at once, or indeed in any identifiable form; rather, it would be asked on a year-by-year basis, beginning in fiscal year 1983, to approve the funding necessary to build and maintain the proper inventory levels for the number of air wings the Navy will have.

The Administration's 1983 budget request includes funding for the first F-14s for the 10 additional fighter squadrons. If the Navy had continued with its former plan to equip only 18 squadrons with F-14s, F-14 procurement would have terminated with a reduced buy in 1983. The Congress must decide whether to ratify the new plan. A decision by the Congress not to fund the additional F-14s in 1983 would not mandate a return to the former plan, but a similar decision in 1984 probably would. <sup>4/</sup> Similarly, a decision

---

<sup>4/</sup> The F-14 production line would stay open at some level for several years to complete those aircraft under construction.