EVOLUTION OF THE ATTACK AIRCRAFT CARRIER:
A CASE STUDY IN TECHNOLOGY AND STRATEGY

By

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ABSTRACT

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Desmond P. Wilson, Jr.

Submitted to the Department of Political Science at the Massachusetts Institute of Technology on January 10, 1966 in partial fulfillment of the requirement for the degree of Doctor of Philosophy.

This study examines the Navy's requirements for attack aircraft carriers where alternative weapons capable of performing approximately the same missions have been or are available. The alternatives of the aircraft carrier and the battleship in the 1920's and 1930's are examined to determine how the Navy planned the composition of its World War II fleet. The largely unique role of the carrier in World War II is analyzed and contrasted with post-War carrier requirements when the Navy sought a nuclear delivery role then held exclusively by the Air Force. Finally, the limited war roles of carrier-based and land-based aviation are compared to determine some of the various political, cost, and operational factors which enter into decisions on the nation's overall, tactical aviation requirements.

The uniqueness which stems from sea basing an aviation system has been greatly diminished since World War II. This is a result of (1) the longer combat radii of land-based aviation systems; and (2) the extensive alliance and overseas-base structure which supports the forward deployment of over half the active military forces of the United States, including land-based aviation systems. Nevertheless, the carrier system has proved to be useful and complementary to land-based aviation in limited wars. Though potentially vulnerable to submarine and air attack, the carrier at sea is free from sabotage; guerrilla attacks against parked aircraft, ordnance and fuel supplies; and from battlefield reverses resulting in the possible loss of forward airfields. In addition, the carrier retains the unique capability to project airpower into regions where land airbases may not be available.
Provided the United States maintains its present military and political commitments in Western Europe and in the Western Pacific, there will be a continuing requirement for attack carriers. The size of the force will continue to be a matter of controversy and study, but it is expected to remain closely equivalent to the present force at least through 1970.

Thesis Supervisor: William W. Kaufmann

Title: Professor of Political Science
ACKNOWLEDGMENTS

The sources for this study have been principally congressional hearings; annual and semi-annual reports by secretaries of the Navy and the Department of Defense; and official Navy materials such as periodic or one-time reports, memoranda, and studies from the archives of the Chief of Naval Operations. Particular mention should be made of a WSEG study (Weapons-System Evaluation Group) entitled Operational Experiences of Fast Carrier Task Forces in World War II. Completed in August 1951 and declassified from Confidential in 1963, the WSEG study is the single best source of statistical data on the carriers' World War II performance. After a security review, the Navy materials were made available to the author through the courtesy of the Office of Naval History. In addition to the above materials, considerable use was made of The Forrestal Diaries, professional journals, periodicals and newspapers, notably the monthly United States Naval Institute Proceedings, Aviation Week and Space Technology, and The New York Times.

The author wishes to acknowledge the financial assistance provided by the Institute of Naval Studies, Cambridge, Massachusetts and the Center for International Studies of the Massachusetts Institute of Technology.

For their time and assistance in discussing and explaining various aspects of carrier operations and naval strategy, the writer is very grateful to numerous Naval officer and civilian colleagues at the Institute of Naval Studies. Particularly helpful, but in no way responsible for any errors or interpretations, were Captain Robert F. Hunt, Dr. Homer J. Hagedorn, Mr. James R. McReynolds and Mr. Jean F. Duvivier. Thanks to also to Mrs. Joan M. Wynne of the Institute of Naval Studies, and to Mrs. J. B. Tigner of Atlanta, Georgia, for their many hours of secretarial assistance. A large part of the credit for completing this study goes to the author's wife, Elizabeth, for her encouragement, help and endurance. Finally, the author is grateful to Professor William W. Kaufmann for suggesting as an area of study the problem of relating military force to the
nation's foreign and security policy needs. It is, I think, a particularly appropriate area for the student of political science at the Massachusetts Institute of Technology.
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GLOSSARY OF SELECTED MILITARY TERMS
AND ABBREVIATIONS

AAW  Anti Air Warfare

ASW  Anti Submarine Warfare

BB   Battle Ship. None operational in the United States Navy since 1953

CA   Heavy Cruiser

CAG  Guided Missile Heavy Cruiser

CAS  Close Air Support. Air action against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces

CAW  Carrier Air Wing (formerly CAG or Carrier Air Group). Two or more aircraft squadrons formed under one command for administrative and tactical control of operations from a carrier

CG   Guided Missile Cruiser

CV   Aircraft Carrier. Sometimes referred to as fleet carrier. Prior to World War II, the Navy designated all carriers as CV's. To account for the specialized missions during and after WWII and the different kinds and sizes of carriers, new designations were created. The CV designation is no longer used.

CVA  Attack Aircraft Carrier. Current designation give the Navy's fifteen attack carriers of the Forrestal, Enterprise and modernized Midway classes. CVA(N) designates nuclear propulsion.

CVB  Large Aircraft Carrier. World War II designation given to the Midway Class carriers which were the largest and most heavily armored carriers as of 1952.
<table>
<thead>
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<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>CVE</td>
<td>Escort Aircraft Carrier. World War II conversions from merchant ships which were used in convoy escort duties, anti-submarine missions, and in support of amphibious missions. CVE's were sometimes referred to as &quot;jeep&quot; carriers.</td>
</tr>
<tr>
<td>CVL</td>
<td>Light Aircraft Carrier. A designation given the Independence Class of carriers which were World War II conversions from light cruiser hulls.</td>
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<tr>
<td>CVS</td>
<td>Support Aircraft Carrier. Current designation given the Navy's nine anti-submarine warfare carriers. Former CV's and CVA;s which have been redesignated.</td>
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<tr>
<td>DD</td>
<td>Destroyer</td>
</tr>
<tr>
<td>DDG</td>
<td>Guided Missile Destroyer</td>
</tr>
<tr>
<td>DL</td>
<td>Frigate</td>
</tr>
<tr>
<td>DLG</td>
<td>Guided Missile Frigate</td>
</tr>
<tr>
<td>TAC</td>
<td>Tactical Air Command</td>
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<tr>
<td>Sortie</td>
<td>One flight by one aircraft</td>
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<tr>
<td>VA</td>
<td>Attack Aircraft. Navy attack airplanes, <em>i.e.</em>, aircraft whose principal use is in striking targets other than enemy aircraft in flight</td>
</tr>
<tr>
<td>VAH</td>
<td>Heavy Attack Aircraft</td>
</tr>
<tr>
<td>VAL</td>
<td>Light Attack Aircraft</td>
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<tr>
<td>VF</td>
<td>Fighter Aircraft. Designation of Navy fighter type aircraft. May be either land or carrier based.</td>
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CHAPTER I

INTRODUCTION

Since about 1800, the Navy has been an important instrument serving the foreign and security interests of the United States. Through most of this history, the requirements for naval forces have been sufficiently distinct from the requirements for land forces to have been treated largely as a separate problem. Different military departments, often with differing assessments of the threats to the nation and plans to counter them, answered to separate Congressional committees for their military requirements. Prior to the Twentieth Century, the forces and missions of the Army and Navy were defined mostly by conditions of geography rather than by conditions of technology; consequently, it was in coastal areas where conflicting missions first gave rise to rivalries between the Army and Navy. Subsequent rapid advances in the technology of warfare, notably the airplane, the guided missile and nuclear weapons, have increased further the actual and potential overlap between forces and missions of the military services.

In addition to technological advances, related changes in the nation's defense policies have further affected the nation's forces and missions. Prior to World War II, the Navy was often referred to
as the "first line of defense." Under a strategy which rested mainly on the nation's mobilization potential, the Navy was expected to deter or defeat an enemy offensive directed at the United States until a military build-up sufficient to support an American offensive could be realized. The shift since World War II from a mobilization strategy to one based on a system of world-wide alliances and forces in being, now finds roughly half of the active military forces--Army, Air Force, and Navy--in overseas locations and mostly deployed forward in Europe and the Western Pacific. As a consequence, there are no geographic regions of significant United States military commitment where any single military service can be said to be completely unique.

Overlapping missions and forces result also from the variety of weapons which modern technology makes possible. Often alternative weapons compete within a single service, as did the battleship and the aircraft carrier; often they compete among different services, as in the case of the Navy's Polaris and the Air Force's Minuteman. Thus, an important problem facing the nation's decision-makers on matters of defense is one of allocating the nation's limited resources to those weapons that can best serve the common defense. It is not always a problem of which alternative to buy to the exclusion of others; more often the issue is how many of a particular weapon to buy in some mix with alternatives. In short, it
involves an understanding of where uniqueness or complementariness of alternative weapons ends and redundancy begins across a wide range of possible situations.

The evolution of the Navy's aircraft-carrier force seems to be a particularly appropriate case to illustrate the aforementioned problems, which are an important aspect of the planning problem of relating force to foreign policy.

Objectives of the Study

This study examines the considerations which have affected the development, use, and size of the aircraft carrier force. The focus is on those carriers which are used to base attack combat aircraft as distinct from anti-submarine warfare aircraft. This particular carrier system has been labelled variously as the fleet carrier, fast carrier, and attack carrier.¹ Since World War II, it has become the major weapon of the surface Navy, having replaced the battleship as the "capital ship" and taking a larger percentage of the Navy's annual budget relative to other naval weapons.²

In deriving carrier requirements, the Navy somehow has had to meld foreign and security policy needs with the growing inventory

¹Unless specifically designated otherwise in this study, references to "carrier," "carrier force," or "sea-based aviation" are to mean the attack carrier.

²For information on carrier system costs see pp. 18, 33, 82-83, 132-139.
of weapons which modern technology makes available. Thus an exami-
nation of carrier force requirements encompasses a broad spectrum of
political and technological considerations of which the following are
addressed in this study:

1. The determination of the missions and size of the
carrier force

2. An examination of a range of employment conditions
which have determined the carriers' usefulness

3. An examination of some of the major technological
constraints and attributes which bear on effective-
ness and costs and influence carrier characteristics
such as carrier size and propulsion systems

The above questions point up the fact that the carriers are, and
properly should be, viewed as systems whose performance is determined
not only by the ships themselves, but also by their aircraft and
ordnance as well as supporting ships and equipment. A decision af-
fecting any component of the system has performance implications for
the other components. Awareness of the system aspects of the attack
carrier is necessary for an understanding of the role problem.

A historical-analytic approach to the problem is taken for a
number of reasons. Foremost among these is the conviction that
present systems are understood best in historical perspective despite
marked changes in the strategic environment. This seems particularly
true of Navy systems which, if they are ships, are limited in the
extent to which they may be subsequently modified to meet unforeseen
contingencies. A second reason is the belief that the problems which Navy planners faced in the past are not unlike those which are faced today. This is not to say that the uncertainties of the past are today's uncertainties, but rather that an explication of the ways in which the Navy went about making decisions and the outcomes of particular decisions over the past three decades may have some limited contributions to make to the decisional problems of the 1960's. Finally, there is the problem of classification. Some operational data which are ten years old or more are just becoming available for the public record. To do research on a contemporary weapons system on an unclassified basis assures that it would be either historical or highly theoretical.

The Carrier in Brief Historical Perspective

The airplane was introduced to the Fleet in the early 1900's and the first fleet aircraft carrier, the Lexington (CV-2), was

3Warships and airplanes do not "wear out" in the literal sense of the term. Instead, they age in a competitive technological sense. In this regard the Navy's Fleet Rehabilitation and Maintenance program (FRAM) is an endeavor to modernize older ships and to stay abreast of rapid technological change. Aircraft obsolescence has been more difficult to counter. The lifetime of first-line combat aircraft usually has been about five to eight years, at the end of which time they are replaced on board the carriers with more modern aircraft. Some of the late World War II carriers have experienced four and five generations of aircraft. It is one manifestation of the difficulties in planning for carrier aviation that the Navy must somehow meld the 25- to 30-year lifetime cycle of the carrier with the lifetime cycle of the aircraft.
launched in 1927. By the time the Lexington joined the Fleet, aviation technology had progressed sufficiently so that the new weapon, sea-based airpower, represented an alternative of increasing potential to the battleship and, in some cases, to the Army Air Corps. Prior to World War II, however, most of the controversy which surrounded carrier aviation was confined within the Navy, principally because the emergence of aviation presented a direct threat to the battleship. It required the clarifying experiences of the war to affect a significant change in the composition of the Navy in favor of the aircraft carrier.

Since World War II, the missions of the carrier force have been sufficiently similar to those of land-based air to occasion often heated rivalries between the Air Force and the Navy. In the late 1940's and early 1950's the issue centered on the assignment of strategic, nuclear-bombing missions and capabilities of land-based bombers and sea-based bombers. The issue of the 1960's centers mainly on the comparative cost and effectiveness of land and sea-based aviation in limited wars.

Carriers are the core of the Navy's four-numbered fleets, the First and Seventh Fleets in the Pacific and the Second and Sixth in the Atlantic and Mediterranean. Embarking over 1300 aircraft of mixed types, this force possesses both nuclear and conventional war capabilities. As demonstrated at Lebanon, the Taiwan Straits, the
Cuban "quarantine" and in the Gulf of Tonkin, carrier aviation can move rapidly in support of the nation's diplomacy.

The carrier force along with marine aviation and Tactical Air Command's 24 fighter-bomber wings comprise the combat, tactical aviation forces of the United States. According to Deputy Assistant Secretary of Defense, Alain Enthoven, the Navy's fifteen attack carriers and their escorts alone cost $5 billion to operate in fiscal year 1961. This was roughly one third of the Navy's budget and one tenth of the entire defense budget for that year.

The cost and size of the carrier force combined with long-standing questions of effectiveness in a range of environments assure that the carriers will continue to be examined closely by the nation's defense decision makers.

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CHAPTER II

CARRIER AVIATION AND NAVY PLANNING FOR
WORLD WAR II

This chapter examines the development and growth of carrier aviation within the Navy during the two decades leading up to World War II. Particular attention is given to the issues surrounding the growth of the carrier force as an alternative to the battleship, to include the debates on comparative offensive effectiveness and vulnerability.

Naval aviation got its start in the early twentieth century at a time when the quantity and quality of battleships were an important index of a nation's military power. Just as the nuclear-tipped intercontinental missile gives substance to a policy of general war deterrence today, battleships were the "nation's first line of defense" in the early 1900's. At the level of national planning, comparative international battleship tonnages constituted one of the more important criteria by which strategists determined the allocation of resources to naval armaments. A major objective

of post-World War I United States foreign policy was to control the arms race in battleships and their supporting war vessels. In short, the battleship was the dominant weapon of the world's major maritime nations. The rise of the airplane threatened all of this. While the strategic significance of the airplane was only dimly perceived before World War I, by the 1920's the thrust of aviation technology created new uncertainties and threatened changes which were not entirely welcome to the battleship Navy. The effectiveness of the battleship was challenged not only by the air-minded within the Navy, but also by the Army's Colonel William Mitchell. For the Navy and the nation, the stakes were the shape and composition of the fleet. In a larger sense, the controversy reflected the country's endeavors to integrate a new technology into its existing military structures with all that it implied for operating doctrine, hardware, and the relationships of force to foreign policy.

Colonel Mitchell argued that the airplane and the submarine could perform the battleship's missions; that the battleship itself had become dangerously vulnerable to air attack in particular; and that the construction of each battleship along with its screen of one cruiser and four destroyers diverted about 100 million dollars from the air or submarine forces. On the issue of land-based versus

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3 Mitchell, op. cit., pp. 71, 100, 104.
carrier-based aviation, Colonel Mitchell was somewhat less definite. His assertion that carrier aviation "cannot compete with aircraft acting from land bases," rested on his belief that the carrier was vulnerable and that airplanes designed to be compatible with carrier operations suffered penalties of range and ordnance-carrying capacity which the land-based airplane did not.\(^4\) Within the Navy, the disrupting influence of airpower was less publicized than the Navy's controversy with Colonel Mitchell. By the time the Navy's Bureau of Aeronautics was created in 1921, the technical feasibility of flying, both fighter and bomber-type airplanes from the deck of a ship was no longer in question. The British had developed and operated the first aircraft carrier during World War I, and in 1922 the United States Navy began acquiring experience with the experimental carrier Langley (CV-1), a converted collier.\(^5\) As naval aviation grew, so too did its demands for a greater share of the Navy's scarce resources. Of particular sensitivity to the battleship Navy was the desire of the Bureau of Aeronautics for carriers to take the airplane to sea as an offensive weapon. With the fleet at sea, the carrier-borne bombing plane became a direct competitor of the battleship against the enemy fleet. The problem very quickly became one of comparative effectiveness between the battleship and the aircraft

\(^4\) Ibid., p. 102.

\(^5\) Turnbull and Lord, op. cit., p. 251.
carrier against naval targets.

Within the Navy the two contending schools of thought over the early carrier's role were represented by those who felt that the battleship should remain as the Navy's major offensive weapon, and those who saw carrier aviation capable of fulfilling not only the battleship's mission but possessing unique capabilities in addition. The advocates for the battleship tended to think of the aircraft carrier as an auxiliary in support of the battlefleet. Since this group represented the great majority of naval officers and, in particular, the key decision-makers, the view of the aircraft carrier as a supporting vessel prevailed in the official doctrinal publications until World War II. On the other hand, the more air-minded within the Navy grew increasingly strengthened in their convictions that the carrier should have an independent offensive mission, particularly as aviation technology progressed, allowing heavier payloads to be airlifted for longer distances.

Navy decision-makers needed criteria for designing, building and operating a fleet. Not only did decisions have to be made allocating scarce resources among the various warship types, but in the case of the carrier, problems concerning the number of carriers

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6 United States Navy Department, War Instructions, Fleet Training Publication No. 143, 1934. This was the last basic doctrinal publication dealing with the missions of the battleship and the aircraft carrier until the 1943, U. S. Pacific Fleet, Current Tactical Orders and Doctrine, PAC-10, June, 1943.
in the Fleet, their size, speed, armament, aircraft, ordnance load, and operating doctrine all had to be resolved.

**Carriers in a Battlefleet Support Role**

Battleship doctrine had been well clarified since the writings of Alfred Thayer Mahan. The famous "command of the sea" through "battlefleet supremacy" concept usually attributed to Mahan had been incorporated into official Navy doctrine. The two ideas central to the concept were the necessity for control over vital sea lanes and the need for a concentration of superior weapons to gain that control in a decisive engagement if possible. The belligerent which could gain and maintain control over vital sea lanes would then be in a position to project power against an opponent's inner defenses. The forms which the projected power might take could vary among interdicting blockades, bombardment of shore bases, amphibious assault against an opponent's land areas or some combination of these three. While sea control was not necessarily equated with final victory, it was viewed as a requisite condition which enabled the controller to adopt other offensive strategies and move progressively closer to the enemy's central sources of resistance.

---

Thus the battlefleet's priority and major target was the enemy fleet as noted below.

To Gain and Maintain Command of the Sea in the Principal Theater of Operations:

301. This task involves operations to accomplish the following:

(a) Location of the enemy main fleet.

(b) Destruction or decisive defeat of this fleet or its immobilization by effectively containing it, thus gaining command of the sea.

(c) Protection of own lines of supply and maintenance of own forces in the principal theater of operations.

(d) Defense of own territory lying within the principal theater of operations.

(e) Escort of and cooperation with expeditionary forces in the seizure and defense of advanced bases and the invasion of enemy territory.

(f) Destruction of enemy commerce.

(g) Protection of own commerce.

(h) Blockade of enemy territory.8

The battleship's advocates tended to emphasize the demonstrated effectiveness of the battleship and to esteem lightly the prospects of the carrier bomber or torpedo plane.9 According to the battleship

8USN, War Instructions, p. 7.

9Land-based bombers had demonstrated their load capabilities and effectiveness in the famous bombing tests against captured German warships in 1921 off the Virginia coast. However, carrier bombers and torpedo planes awaited the larger flight decks of the Lexington
school, the job for carrier aviation would be principally defensive in character, consisting of reconnaissance, gunfire adjustment, and, if the problem should arise, over-the-fleet air superiority by fighter aircraft.

As the capabilities of naval aviation increased, the concept of the aircraft carrier in support of the battleship became increasingly difficult to maintain. Chief of Naval Operations, Admiral E. W. Eberle, in testimony before the Morrow Board in 1925, presented the following somewhat confusing image of the decisive fleet engagement in which aircraft would be involved:

The first duty of our planes would be that of scouting to locate the enemy, give us the disposition of forces and the strength of his forces. Then our combat planes or fighting planes as we call them, from the carriers and also from the ships, will try to control the air over the fleet. Because if we did not control the air over the fleet, we could not keep off his bombing planes, and if we did (control the air), we would also give protection to the spotting planes which are controlling our fire. We must control the air within gun range or otherwise we could not do our spotting or launch bombing torpedo planes against the enemy.10

Admiral Eberle held the gunfire of the battleship to be the decisive weapon against enemy warships. Along with most of the battleship's

and Saratoga in 1927 before demonstrating their effectiveness. Thereafter the capabilities of carrier-based bombing aircraft advanced rapidly. See Table I, page 26, for the advances made by carrier bombers.

### TABLE I

**DEVELOPMENT OF CARRIER BOMBER CAPABILITIES 1921-1952**

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<th>Aircraft Type</th>
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<td>-</td>
<td>T3M-1</td>
<td>T5M</td>
<td>SBU</td>
<td>SB2C</td>
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<tr>
<th>Maximum Bomb Load Lbs.</th>
<th>1921</th>
<th>1927</th>
<th>1932</th>
<th>1935</th>
<th>1942</th>
<th>1952</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Maximum Speed mph</th>
<th>1921</th>
<th>1927</th>
<th>1932</th>
<th>1935</th>
<th>1942</th>
<th>1952</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>100</td>
<td>135</td>
<td>200</td>
<td>300</td>
<td>364</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. Combat Radius Cruising Speed (statute miles)</th>
<th>1921</th>
<th>1927</th>
<th>1932</th>
<th>1935</th>
<th>1942</th>
<th>1952</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>180</td>
<td>200</td>
<td>250</td>
<td>500</td>
<td>400</td>
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<table>
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<tr>
<th>Service Ceiling ft.</th>
<th>1921</th>
<th>1927</th>
<th>1932</th>
<th>1935</th>
<th>1942</th>
<th>1952</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>5700</td>
<td>14,100</td>
<td>23,100</td>
<td>26,000</td>
<td>28,500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horsepower</th>
<th>1921</th>
<th>1927</th>
<th>1932</th>
<th>1935</th>
<th>1942</th>
<th>1952</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>575</td>
<td>525</td>
<td>700</td>
<td>1500</td>
<td>2700</td>
</tr>
</tbody>
</table>

*These aircraft were capable of getting airborne with a 1000 Lb. bomb load. However, their operational loads from a carrier in a dive-bombing mission were 250 and 500 Lbs. respectively.

Source: Navy Department, Bureau of Aeronautics, "Material Design" (Annual charts giving detailed aircraft performance data) located in the Naval Aviation History Division Op-05A5G, Washington, D. C.
protagonists, the Admiral would not quite admit that the air battle could be decisive to the objective of sea control. While this image of a sea battle is partly understandable in 1924, it became increasingly dissonant with the technological advances in aviation during the 1930's. Yet the position of the battleship as the decisive naval weapon was maintained and reflected in official Navy publications for 14 more years, despite the considerable operational experience with the Lexington (CV-2) and Saratoga (CV-3) and advances in carrier aircraft. It is certain that the emphasis on the battleship impeded the growth of naval aviation during the twenties and thirties. For example, in 1925 the expenditures of the 4-year-old Bureau of Aeronautics constituted 4.5 per cent of the total Navy expenditures for that year. In 1939 they constituted 6.9 per cent, an increase of only 2.4 per cent in a 14-year period of marked technological change. One of the last statements in support of the battleship, before the clarifying experiences of World War II, was made in a journal article in May 1939:

The battleships, it is conceded, form the nucleus for that major force which is organized primarily for fighting battles. These battleships are the backbone of the fleet. . . . Such cruisers, destroyers and aircraft best suited for operating in battle with these battleships, and in such numbers as may be

11 USN, War Instructions, pp. 11-12.
12 See Figure 1, Growth of Naval Aviation, page 28.
FIG. 1: GROWTH OF NAVAL AVIATION (1921-1942)

Source: Expenditure data from Bureau of Aeronautics Memorandum, 18 August 1945, No. Aer-FI-11-RDE in Op 05A5G; Naval Officer Aviator data from Annual Reports, Chief, Bureau of Aeronautics.
available for making a well-balanced fighting force, and for giving close security while cruising, should be assigned to that organization of which the battleships are the nucleus.\(^{13}\)

**Aircraft Carriers in an Offensive Role**

The other major school of thought, held predominantly but not exclusively by the carrier aviators, placed emphasis upon the offensive capabilities of aircraft against not only enemy warships, but land targets as well. An early article by Edward P. Warner, the first Assistant Secretary of the Navy for Aeronautics, anticipated the distant offensive role for carrier aviation.

The airplane justifies its claim to be considered as the Navy's first line of action, in that it would be likely to be through the medium of air force that contact would first be made between vessels of the opposing fleet and information first furnished. It establishes its position again in the probability that airplanes would be first to take actual offensive action.\(^{14}\)

This view of carrier aircraft as a major offensive weapon led directly to emphasis on the importance of numbers of aircraft and vessels with aircraft-carrying capacity. Assistant Secretary Warner wrote:


In recapitulation, if naval battle is joined the degree of success gained, at least in the first stages of that battle, is likely to be influenced very largely by the relative strength in aircraft of the opposing forces. That, in turn, is dependent on the number and nature of aircraft-carrying ships possessed. From this time on, the aircraft carrier is a vital element in naval power ... 15

By the mid-1920's, it was generally recognized by the carrier aviators that high sortie rates were significant in saturating a target ship's defense or in gaining air superiority. However, it was not entirely clear how many carriers the Navy should have or what the most satisfactory carrier size should be. While those who saw the battleship as the decisive offensive weapon reasoned that carriers should be small in size and few in number (at least until the significance of air power became clearer), the proponents for offensive air power viewed the choice as between few large or more small carriers. It appeared that under the budget constraints of the times, high sortie rates were attainable from either a large number of small decks or a small number of large decks. As it turned out, considerations weighted the choice of new carrier construction in both numbers and sizes in the direction of four smaller vessels of 14,000 to 20,000 tons until late 1940 when

15 Ibid., p. 7.
the plans for the Essex Class carriers were completed.

**Carrier Size and the Vulnerability Problem**

The period between the world wars saw considerable debate on the question of surface warship vulnerability. To the Navy, this was a problem of growing importance and sensitivity. While extensive armoring of battleships, cruisers and destroyers represented a partial countermeasure to the more destructive explosives, the defense problems presented by the advent of the aircraft carrier, with exposed inflammable and explosive materials, seemed insurmountable. On this particular issue (i.e., carrier vulnerability), there was a measure of agreement between the aviators and the battleship school, though they differed as to the principal threat. Consistent with the premise of the battleship as the decisive weapon, the battleship's proponents viewed plunging shell

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16 The ship tonnages cited in this study, unless specifically noted differently, are the standard or light displacement tonnages which include the vessel and all of its integral equipment, but does not include consumables such as fuel oil, aviation fuel, ordnance, nor the weight of the aircraft. The differences between standard tonnage measures and full-load tonnage can be quite significant—amounting to an increase in the range of 20-35 percent of the standard tonnage.

17 An issue of particular sensitivity was the results obtained in the famous bombing tests off the Virginia coast in 1921 and the conflicting analysis presented by the Army's General Mitchell on the one hand and the Navy on the other. A description of the test and the polemics is contained in A. D. Turnbull, and C. L. Lord, *History of the United States Naval Aviation*. 
fire as the major threat to the carrier and enemy aviation as a lower-order threat. Carrier aviators, on the other hand, feared enemy sea and land-based aircraft; enemy gunfire was viewed as a threat only if the aircraft carrier operated in support of the battlefleet with an inadequate offensive and defensive aviation capability. The two different schools of thought on the threat and vulnerability problem led to similar recommendations for carrier size. The battleship's proponents sought small and inexpensive carriers with the expectation that they would be lost in Fleet engagements. The Naval aviators had to reconcile two conflicting concerns; i.e., getting a large number of airplanes and ordnance aboard any one vessel and carrier vulnerability. Therefore, the aviators somehow had to balance the desires to maximize air-group offensive capabilities while minimizing carrier vulnerability. The dilemma was never fully solved in the sense that an optimum carrier size was achieved. Instead, a variety of sizes were built in response to technological developments which, at different times, mitigated in different ways the enduring concerns of vulnerability and offensive capabilities.  

See Table II for data on carrier sizes. It should be noted that the problem of carrier size is not solely a problem of the past. The British, who in 1963 announced the construction of a new aircraft carrier to be equipped with VTOL aircraft, are debating the question of carrier size precisely on the issues of vulnerability and air-group effectiveness. The carrier was originally planned at 50,000 tons. However, recent announcements indicate that it may be smaller if it is built. See The Economist, August 3, 1963, p. 440
<table>
<thead>
<tr>
<th>Carrier Class</th>
<th>Commissioning Data</th>
<th>Standard Displacement Tonnage</th>
<th>% Increase Over Ranger Class (CV-4)</th>
<th>% Increase Over Previous Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV-2, Lexington</td>
<td>1927</td>
<td>33,000</td>
<td>+ 127.0</td>
<td>--</td>
</tr>
<tr>
<td>CV-4, Ranger</td>
<td>1934</td>
<td>14,500</td>
<td>--</td>
<td>- 127.0</td>
</tr>
<tr>
<td>CV-5, Yorktown</td>
<td>1937</td>
<td>19,800</td>
<td>+ 36.5</td>
<td>+ 36.5</td>
</tr>
<tr>
<td>CV-7, Wasp</td>
<td>1940</td>
<td>14,700</td>
<td>+ 1.4</td>
<td>- 34.7</td>
</tr>
<tr>
<td>CV-8, Hornet</td>
<td>1941</td>
<td>20,000</td>
<td>+ 37.9</td>
<td>+ 36.0</td>
</tr>
<tr>
<td>CV-9, Essex</td>
<td>1942</td>
<td>27,000</td>
<td>+ 86.2</td>
<td>+ 35.0</td>
</tr>
<tr>
<td>CVB-41, Midway</td>
<td>1945</td>
<td>45,000</td>
<td>+ 210.3</td>
<td>+ 66.6</td>
</tr>
<tr>
<td>CVA-59, Forrestal</td>
<td>1953</td>
<td>60,000</td>
<td>+ 313.8</td>
<td>+ 33.3</td>
</tr>
<tr>
<td>CVAN-65, Enterprise</td>
<td>1962</td>
<td>72,500</td>
<td>+ 400.0</td>
<td>+ 20.8</td>
</tr>
</tbody>
</table>

*Tonnages for the Essex and Midway Class carriers are the tonnages previous to their modernization in the 1950s. Following modernization, their standard tonnages increased to 32,800 and 48,950 for the Essex and Midway respectively.

The Oriskany (CV-34) is a modernized Essex Class carrier which was laid down at the close of World War II but not completed until 1950. Instead of the 27,000 tons of the Essex Class, this more recent Essex Class carrier displaced 30,800 tons before modernization. It is not indicated here as a separate class.
The Navy's first two fleet aircraft carriers were the Lexington (CV-2) and the Saratoga (CV-3). At 33,000 tons each, they were regarded as giant ships for their type, a fact which stirred considerable adverse comment both inside and outside the Navy. These ships were not planned as carriers but were converted from battle cruisers under a special provision in the Naval Arms Limitation Treaties. Their large size was against the mainstream of thinking on the size for this type of warship. A statement which reflected the consensus in the Navy on carrier size was made by an officer in the Bureau of Aeronautics before the President's Aircraft Board set up in 1925 to investigate the role of aviation in national defense. In addition to considerations of vulnerability, this statement sums up the major arguments for and against large and small carriers in a manner which had the ring of contemporary operations research.

At the present time considerable difference of opinion exists as to what the future type of carrier will be. There appear to be two distinct views; one which favors the larger tonnage ship and the other believing that three 10,000 ton ships would have very decided advantages over the larger carrier. The cost of the three small ships would be approximately the same as the Saratoga, costing with all its latest improvements about $45,000,000. The larger ship would have the advantage of speed, ability to maintain speed in heavy seas, a stable platform and to carry a large number of airplanes.

19 At 33,000 tons, the Lexington and Saratoga were "large" ships for their time, regardless of their type. For example, the largest battleships in our Fleet at that time were the New Mexico class at 33,400 tons and the Colorado class at 32,500 tons.
The smaller carriers would be able to fly their aircraft off the decks three times as fast as the larger carriers, and also receive them on board three times as fast. They would be three times less vulnerable to attack, and when lost, the deficiency in air power would not be so great. While the flying platform is less stable, it is believed that the smaller carrier will give a percentage of flying availability that would be satisfactory, considering the results that have been attained in operations on the high seas in various kinds of weather, in restricted harbors, and operations by night. Three small ships would cover more area and carry more planes than the big carrier. In view of the above I believe that a construction program for 10,000 ton cruisers should be held in abeyance until the effectiveness of a 10,000 ton carrier has been determined.  

The widespread feeling that greater effectiveness could be attained from a carrier force of more small carriers rather than few large had a great deal to do with design size and armament of the early carriers. The Ranger (CV-4), Yorktown (CV-5), Enterprise (CV-6), Wasp (CV-7), and the Nornet (CV-8) were all regarded as small or intermediate in size relative to the Lexington (CV-2) and the Saratoga (CV-3).  

The Ranger (CV-4) was the first aircraft carrier that was designed and built as such by the United States. Constructed at

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21 With the exception of the Lexington and the Saratoga, the Naval Treaties (1921 and 1930) established maximum permissible tonnages for aircraft carriers; first at 27,000 tons and then, in 1930, reduced to 23,000 tons. The United States, however, did not build any of its pre-war carriers up to the allowable maximum.
14,500 tons, this vessel clearly represented the views of advocates of the small carrier.

Commenting on the building of the Ranger, a contributor to the Marine Engineering and Shipping Review wrote:

It is believed that armor will not be fitted, as a carrier is necessarily so vulnerable to bombing attacks and to explosives and fires from hits on her loaded planes on deck, that any other protection of her waterline than compartmentation seems a waste of weight.²²

In emphasizing the case for the smaller carriers, the Navy was apparently following reasoning which was shared by other modern navies as was noted by a contributor to a British military journal assessing the London Treaty of 1930 on carrier sizes:

Apart from the fact that the new Treaty reduces the displacement of carriers in three navies from 27,000 to 23,000 tons, there seems to be a growing preference for a smaller type. The huge Lexington and Saratoga (33,000 tons), the Kaga and Akagi (26,900 tons) and even our Eagle (22,600 tons) Furious, Courageous and Glorious (22,500 tons) are recognized as being unduly large and vulnerable baskets with an overconcentration of eggs. The United States Enterprise and Yorktown (19,900 tons); Japanese Soryu and Hiryu (10,500 tons) and Ryujo (7100 tons); and the fact that our Ark Royal (22,000 tons) is to have smaller successors in the Illustrious and Victorious, all show that the trend is towards a lighter and more economical type. It must be realized, however, that with the growing number of aircraft required for

fleet work, a reduction in the size and capacity of
the individual carrier will mean that a greater number
of these ships will be required.23

When the war with Japan started, the Navy fought the famous
carrier battles of 1942 with the few vessels that had been the
products of peace-time planning.24 The carrier force was neither
the many small nor the few large which had been the debated alter-
natives. It was instead a heterogeneous mixture which reflected
the low defense budgets of the period and the doctrinal conflicts
and uncertainties over the future role of air power. Despite their
age, the two most highly valued carriers in the opening months
of the Pacific campaigns were probably the Lexington and the Sara-
toga. Their size permitted them greater speed, endurance, armor,
aircraft and ordnance carrying capacity. Yet, these two vessels
were more the product of fortuitous circumstance than of planning.
It is safe to say that, given the prevailing intellectual atmosphere
of the times, these ships would never have been built as large car-
rriers had it not been for the Naval Arms Limitation Treaty of 1921.

23"The Trend of Naval Construction," reprinted from a British
periodical in the Journal of the American Society of Naval Engineers,

24The Navy had seven fleet carriers in the operational inventory
at the time of Pearl Harbor. The Essex (CV-9) did not join the Fleet
until December 1942. The Ranger (CV-4) did not participate in the
Pacific campaigns, but was used in the Atlantic and Mediterranean
ferrying aircraft, escorting convoys, supporting amphibious campaigns
in North Africa and later for training in the Pacific Fleet.
Battleships, Aircraft Carriers, and the Origin of the Number Fifteen

To understand the quantity and types of major warships with which the United States entered World War II, reference must be made to a number of historical factors. In addition to the uncertainties over the significance of airpower and its relationship to the battleship, account must be taken of past policies determining Fleet size, of domestic political pressures for holding down naval expenditures between world wars, and of the treaties limiting naval armaments.

With the battleship as the standard measure for sea power, the size of the Fleet was determined by striking a balance between the Navy's desires to build battleships at least equal in quantity and quality to all other fleets combined, and the Administrations' desires for economy. Striking this balance led to two distinct naval policies. The policy which prevailed from roughly 1900 to 1916 was to maintain a fleet second only to that of Great Britain. In 1916 with Britain in danger of defeat, President Wilson launched a program to build and maintain a Fleet second to none. Using comparative international battleship tonnages as the criterion, the Navy began in 1916 an ambitious program of construction to include 10 new

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25 The history of the Navy's building programs during this period is detailed in a number of volumes. One of the more thorough treatments is found in Harold and Margaret Sprout, The Rise of American Naval Power: American Naval Policy and the World Scene.
battleships and 6 battle cruisers.\textsuperscript{26} It was this construction program that was stopped by the 1921 Washington Naval Arms Limitation Treaty. The maximum size of the Navy was then regulated by the 5:5:3 ratio in comparative tonnages established by the Treaty. This ratio set the allowable battleship tonnages at 500,000 standard displacement tons each for the United States and Britain, and 300,000 standard displacement tons for Japan. Battleship sizes at that time averaged about 32,000 tons. Given the prevailing size of the individual unit, 500,000 tons meant 15 vessels. The basis for the 15 battleships totalling 500,000 tons was that it most nearly reflected the existing naval strengths of the powers concerned at the opening of the Washington Conference.\textsuperscript{27} Thus the number 15 had its origin in comparative international battleship tonnages, and, in 1921, was made more enduring by the Naval treaties.\textsuperscript{28} The Navy continued to maintain the maximum allowable

\begin{itemize}
  \item \textsuperscript{26} At the time, under the concept of a "balanced" fleet, the number of cruisers and destroyers constructed was largely determined by the number of battleships. Thus the number of battleships was the "master" criterion.
  \item \textsuperscript{28} It should be noted briefly at this point that the number 15 recurs in the post-World War II period as the model size for the attack-carrier force. This occurred despite the marked changes in the strategic environment, replacement of the battleship by the carrier and the lessened significance of comparative international warship tonnages. The Navy's reasoning supporting the 15-carrier force is discussed subsequently on pages 173-182.
\end{itemize}
strength of 15 battleships throughout the period of the treaties. Under the terms of the Washington Treaty, aircraft carrier tonnages were limited to 135,000 standard displacement tons for the United States and Britain and 81,000 tons for Japan in the same 5:5:3 ratio as battleships. There was very little difficulty among the negotiators at the Conference in establishing the carrier tonnage limitations because of the shared tendency of the major naval powers to esteem lightly the significance of carrier aviation at that time. However, the Washington Treaty favored the cause of American carrier aviation in an indirect way. Since the Treaty stopped the building of battleships and battle cruisers, those vessels that were under construction were either scrapped or converted to types permissible under the terms of the Treaty. The Navy got its first two fleet aircraft carriers in this fashion. The Lexington (CV-2) and Saratoga (CV-3) were originally designed and laid down as battle cruisers. A special provision in the Treaty permitted their completion as aircraft carriers and they were subsequently commissioned as such in 1927. Outside of the experimental Langley (CV-1), these were the only two carriers the Navy had for a period of 7 years until the Ranger (CV-4) was commissioned in 1934. In addition to the Treaty provisions which prohibited further battleship or battle-cruiser construction, the reasons for building the carriers were the following:
1. There was a growing recognition within the Navy, though reluctantly accepted by the battleship protagonists, that carrier aviation could make a unique contribution to the Fleet in aerial reconnaissance, the projection of Naval power inland and in over-the-fleet air superiority. Despite continuing controversy over whether the carrier or the battleship was best suited for engaging enemy fleet units, the foregoing reasons were sufficient to back carrier construction particularly if battleships were prohibited.

2. The Japanese Navy was developing its carrier aviation capability. It completed the world's first aircraft carrier, designed as such from the keel up, in December 1922, the year the Washington Treaty was signed. By December 1941, Japan had nine fast carriers; the United States had seven. The completion of carriers by Japan and the United States demonstrates the close matching of forces between 1922 and 1941. (See Table III, p. 42.)

Until World War II was imminent, funds were not available for the Navy to undertake even a moderately ambitious carrier building program and maintain the aging battleship fleet at the same time. For example, Navy expenditures declined by over 50% of fiscal 1920's $736 million to $332 million in 1924, reaching their nadir of $296 million in 1934. \(^{29}\) However, with Japan's withdrawal from the naval

### TABLE III

COMPARATIVE GROWTH OF UNITED STATES-JAPANESE CARRIER FORCE 1922-1941

<table>
<thead>
<tr>
<th>Year</th>
<th>Japan</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>1</td>
<td>1*</td>
</tr>
<tr>
<td>1923</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1924</td>
<td>1</td>
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<td>1925</td>
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<tr>
<td>1926</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1927</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1928</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1929</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1930</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1931</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1932</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1933</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1934</td>
<td>4</td>
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<td>1935</td>
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<td>1936</td>
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<td>1937</td>
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<td>1939</td>
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<td>5</td>
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<td>1940</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>1941</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

*The first U. S. carrier, the Langley (CV-1), was a converted collier and regarded as experimental. It was removed from the carrier force in 1936 and converted to a sea plane tender.*
treaties in 1936 and the menacing international situation, the Navy began a gradual expansion which ultimately would alter the composition of the Fleet in favor of the aircraft carrier. It should be noted though that the momentum of the pre-war planning concern with the battleship, the low budgets of the 1920's and 1930's and the 4 or 5-year construction time for a major warship still found the Navy at the close of World War II with 150,000 more tons of battleships than carriers.

In response to the international threat, the Navy undertook its expansion program designing the Fleet according to two dominant sets of criteria—the familiar battlefleet doctrine, and information on what the possible combination of opponents were building. Secretary of the Navy, Frank Knox, in a statement before the House Subcommittee on Appropriations in 1941 outlined the Navy policy in this way:

After the last World War and prior to the present one, our policy of enforcing the Monroe Doctrine, interpolated into terms of sea power, was to maintain a navy second to

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30 In addition to the regular Navy budgets, the Congress in 1938 and in 1940 made a total of $6.9 billion available for new ship construction. See: U.S. Cong., House of Representatives, Committee on Appropriations, Naval Appropriations Bill, Fiscal 1942, Hearings before the Subcommittee, 76th Cong. (Washington: G.P.O., 1941), pp. 2-3.

none. This policy, until December 31, 1936, was affirmed by treaties to place the United States on a 5-5-3 ratio as to sea power with respect to Great Britain and Japan. . . .

This policy was reaffirmed by the passage of the Vinson-Trammell Naval Expansion Act of 1934, which established the United States Navy at the revised treaty levels. After the expiration of the treaties in December, 1936, competitive building among sea powers started again. Subsequent to that date three naval expansion acts have been passed to increase the sea power of the United States as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Expansion</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 17, 1938</td>
<td>20 percent</td>
<td>Expansion of other navies</td>
</tr>
<tr>
<td>June 14, 1940</td>
<td>11 percent</td>
<td>War in Europe</td>
</tr>
<tr>
<td>July 19, 1940</td>
<td>70 percent</td>
<td>Two-ocean Threat</td>
</tr>
</tbody>
</table>

The two-ocean Navy authorized by the 70 percent act of July will not be completed as to major units until 1946-47. 32

Secretary Knox went on to present the projected, comparative United States and Axis warship strengths as a basis for the planned United States building program. 33

ESTIMATED COMPARATIVE WARSHIP STRENGTH BY WARSHIP TYPE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S.</td>
<td>Axis</td>
<td>U.S.</td>
</tr>
<tr>
<td>Battleships</td>
<td>15</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Carriers</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

At the time Secretary Knox was making the above presentation,

33 Ibid., p. 3.
the war in Europe had begun, but the United States had not yet joined the conflict. Even at this late date, there was no conclusive analysis on the comparative effectiveness of the aircraft carrier and the battleship against the traditional naval targets. For this reason the number of carriers, as well as battleships, that were built or in the planning stages through 1940 was mainly in response to what the opponents were building and not based primarily upon any independent assessment of the capabilities of carrier aviation. It took the early lessons of the war in Europe and the experiences of actual conflict in the Pacific to gain a sufficient consensus within the Navy that carrier aviation would prevail over the battleship. The shift of emphasis to a carrier Navy is numerically demonstrated in Table IV on page 46.

In summary, the Navy carrier-building program during the years between world wars was molded by a number of factors. Foremost among these was Japan's carrier-construction program. Second, the 1922 Naval Arms Limitation Treaty was both an incentive for the Navy to convert the battle cruisers Lexington and Saratoga to aircraft carriers, and a potential limit on the number and sizes of the carrier force; although the United States never built up to the allowable limits during the periods of the Treaties. Finally, even though the Navy's General Board in 1927 had established a requirement for one new 13,800-ton carrier each year until the Treaty limits were reached, such a construction program was not possible under the
<table>
<thead>
<tr>
<th>Year</th>
<th>In Commission</th>
<th>Under Construction</th>
<th>Sunk</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BB</td>
<td>CV</td>
<td>BB</td>
<td>CV</td>
</tr>
<tr>
<td>1926</td>
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<tr>
<td>1928</td>
<td>15</td>
<td>2</td>
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<td>0</td>
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<tr>
<td>1929</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>0</td>
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<tr>
<td>1930</td>
<td>15</td>
<td>2</td>
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<tr>
<td>1931</td>
<td>15</td>
<td>2</td>
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<td>1</td>
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<tr>
<td>1932</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1933</td>
<td>15</td>
<td>2</td>
<td>0</td>
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</tr>
<tr>
<td>1934</td>
<td>15</td>
<td>3</td>
<td>0</td>
<td>0</td>
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<td>1935</td>
<td>15</td>
<td>3</td>
<td>0</td>
<td>2</td>
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<td>1936</td>
<td>15</td>
<td>3</td>
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<td>1937</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
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<td>15</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1939</td>
<td>15</td>
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<td>2</td>
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</tr>
<tr>
<td>1940</td>
<td>15</td>
<td>6</td>
<td>8</td>
<td>1</td>
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<td>1941</td>
<td>13</td>
<td>7</td>
<td>8</td>
<td>10</td>
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<tr>
<td>1942</td>
<td>17</td>
<td>3</td>
<td>4</td>
<td>25</td>
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<td>1943</td>
<td>19</td>
<td>17</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>1944</td>
<td>21</td>
<td>24</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1945</td>
<td>21</td>
<td>24</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

budget levels then considered acceptable by the Congress. The bulk of the Navy's resources went to operate the fifteen battleships which were kept in the active force. While it is not entirely clear just how much faster naval aviation would have developed and grown had the Navy retired some of its battleships allocating more of the limited resources to naval aviation, it is clear that its growth would have been faster than it actually was.  

For example, according to Colonel William Mitchell, "an average of four thousand airplanes can be built for the price of a battleship" which, at the time, cost between $50-$70 million to construct.  

Rather than await the abruptly clarifying experiences of World War II to alter the composition of the Battleship-centered fleet, carefully designed fleet exercises testing the carrier against the battleship might have brought about a more innovative attitude on the part of the Navy. However, none of the sixteen major fleet exercises held with carriers and battleships between 1926 and 1940 was specifically set up to test comparative effectiveness of the two weapons. The exercises tended to emphasize carriers operating in conjunction with the battlefleet and carriers in raids against

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34 Undocumented references are made to President Roosevelt's role in influencing the allocation of resources to naval aviation over and above what the Navy had planned, in Mark Skinner Watson, Chief of Staff: Pre-War Plans and Preparations (Washington, D.C.: G.P.O., 1950), p. 127.

35 Mitchell, op. cit., p. 110.
land targets--often the Panama Canal.\textsuperscript{36}

The issue of carrier size gave way for a time to the demands of World War II. In fact, great efforts were made to acquire carriers regardless of size.\textsuperscript{37} However, the issues which had given rise to the design problem were a continuous concern to the carrier commanders. In particular, the continuing problem of how to minimize vulnerability at any given offensive effectiveness now became the problem of the users in the Pacific. While the sizes of the carriers operating in the Pacific were fixed, tactics were not. As it turned out, task-group organization and unanticipated technological innovations had a great impact on the effectiveness of the aircraft carrier.

\textsuperscript{36} It should be pointed out that some valuable information on carrier operations came out of fleet exercises. For example, the need for underway replenishment capabilities for CV's; the need for screening vessels to operate with the CV's in a Carrier Group, and the importance of high task-force speed were incorporated into several exercise recommendations.

A description of some of the fleet exercises with particular relevance for carrier aviation is contained in Turnbull & Lord, pp. 270-283; Scot MacDonald, "Flattops in the War Games," Evolution of Aircraft Carriers (Collection of a series of articles from Naval Aviation News), February 1, 1964, pp. 28-33.

\textsuperscript{37} Both the CVL's and the CVE's were conversions for wartime expediency. The CVL's were converted from light cruisers and became the Independence Class at 11,000 tons. The CVE's were mostly converted merchant ships and oilers. For a brief and authoritative discussion of the small carriers' development and important role in World War II see: Lt. William G. Land, USNR, "Functional Development of the Small Carrier," an unpublished monograph dated February, 1946, located in the Aviation History Unit Op-05A5G, Washington, D. C.
CHAPTER III

THE FLEET CARRIER IN WORLD WAR II

This chapter examines the development of the carrier force and its missions during the Pacific campaigns in World War II. Particular attention is given to the relationships between the geography of the theater of operations and innovations in tactics and technology, both of which contributed to making the carrier a particularly effective weapon.

The Western Pacific as a Naval Theater of Operations

Army and Navy military plans had identified Japan as the nation's most likely opponent in the Pacific for at least thirty years prior to the attack on Pearl Harbor in 1941. These plans reflected Japan's growing power as notably manifested in its victory over Russia in 1905; its intermittent territorial gains at the expense of China; the acquisition of Germany's extensive island holdings in the Pacific (present-day Strategic Trust Territory) as a result of World War I; and, in the late 1930's, the diminishing influence and power of France and Britain in the region. The United States alone constituted the major threat to expanding Japanese interests in the
Western Pacific.\textsuperscript{1} However, even United States power in the Pacific through the Twenties and Thirties was more potential than real as was evident in the limited Army and Navy deployments west of Hawaii. National strategy rested on the concept of defensive campaigns at the outset of a war to gain time for industrial and military mobilization. Thus the 1939 version of War Plan Orange was designed "to insure the security of the Continental United States, Alaska, Oahu, and Panama" until the build-up of forces permitted the extension of United States power "progressively to the westward as rapidly as is consonant with the maintenance of secure lines of communications."\textsuperscript{2} Given the expanse of the region and the scarcity and distances between developed Army and Navy bases, it was widely understood in military planning circles that a war with Japan would be naval in character.

Long before World War II, the Navy thought of its fast carrier force in terms of operations in the Pacific Ocean. With the exception of an occasional cruise or exercise in the Caribbean or the Atlantic,

\textsuperscript{1}There are a number of published and unpublished works on political developments in the Pacific in the 20th century. Two that are particularly useful for their naval viewpoints are Seward Livermore, "American Naval Development 1898-1914, with Special Reference to Foreign Affairs" (unpublished Ph.D. dissertation, Cambridge: Harvard University, 1935); William R. Braisted, The United States Navy in the Pacific, 1897-1909 (Austin: University of Texas Press, 1958).

\textsuperscript{2}Chief of Naval Operations, Annual Estimate of the Situation of the Chief of Naval Operations for the Fiscal Year 1941, Washington, April 15, 1939, p. IV-8.
the carriers operated mostly in the Pacific from the time of the 1927 launchings of the Lexington and Saratoga. Three reasons may be offered for the deployment scheme. First, Navy planning had always been sensitive to what one's opponents or combination of opponents were building. In this case Japan had aircraft carriers and presented the major threat to the United States. Secondly, the British Navy provided to some extent a buffer or shield against possible German surface, naval activities in the Atlantic. Finally, the wide expanses of the Pacific with its many islands and lack of developed airfields seemed to be the more reasonable place for sea-based aviation systems.

Unlike the Navy's pre-World War II planning difficulties over the aircraft carrier and the battleship, the threat analysis and what might be called geo-political planning were quite accurate and accorded well with subsequent reality. The Pacific campaigns turned out to be a series of space-reducing missions or tasks undertaken sequentially to allow the instruments of war to be brought ever closer to the enemy's central sources of resistance. The first of these tasks, the destruction of the enemy fleet, followed closely the precepts of traditional naval doctrine. Given the expanse of the Pacific, Japanese reliance on carrier aircraft, and the state of warfare technology in the 1940's, it is unlikely that any weapon other than the aircraft carrier could have accomplished the first
of the tasks which led to eventual victory. In short, air control became the vital prerequisite to the subsequent surface operations. In assessing the Pacific campaigns, the United States Strategic Bombing Survey reported in 1946:

Japan's geographical situation determined that the Pacific war should in large measure be a war for control of the sea and to insure control of the sea, for control of the air over it. As a result, attacks against warships and merchant ships and amphibious operations for possession of island positions on which forward bases could be located were close to the heart of the struggle. Carrier task forces, surface ships to provide logistic support and submarines therefore assumed roles of unusual importance.3

Development of the Carrier Task Force

One of the earliest concerns of the Pacific commanders centered on the problem of task-force formation. Throughout 1942, with enemy carriers as the major threat, an important and debated question was, should carriers be operated as single or multi-carrier task forces?4

3 United States Strategic Bombing Survey (USSBS), Summary Report (Pacific War), (Washington: Government Printing Office, 1946), July 1, 1946, p. 27. The USSBS Report also gives one of the first definitions of air control: "It was never completely possible to deny the air to the enemy. It was considered that we had control of the air when the enemy could not operate in it without prohibitive losses in relation to results achieved, while our own planes could operate in it at will with acceptable risk of loss."

4 Early task-force organizational problems are discussed with quotations and references to the original correspondence between Admiral F. J. Fletcher and Captain A. C. Davis in: Lt. Andrew R. Hilen, Jr., "Remarks on the Development of the Fast Carrier Task Force," an unpublished monograph, dated October 1945, located in Naval Aviation History OP-05A5G, Washington, D. C.
The organizational problem turned on the considerations of command and control to gain the best defensive and offensive use of carrier power.

At the battle of Coral Sea, the Lexington (CV-2) and the Yorktown (CV-5) were operated in close proximity to gain better coordination of aircraft sorties and the screening vessels' anti-air capabilities. Once under attack, however, the two ships became separated, and their screening ships in turn divided on an ad hoc basis without reference to previous plan. As a result of this experience, Admiral Ernest J. King recommended that each carrier be assigned its own permanent screen. While inroads were made on this one particular difficulty, the task-force size problem awaited subsequent developments before it was resolved.

Following the battle at Midway, the four remaining United States carriers had become the flagships of individual task forces even though the multi-carrier force concept was favored by some commanders. In an exchange of views on the question of task-force size, the commanding officer of the Enterprise (CV-6), Captain A. C. Davis, and his task-force commander, Admiral F. J. Fletcher, took different positions. Captain Davis opted for the single-carrier task force, stressing the problem of vulnerability, the difficulties of maintaining visual contact and the dangers of collision at night or while undergoing evasive maneuvers during an air or submarine attack. Admiral Fletcher, on the other hand, advocated the multi-carrier task
force by emphasizing the greater offensive and defensive capabilities attainable from the coordinated efforts of carriers in close formation.\(^5\) As the historian, Lt. Andrew R. Hilen pointed out, the argument was increasingly "academic" at that time in 1942 when the United States had only two carriers left in the Pacific force.\(^6\)

The problem of the most effective task-force organization was not "solved" in 1942. It would be more correct to say that in the following year the problem was overtaken by technological and other developments which changed the context and thereby changed the problem itself. These developments were the introduction of radar into fleet and air operations; the addition of anti-aircraft ships to the force; the enlargement of the carrier inventory with the beginning flow of Essex class ships to the combat theatre; the development of mobile supply techniques; and the fact that from 1943 on, the character of the Pacific campaigns had changed thereby

\(^5\) Ibid., pp. 8-10.

\(^6\) At the close of 1942, the United States had only the Enterprise and the Saratoga operational in the Pacific. The status of the original fleet carrier force was as follows:

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Where Deployed</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV-2 Lexington</td>
<td>Pacific</td>
<td>Sunk by enemy air in Coral Sea</td>
</tr>
<tr>
<td>CV-3 Saratoga</td>
<td>Pacific</td>
<td>Operational</td>
</tr>
<tr>
<td>CV-4 Ranger</td>
<td>Atlantic</td>
<td>Operational in escort missions</td>
</tr>
<tr>
<td>CV-5 Yorktown</td>
<td>Pacific</td>
<td>Sunk by enemy air &amp; sub at Midway</td>
</tr>
<tr>
<td>CV-6 Enterprise</td>
<td>Pacific</td>
<td>Operational</td>
</tr>
<tr>
<td>CV-7 Wasp</td>
<td>Pacific</td>
<td>Sunk by enemy sub off new Hebrides</td>
</tr>
<tr>
<td>CV-8 Hornet</td>
<td>Pacific</td>
<td>Sunk by enemy air off Guadalcanal</td>
</tr>
</tbody>
</table>
affecting the targets with which the carriers would be principally concerned.

In 1943 the previous organizational form of the single carrier had given way to the multi-carrier task force. More than any other development, the widespread introduction of radar into fleet units made carrier task-force concentration possible. This new innovation enhanced offensive effectiveness while greatly diminishing vulnerability. In a very perceptive comment on the impact of radar, Lt. Andrew Hilen wrote in 1945:

In any analysis of the development of carrier warfare, the part played by radar deserves particular attention. It is beyond the scope of this monograph to engage in a learned discussion of this invention; but two generalizations can be made concerning the influence of radar on the evolution of the fast carrier task force which establish its importance without demanding an explanation of its intricacies. In the first place, radar, as a maneuvering instrument, furthered the case of the multiple carrier formation by making easier high-speed maneuvering at night and in difficult weather. With the installation of the Position Plan Indicator (PPI) on carriers and screening ships, the problems of the tactical handling of large dispositions were greatly facilitated, and the arguments against the coordination of carriers could only be abandoned. Secondly, as a medium of defense against attacking enemy aircraft, radar contributed to the self-sufficiency of carrier groups. It had formerly been considered suicidal to

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7 Commander-in-Chief, United States Pacific Fleet, Current Tactical Orders and Doctrine, U.S. Pacific Fleet, PAC-10, June, 1943. PAC-10 was the first comprehensive doctrinal publication to cover carrier operations. Its introduction in 1943 ended a hiatus in carrier doctrine which had existed for the previous two decades.
bring aircraft carriers, known for their vulnerability, within range of shore-based airplanes, but long-range search radars, radar-controlled gunnery and radar-directed combat air patrol provided a system of defense which the Japanese penetrated only with heavy losses. One may conclude, therefore, that the fast carrier task force, without benefit of radar vision, would have been a less effective weapon bound by the limitations of the human eye.\(^8\)

It should be noted that the impact of radar on the Pacific carrier operations was somewhat analogous to its impact on fighter command in the Battle of Britain. In both cases it allowed a significant and perhaps essential increase in the effectiveness of defensive aircraft. Radar also greatly increased the effectiveness of anti-aircraft fire. Not only did radar control the guns, but most projectiles above a certain size contained a small radio-activated fuse (variable time fuse) which detonated the projectile in the vicinity of the target aircraft.

The multi-carrier force which evolved in 1943 contained a very large concentration of naval power. The task force itself was comprised of three or four carrier task groups, each one of which had this typical organizational form:\(^9\)

\[
\begin{array}{ll}
4 \text{ Aircraft Carriers} & (3 \text{ CV's & 1 CVL}) \\
2 \text{ Battleships} & \\
4 \text{ Cruisers} & (1 \text{ CA & 3 CL's}) \\
16 \text{ Destroyers} & \\
\end{array}
\]

\(^8\)Hilen, op. cit., p. 15.

The task force was first used in action against the Gilbert Islands in November 1943 when four of the above task groups comprised the force.

In addition to radar, the development of the anti-aircraft cruiser and mobile logistic systems helped make the multi-carrier task force possible.\textsuperscript{10} In particular, attention should be called to the underway replenishment techniques developed by service Squadron 6 which kept a Carrier Task Group (38 warships and their aircraft) continually operational during the Okinawa campaign for 77 consecutive days—a record for on-line endurance achieved by the carriers during World War II.\textsuperscript{11} This does not mean that offensive air operations were conducted during the 77-day period. It is possible to find fast carriers conducting offensive air operations on as many as 20 days out of a 30-day period.\textsuperscript{12} With underway replenishment, a carrier group could carry on offensive air operations

\textsuperscript{10} Along with their many other innovations in the field of naval aviation, the British were the first to build and operate the specialized anti-aircraft cruiser in the late 1930’s. Other British "firsts" have been the aircraft carrier itself, radar, the steam catapult, and the angled deck, the mirror-landing system.

\textsuperscript{11} The World War II record for on-station endurance had not been surpassed as of April 1965. Another notably long period was the Cuban missile crisis in 1963, when the Enterprise and Independence were on station for 49 and 41 days respectively. Admiral D. L. McDonald, USN, "Carrier Employment Since 1950," United States Naval Institute Proceedings, November, 1964.

\textsuperscript{12} WSEG Staff Study No. 4, p. 7.
for three consecutive days and then withdraw for a day or two to meet its resupply ships. During the days in which the force was mounting offensive air efforts, 1.5 sorties per complement aircraft per day were representative.\textsuperscript{13}

It required an enormous effort to maintain in a state of high operational readiness a force of ships and airplanes the size of a carrier task force. The underway replenishment group, Service Squadron 6, itself aggregated 73 ships of mixed types.\textsuperscript{14}

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light cruiser</td>
<td>1</td>
</tr>
<tr>
<td>Escort aircraft carrier</td>
<td>7</td>
</tr>
<tr>
<td>Destroyer/destroyer escort</td>
<td>28</td>
</tr>
<tr>
<td>Cargo</td>
<td>2</td>
</tr>
<tr>
<td>Oilers</td>
<td>24</td>
</tr>
<tr>
<td>Ammunition</td>
<td>5</td>
</tr>
<tr>
<td>Fleet tugs</td>
<td>4</td>
</tr>
<tr>
<td>Distilling ships</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>73</strong></td>
</tr>
</tbody>
</table>

In addition to the underway replenishment capability, the Navy developed a mobile-base-support system which was essential to sustain the projection of naval power west of Pearl Harbor.\textsuperscript{15} Service Squadron 10, the mobile logistic support group which provided the advanced base components, controlled 609 vessels located in five anchorages at the

\textsuperscript{13} Ibid.
\textsuperscript{14} Ibid.
\textsuperscript{15} Ibid., p. 26.
height of its activity in the Pacific. Eventually, nineteen advanced bases and fleet anchorages were developed in the southwestern and western Pacific for use by the fast carrier task forces directly and indirectly by the carriers' underway replenishment groups. These bases provided areas for rest and recreation for crews, and replenishment and minor repair facilities. At the time of the Okinawa campaign, 46 vessels from Service Squadron 10 based at Ulithi were used to support Carrier Task Force 58. Without the mobile logistic support systems and their advanced base components, the carriers would have been a much less effective weapon since they would have been forced to retire frequently to distant rear bases.

Carrier organization took nearly two war-time years to evolve. The combat experiences of 1942 combined with developments, the implications of which had not been fully anticipated, led to an organization which increased offensive capabilities. However, by the time the large task force came into being, six of Japan's original nine aircraft carriers had been sunk and the bulk of the remaining major fleet units had retired to a defensive posture under cover of

16 Ibid., p. 29.
17 Ibid., p. 30.
18 For an explanation of the relationship between the size of the carrier force and the distances from base to operating areas, see pp. 176-177.
Japanese land-based aviation.\textsuperscript{19} For this reason the targets with which the carrier task forces were concerned shifted from enemy carriers to supporting amphibious campaigns, and to eventual strikes against the Japanese home islands.

**Missions and Performances of Fast Carrier Forces**

The performance of the fleet carriers during the Pacific campaigns varied with the changing locations and types of enemy targets. In general, the contribution of the carriers to the overall progress of the war was most significant in their missions against enemy fleet units and other sea-based targets which were frequently beyond the combat radii of land-based aviation and which did not make good targets for high altitude bombardment. In addition, the carriers provided vital air support for many of the amphibious campaigns which were also beyond reach of land-based aviation. In these missions the carriers were unique in the sense that there were no reasonable alternatives for doing the job. The carriers were, in effect, weapons with a 300 nautical mile range of fire which could move about, crossing wide expanses of sea with the necessary combat aviation and support to challenge local enemy sea and air superiority. Where land-based air became available in an area, the carriers were no longer necessary.

\textsuperscript{19}Following Midway in 1942, one other major carrier engagement occurred in the Leyte Gulf in 1944. The Japanese deliberately chose to sacrifice their carriers using them as decoys to draw U. S. forces northward from the main area of action.
and generally could not mount nor sustain the volume of efforts that a large and equipped airfield could. Instead, the carriers would move in search of other targets, to include merchant shipping, raids against military installations, and strikes against the industry, communications and transportation in the Japanese home islands. Aside from the vital missions involved in defeating enemy fleet units and in providing the air support in many of the amphibious campaigns, the remainder of the carriers' missions were capable of being performed by either submarines, long-range, land-based bombers, or tactical land-based aviation where bases were available. This is to say that there were times and locations where the carriers were a unique form of air power; there were other times and locations where, with respect to the target, the carriers were one of two or more alternative weapons. An examination of some of the World War II data should help to bear this point out.

One of the striking features of the carriers' performance was the relatively small volume of effort in terms of both ordnance and sorties which was used against sea-based targets as distinct from land targets. As the data in Table V indicate, the earlier and popular conception that naval engagements took place at sea and that navies existed to fight other navies would have to be broadened to account for the sea-based airplane's capability to project power inland. The famous carrier battles, which marked the turning point
TABLE V*  
DISTRIBUTION OF ORDNANCE DELIVERED BY FAST CARRIER  
TASK FORCES CLASSED BY LAND AND SEA TARGETS  
(1941 - 1945)  

<table>
<thead>
<tr>
<th>Location of Target</th>
<th>Tons of Bombs</th>
<th>Percentage of Total</th>
<th>No. of Rockets</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On/over Land</td>
<td>28,937</td>
<td>77</td>
<td>77,128</td>
<td>84</td>
</tr>
<tr>
<td>On/over Sea</td>
<td>9,593</td>
<td>23</td>
<td>13,916</td>
<td>16</td>
</tr>
</tbody>
</table>

*WSEG No. 4, p. 58

in the war, the interdiction of merchant shipping and some of the  
over-the-sea interdiction of enemy air yielded the advantage of sea  
control with a small percentage of the carriers' total wartime  
efforts. The reasons for this, and a more detailed examination of  
how the carriers were used, is discussed below.

**Carrier-versus-carrier campaigns.** One measure of the volume of  
effort expended in the campaigns to break the enemy's offensive car-  
rrier strength was the number of action sorties flown by the fast  
carriers during the early period of the war. Of the 115,923 action  
sorties (offensive, defensive and search sorties associated with an  
engagement) flown from the fast carriers during the entire Pacific  
War, 2259 were flown during 1942. This is 1.9 per cent of the total.  
Of the 1942 figure, 706 represented the total effort at Coral Sea  
and Midway. Thus, in terms of total action sorties flown during the  
entire Pacific War, the important battles of Coral Sea and Midway
constituted .6 per cent of the fleet carriers wartime efforts. When
the June 1944 Battle of the Philippine Sea is added to this, the
Pacific carrier battles represented only .9 per cent of the total
action sorties flown during the war.\textsuperscript{20}

Several reasons may be offered in explanation for the far larger
volumes of both ordnance delivered and sorties flown against land
targets than against sea targets. First, the United States' carrier
force began expanding after the 1942 sea battles had been fought
and thus more aircraft became available at a time when sea-based
targets were becoming increasingly scarce. As the war progressed,
the efforts of the carriers were directed in large part to the sup-
port of the offensive amphibious and land campaigns. In addition,
it often required more firepower to knock out land targets—particu-
larly where the enemy made skillful use of camouflage and protective
sheltering. The neutralization of bunker-type fortifications simply
involved a greater aviation effort. Finally, the nature of sea or
air targets made the outcome of a conflict more easily determinable.
A ship or an airplane represented a point target and, when inter-
dicted, sunk or shot down, was simply gone. The criteria for

\textsuperscript{20}Percentages derived from statistical data in WSEG No. 4. An
action sortie is defined as one involving contact with the enemy.
Complete data on all sorties flown (non-action) did not generally
become available until January 1944 when squadrons were required
to report all flights. It can be surmised that non-action sorties
accounted for many more flights than did action sorties. Judging
from 1944-45 data, fighter-type combat air patrol, non-action
sorties were double the fighter-action sorties for the same period.
measuring effectiveness in this case were fairly clear; whereas in the case of a land target, enemy activity during or subsequent to a strike often salvaged some of the undestroyed portion of the target for re-use.

**Carriers in amphibious operations.** As mentioned above, one of the major roles for the carriers was the support of the series of amphibious operations across the Pacific. Either close-air-support or indirect support of the amphibious campaigns accounted for the great bulk of the carriers' efforts. An examination of this role will be more meaningful if it follows a brief look at the introduction of the escort carriers into the Fleet.

At the beginning of the war, the United States began an extensive program of converting merchant ships and oilers to small aircraft carriers, known as escort carriers or CVE's. This program was undertaken primarily to help bridge the shortage in carrier air-power with which the nation found itself in 1941. It was done also, to acquire a small carrier for many specialized missions which did not appear to require large aviation offensive capabilities. The size of the CVE program was quite large, as the nation ended the war with 70 of these vessels operational and 26 more under construction or conversion.21 The CVE's proved to be "work horses" in both oceans.

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and were used ferrying aircraft, escorting convoys and mobile replenishment groups, providing defensive aviation support for the fast carrier task forces on occasion, and providing close air support for the amphibious forces in both theaters. However, it is the role of the CVE's in the Pacific amphibious campaigns and their relationship to the fast carrier task forces that is of particular interest. In these operations the bulk of the direct, close air support of troops provided by the naval and marine air forces was provided by the CVE's. This came to be their principal mission from 1943 until the end of the war in the Pacific. The Navy used the fast carrier task forces in what might be termed a more general support role, designed to reduce the area threat and to maintain general air superiority.

The orchestration of carrier air with the efforts of other forces to advance across the Pacific is aptly described by the Strategic Bombing Survey:


23 United States Navy Department, Office of the Chief of Naval Operations and Bureau of Aeronautics, Naval Aviation Confidential Bulletin (a quarterly which was discontinued in 1954), p. 12.

The relationship of CVE's to CV's and CVL's in amphibious operations is discussed briefly in: Commander, Pacific Air Forces, Analysis of Carrier Operations, July-Aug. 1944, Serial 001513, November 9, 1944.

24 Two CVE's were lost in the Pacific supporting land operations, the Liscome Bay (CVE-56) and the Bismark Sea (CVE-95). The first to a single torpedo and the second to a Kamikaze attack.
Carrier-based air and available shore-based air softened the area to be occupied, and as the amphibious force moved up, fast carriers advancing beyond the objective struck swift blows at all positions which could threaten the objective area. With close air support from both escort and fast carriers and a concentration of gunfire from combatant ships of the support force, an amphibious assault over the beaches was made. The objective was secured under air support and cover from the carriers which were not withdrawn until airfields ashore could be prepared and activated. 25

In carrying out the role of general support of the amphibious campaigns, the fast carriers struck a wide variety of targets, including harbor facilities and shipping, airfields, military supply installations, transportation facilities, and enemy troops and fortifications. Of the total action sorties flown by all carriers (CVE's included) in the Pacific, the largest category, 40 per cent, was against enemy airfields; the second largest group of action sorties, 39 per cent, was flown against other military installations. Of the remainder, 16 per cent were recorded as "other land targets," mostly battlefield targets, and 5 per cent were against enemy transportation systems. 26

A Japanese source on the effectiveness of carrier air in close support of the amphibious operations estimated that their troop losses from all aircraft activity in the island campaigns accounted for 25

25 USSBS, p. 7.

26 WSEG No. 4, pp. 142-271.
per cent of their combat deaths. Of the remainder, 58 per cent stemmed from small arms fire, 15 per cent from artillery and 2 per cent from other causes. 27

Carriers in sea interdiction. Another of the missions of carrier air, but one that represented a small percentage of their overall effort, was the interdiction of enemy supply shipping. At Guadalcanal, for example, General Miyazaki claimed that inability to achieve air control resulted in the loss of 80 per cent of the supplies dispatched from Rabaul. 28 In addition, carrier planes were effective in seeking out and destroying elusive Japanese ships in inland seas and harbors where American submarines had difficulty operating. While submarines were by far the most effective weapon against enemy tankers and merchant ships, carrier air accounted for an appreciable amount of the tonnage and was the principal agent in the destruction of enemy warship tonnages. 29

Air group composition. As has been shown, maintaining carrier aviation effectiveness during the course of the Pacific campaigns required continual innovation and adaptation to changing circumstances and targets. In addition to task-force organization, the carrier

27 USSBS, p. 13.

28 USSBS, p. 5.

TABLE VI*  
PERCENTAGE OF TOTAL ENEMY SHIP TONNAGES SUNK  
IN PACIFIC CAMPAIGNS BY CAUSING AGENT  
(1941 - 1945)

<table>
<thead>
<tr>
<th></th>
<th>Carrier Aircraft</th>
<th>Submarines</th>
<th>Other Surface Warships</th>
<th>Army Air Forces &amp; AAF Mines</th>
<th>Combinations**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Warships</td>
<td>38</td>
<td>27</td>
<td>14</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Japanese Tankers</td>
<td>31</td>
<td>55</td>
<td>--</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Japanese Merchant</td>
<td>18</td>
<td>56</td>
<td>--</td>
<td>14</td>
<td>12</td>
</tr>
</tbody>
</table>

*Source: U.S. Naval Aviation in the Pacific, p. 49.

**"Combinations" include the figures for those cases where more than one causing agent participated in the destruction of an enemy vessel and those cases where allies were the sole destruction agents.

commanders were faced with a problem of matching the composition of the carriers' air groups and the ordnance loads with the changing and varied targets. The range of choice which existed in the carrier system was accompanied by the dilemma of choice. Selections had to be made between various combinations of bomber aircraft, fighter aircraft, a wide variety of bomb sizes and types, machine gun bullets, rockets, torpedos, and mines, with the expectation or hope that, if not the optimum, at least a satisfactory combination would be placed over the right target at the right time. Frequent references are made in ComAirPac reports to this problem and the need for continual endeavors to improve the match.\(^{30}\) The fast-carrier forces did make

\(^{30}\) Analysis of Carrier Operations, July-August 1944, pp. 1-6. ComAirPac was a monthly report from the Commander Naval Air Force in the Pacific. The reports are on file in the Naval History Division, Op-0989A.
substantial adjustments during the course of the war in response to the changing environment. Of particular significance was the shift toward more fighter-type aircraft in the carriers' complements in response to the kamikaze attacks; the lessened need for dive bombers and torpedo bombers; and the development of the fighter-bomber and air-launched rocket which proved to be particularly effective against the more lightly armored targets.

**TABLE VII**

**REPRESENTATIVE AIRCRAFT COMPLEMENTS FOR FAST CARRIERS ON SELECTED DATES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Fighter (%)</th>
<th>Bomber</th>
<th>Torpedo Bomber</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 1942</td>
<td>18 (25)</td>
<td>36</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td>Nov. 1943</td>
<td>36 (40)</td>
<td>36</td>
<td>18</td>
<td>90</td>
</tr>
<tr>
<td>Oct. 1944</td>
<td>55 (57)</td>
<td>24</td>
<td>18</td>
<td>97</td>
</tr>
<tr>
<td>Apr. 1945</td>
<td>73 (71)</td>
<td>15</td>
<td>15</td>
<td>103</td>
</tr>
</tbody>
</table>

*WSEG No. 4, p. 50

Accompanying the shift toward a higher percentage of fighter aircraft in the carrier air groups was an increasing trend toward the use of the lighter 500 and 100-pound general purpose bombs, fragmentation bombs and incendies--particularly napalm in 1944. This was in addition to a marked increase in the use of rockets which first became available in the latter stages of the war.
Carrier system vulnerabilities. Any assessment of the fast-carrier forces must concede that vulnerability turned out to be much less of a problem than had been thought. Developments which enhanced offensive effectiveness also favored survivability. Prior to the technological and organizational innovations of mid-1943, the best defense, particularly in the carrier battles, was a combination of powerful offensive strikes by the air groups and passive, evasive techniques by the carriers and their screening vessels. In strikes against land targets during the early period of the war, care was taken to maximize the element of surprise in raiding-type operations and to minimize the time the carrier force would be within range of enemy land-based aviation. At any time during the war, however, the dangers of being caught with decks loaded with aircraft and ordnance stand out as one of the greatest vulnerabilities—a lesson which the Japanese in particular experienced.

Two engagements stand out—Midway in 1942 and Leyte in 1944—in each of which the Japanese lost 4 carriers. In the first, they were caught refueling and rearming aircraft, which increased the likelihood of a hit causing extensive damage. All 4 carriers suffered from uncontrollable fires and explosions which forced crews to abandon ship and either sank the vessels directly or made them floating hulks to be finished off by their own screen.31

The 1943 developments which permitted the large task-force

31WSEG No. 4, p. 84.
organization helped in overcoming the air threat in particular. With qualitative and often quantitative superiority in weapons, the carrier task forces, on many occasions, were brought within range to challenge successfully land-based aviation. Task-force organization helped in overcoming the air threat, and also contributed to overcoming the submarine threat through an increased number of destroyers. In combating the submarine threat, the active defenses provided by the destroyer screen, combined with the passive technique of high task-force speed, helped to mitigate the danger.

In addition to the previously discussed technological and organizational innovations, it should be pointed out that better fuel and ordnance handling techniques, improved fire and damage-control methods, and high cruising speeds helped to make the carrier system less vulnerable than it had been in 1942.

The United States lost five fast carriers during the course of the Pacific campaigns, four CV's in 1942 and one CVL in 1944. Of the five losses, four were due to air attack, and one to submarine attack. In addition, there were thirty-seven other instances of carriers being struck without sinking during the course of the war.

Air superiority and vulnerability. In considering the problem of vulnerability, defense of the carrier was only one part of the problem. The capability of the carrier's aircraft to gain local air
superiority; to penetrate to a target; to deliver the ordnance; and to survive to return to the carrier were equally if not more important. The carrier, after all, existed to support the aircraft and not the reverse.

In clearing the skies of Japanese aircraft, carrier aviation presented an impressive record. The Navy claims for its carriers were 12,268 enemy planes destroyed for a Navy combat loss of 2,488 carrier-based fighter, bomber and torpedo-type aircraft. This compared with the Army Air Forces claim of 10,343 enemy aircraft destroyed for a combat loss of 1,819 aircraft.

Of the total Japanese aircraft destroyed by Navy carrier aviation, 48 per cent were caught on the ground. Of those destroyed by the land-based tactical air forces, 29 per cent were caught on the ground. This difference lends support to a frequently-made Navy claim that its carrier forces have a greater surprise raiding capability than do the land-based systems, because of the mobility of the carrier base.

It should be noted that Navy "combat losses" as used above means all losses due to enemy action. This includes aircraft which

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32 Two sources are used for the Navy data, U.S. Naval Aviation in the Pacific, p. 44; WSEG No. 4, Appendix D. The Navy figures exclude land-based Marine and Navy aircraft.

33 USAF Historical Division Liaison Office, USAF Tactical Operations World War II and Korean War, with statistical tables, Washington, May 1962, pp. 73-152.
were lost aboard carriers. A more detailed breakdown of Navy carrier aircraft losses is in Table VIII.

**TABLE VIII**

**CARRIER AIRCRAFT LOSSES BY TYPE AND CAUSE OF LOSS**

(1941 - 1945)*

<table>
<thead>
<tr>
<th>Cause of Loss</th>
<th>Fighter No.</th>
<th>Fighter %</th>
<th>Bomber/Torpedo No.</th>
<th>Bomber/Torpedo %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enemy action</td>
<td>1463</td>
<td>36.1</td>
<td>1025</td>
<td>37.7</td>
</tr>
<tr>
<td>Combat not enemy action</td>
<td>30</td>
<td>0.7</td>
<td>30</td>
<td>1.1</td>
</tr>
<tr>
<td>Action of own forces</td>
<td>128</td>
<td>3.1</td>
<td>91</td>
<td>3.2</td>
</tr>
<tr>
<td>Operational Accidents</td>
<td>2390</td>
<td>58.9</td>
<td>1547</td>
<td>56.8</td>
</tr>
<tr>
<td>Other</td>
<td>45</td>
<td>1.2</td>
<td>30</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>4056</td>
<td>100.0</td>
<td>2723</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*WSEG No. 4, p. 72

Of the carrier aircraft lost due to enemy action, 1818 were lost while on a combat flight. Table IX gives the approximated loss rates for the four war years.

**TABLE IX**

**CARRIER AIRCRAFT LOSSES PER 100 ACTION SORTIES**

(1941 - 1945)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. Aircraft Lost</th>
<th>Loss Rates/100 Action Sorties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1942</td>
<td>172</td>
<td>6.4</td>
</tr>
<tr>
<td>1943</td>
<td>80</td>
<td>1.9</td>
</tr>
<tr>
<td>1944</td>
<td>790</td>
<td>1.8</td>
</tr>
<tr>
<td>1945</td>
<td>776</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>1818</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*WSEG No. 4.
An examination of aircraft losses due to enemy action again suggests the higher cost involved in striking land-target systems.

TABLE X*
U.S. CARRIER AIRCRAFT LOSSES BY CAUSING AGENT AS A PERCENTAGE OF TOTAL LOST DUE TO ENEMY ACTION

<table>
<thead>
<tr>
<th>Cause</th>
<th>Per Cent of Total Lost (N = 1818)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enemy Aircraft</td>
<td>22%</td>
</tr>
<tr>
<td>Ship-based anti-aircraft fire</td>
<td>15%</td>
</tr>
<tr>
<td>Land-based anti-aircraft fire</td>
<td>63%</td>
</tr>
</tbody>
</table>

*WSEG No. 4.

As with all weapons, the carrier system has to allocate a certain percentage of its resources to its own defense. In addition to screening vessels such as destroyers, cruisers, battleships, and occasional submarines, part of the air group must fly defensive combat air-patrol missions. Since aviation resources devoted to purely defensive purposes detract from those available for offensive strike purposes, the percentage of defensive sorties can be taken as a measure of effectiveness in any comparison with alternative systems.34 Because of reporting procedures, detailed information on total sorties flown did not become

34 It should be noted, however, that defensive combat air patrol missions frequently contributed to the diminution of the enemy air forces in the Pacific and thus made some contribution to overall air superiority.
available until the closing months of the war. However, complete
data from Task Force 38 from July 1, 1945 to August 15, 1945 indi-
cate that out of a total of 23,556 sorties flown, 12,755 or 54
per cent involved some offensive aspect; 5408 or 23 per cent were
purely defensive; and 5393 or 23 per cent were administrative. 35

The striking feature of the entire vulnerability problem when
viewed from the perspective of pre-World War II planning concerns
is how profound an impact unforeseen technological and consequent
organizational developments had on the problem. Lessened carrier
system vulnerabilities have to be understood as part of a range
of technological superiorities which the United States Navy was
able to incorporate quickly into wartime operations. Commenting
on the superiority of United States forces, the authors of a car-
rier study wrote:

Even in the first year of the war, the United States
carrier forces had the better of the conflict, destroy-
ing 6 enemy carriers for a loss of 4. When the duel
between the two forces was resumed in 1944, United
States superiority was marked. The new ESSEX and
INDEPENDENCE class carriers were more efficient and
less vulnerable than their Japanese counterparts.
The F6F and F4U fighter planes were not only better
than the F4F's which they replaced but showed a
marked advance over anything the enemy possessed. The
Japanese had, at the same time, failed to initiate a
sufficiently expanded training program to replace their
original air groups. The result was a decline in average

35 WSEG No. 4, p. 57.
pilot skill. Radar and communications equipment were not up to United States standards, and finally, when attacked, Japanese operating doctrine continued to call for each ship to take independent action, which—far from protecting the carriers—laid them open to attack.  

Summary of carrier performance, World War II. The Navy's fast-carrier forces made a unique contribution to the war in the Pacific by first defeating the Japanese carrier forces and then by neutralizing enemy land-based air while forward bases were being seized. Forward bases were seized for one or more of three purposes:  

1. To provide forward airfields for land-based air—both tactical and long-range bombers.  
2. To furnish advanced bases for the fleet.  
3. To secure land areas for the staging of troops.  

In a sense the carriers' efforts in World War II were complementary to the efforts of land-based air by helping to secure bases so that local air superiority could be maintained and heavy bombers (B-29's) could be brought within effective combat radius of the Japanese homeland.  

Whenever a target was within range of land-based bombers, the carrier system could not compete in terms of its ability to deliver

36 Ibid., p. 84.  
37 USSBS, p. 7.
heavy ordnance loads. Compared with the carrier force's 38,530 tons of bombs delivered during the War, the 5th Air Force alone delivered 140,991 tons of bombs during the Pacific campaigns.\textsuperscript{38}

Carrier dive-bombers and torpedo bombers were precision delivery vehicles; in part because hitting a moving warship required precision delivery, and in part because carrier aircraft were limited in their take-off weights. However, in the closing months of the war, both land and sea-based aviation brought the Japanese homeland under aerial bombardment. It was at this point that overlapping missions resulted. The Navy tried strategic bombing, albeit briefly, before the war ended.

\textbf{Planning Developments and the Emergence of the Midway Class Carriers.}

The feedback from Pacific experiences inevitably had an impact on the planning for the future Navy. For example, the "Two Ocean Navy" expansion program of 1940 provided for the building of seven additional battleships--five of which were to have been the new Montana Class and two of the Iowa Class. However, by June of 1942, Chairman of the House Naval Affairs Committee, Carl Vinson, euphemistically announced that the completion of these vessels would be "temporarily deferred" so that construction energies could be

\textsuperscript{38} \textit{USAF Tactical Operations}, pp. 73-152.
concentrated on aircraft carriers. The carrier building program was enormous. Between July, 1940 and August, 1945, 27 fast carriers (CV's and CVL's) and 110 escort carriers (CVE's) were completed or converted from other ship types. Twenty-one additional carriers (12 of which were authorized and in various stages of construction in August, 1945) were planned.39 Whether or not the requirements for such a large carrier force were ever questioned seriously within the Navy during the war is unknown, or has not been made a part of the public record. Hindsight of the events in the Pacific, to include the early defeat of the Japanese carrier forces; the elimination in 1944 of the remaining Japanese Navy and effective merchant shipping; the acquisition, by 1944, if island bases within land-based bomber ranges of Japan; and the collapse of Japan itself apparently much earlier than the Navy expected, suggests that the number of aircraft carriers built and under construction was excessive for the tasks unique to carrier aviation. Three years following World War II, Secretary of Defense James V. Forrestal, expressed his concern with "surplus" Naval air power and the redundancy with Air Force missions. In a March 1948 diary notation, he said:

> The mission of the Navy which was inescapable in the Pacific War was the knocking out of enemy-held land bases which were unreachable by land-based air. I should like to see some study given to the

39Annual Report 1945, Secretary of the Navy to the President, p. A-25.
possibility of passing surplus Navy air power into the Air Force when such missions are no longer necessary. For example, the closing phases of the Japanese War . . .

The importance of the aircraft carrier had an effect on the composition of the Navy. Prior to the war, tactical doctrine called for the carrier to operate in support of the battleship. By the end of 1942, however, those battleships which possessed sufficient speed were making a contribution to the Pacific campaigns by operating in support of the carriers. Not only did the battleship become part of the carriers' screen, but those vessels, cruisers and destroyers, which had previously protected the battle fleet were allocated to the carrier. The result was a substantial shift in the composition of the surface Navy, which is not reflected in looking solely at the carrier numbers or tonnages.

The Pacific experiences were also reflected in the planning for the new aircraft carriers, in particular the Midway, CVB-42. This vessel differed in many ways from the earlier aircraft carriers. The need for more armor, compartmentation, and the capacity for handling more of the larger and heavier aircraft were incorporated into the Midway, on which construction was begun in October 1943.


41 See Figure 2, p. 80.
FIG. 2: CHANGING COMPOSITION OF THE NAVY

Source: US Navy Department, Annual Report Fiscal 1945, Secretary of the Navy to the President. Tonnage figures uncorrected for combat losses. They include original 1940 force plus semi-annual additions.
Its displacement, a 66.6 per cent increase over the Essex, was the largest single increase in tonnage over a previous class of all United States carriers built through 1964. Furthermore, its armored flight-deck, armament, fire-fighting and damage control improvements, and even its designation of CVB (Heavy Aircraft Carrier) mark the Midway Class as opening a new period in the carriers' evolution—a period which has been continuous through the later Forrestal and Enterprise Classes. The watershed in carrier evolution which the Midway represented is best understood in terms of the degree of emphasis placed on considerations of vulnerability at different times. In particular, the sizes of the pre-war carriers represented substantial concessions to vulnerability; whereas, the size of the Midway and later post-war carriers reflected the Navy's new-found confidence that vulnerability should be less of a constraint, and that relatively greater emphasis could be placed on offensive capabilities. In short, the Midway was to be a ship which could better challenge hostile land-based aviation. This impetus towards an enhanced offensive role was later reinforced by the development of atomic weapons and the Navy's efforts to obtain a carrier-based nuclear delivery capability in the post-war period.

\[^{42}\text{See Table IV, page 46 for data on carrier sizes.}\]

In one way the Midway reflected an older planning tradition. It was the last carrier class to be constrained in design size by the requirement for passage through the Panama Canal.
Carrier Task Force Costs

Total Navy expenditures from July 1, 1940 to June 30, 1945 amounted to $90.3 billion.\(^{43}\) Looking at the Navy's efforts during the war and judging from known allocations, it is suggested that of the Navy's total "product," fast-carrier forces accounted for about 30 per cent or about $30 billion of the total expenditures during the five-year period. This is an average of $6 billion per year.\(^ {44}\) Matching these average costs against the average numbers of aircraft aboard operational carriers (800 average during the five-year period), it turns out that the costs per fast carrier aircraft for one year were $7.5 million. This approximation costs the aircraft against everything in the Navy which contributed to its on-board operational status.

Another way of arriving at a cost estimate is to look at procurement costs only. By using investment or procurement dollars for ships and aircraft and excluding any operations, maintenance, logistics, personnel or shore establishment costs, it is possible to approximate the procurement costs of the carrier task forces in World War II dollars. For example, in June 1942, the Navy had about $5.5 billion invested in all combatant (warships) vessels and airplanes.

\(^{43}\) Annual Report 1945, Secretary of the Navy to the President, p. A-5.

\(^{44}\) The 30 per cent is an estimate based upon known allocations such as warship tonnages, procurement dollars during the war and present-day program cost data.
The 1942 carrier forces, including aircraft and screening warships, constituted 27 per cent of the $5.5 billion, or $1.5 billion investment dollars. By August 1945, the Navy's investment in all operational warships and airplanes had risen to about $17 billion of which 32 per cent or nearly $5.5 billion was represented by the fast-carrier task forces. In matching the number of airplanes aboard fast carriers against total carrier force investment, it appears to have cost the Navy $3.5 million investment dollars per airplane in 1942, and about $3 million investment dollars per airplane in 1945.45

While these cost data provide a rough idea of system costs, they point to the fact that it is system costs which should be considered and not just aircraft costs, or carrier costs. In the case of the fast-carrier forces, the entire system, including some portion of the Naval shore establishment, overseas bases, logistic ships, cruisers, destroyers, carriers, planes and personnel, contributes to the weapon which exists to deliver ordnance or to effect a target in some way relatable to the nation's interests.

Plans, Technology and the Pacific War

One of the striking features of the Navy's planning for a Pacific war was the near dichotomy between strategic-political planning and "hardware" planning which responded to battleship doctrine. The

45 Cost computed from data made available in Annual Report Fiscal 1945, Secretary of the Navy to the President.
strategic-political plans in the form of War Plan Orange and the Navy's Annual Estimate of the Situation predicted with surprising accuracy the major outlines of a war with Japan. Such features as an initial Japanese offensive, a United States withdrawal from the Western Pacific before undertaking a series of island-hopping amphibious campaigns, and a war of attrition had been reflected on the game boards at Newport, Rhode Island, and in Navy plans for several years before 1941. However, it should be pointed out that even though the aircraft carrier replaced the battleship and was itself altered by new developments during the course of the war, the aggregate of technological innovations and organizational changes did not make the character of the war markedly different in outline from what had been previously envisioned. The diffusion of technology through the carrier force (and other weapons systems) no doubt shortened the war, and made the United States' victory more overwhelming and less costly. It did not, however, amount to a "break-through" or so-called change in kind which would have completely falsified those strategic plans that had been laid with the battleship in mind. In this sense the error came not so much in failure to mesh closely the weapons with the political-strategic threat analysis, but in a failure to arrive at the best of two

46 United States Navy Department, Annual Estimate of the Situation of the Chief of Naval Operations for the Fiscal Year 1941, April 15, 1939.
alternative weapons purely at the "hardware" planning level.

Pearl Harbor and the battles of Coral Sea and Midway marked the demise of battleship theory--a passing which was many years overdue. The theory had come to function in the manner of an ideology, and, like most ideologies, had found its support in the social institutions and human careers for which it was the raison d'etre. While it provided criteria for fleet composition and use, it could not take account of the plurality of ways for affecting sea control which modern technology made possible. The submarine, the airplane, and many types of ordnance could hardly be comprehended by a system of thought which had its roots in an analysis of naval wars of the eighteenth century. Interestingly enough, Mahan himself cautioned against over-reliance on one particular mode for gaining sea control when he said:

He (the strategist) will observe also that changes of tactics have not only taken place after changes in weapons, which necessarily is the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement of weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change; by careful study of the powers and limitations of the new ship or weapon, and by a consequent adaptation of the method of using it to the qualities it possesses, which will constitute its tactics. History shows that it is vain to hope that military men generally will be at pains to do this, but that the one who does will go into battle with a great advantage,--a lesson in itself of no mean value. 47

47 Mahan, op. cit., p. 8.
Battleship theory had been a way of dealing with future fleet composition and operating doctrine. In its absence following World War II, the Navy needed new criteria for decision-making at a time when technology was expanding more rapidly the inventory of new weapons. It was in this milieu that the aircraft carrier made the transition into the nuclear age.
CHAPTER IV

ATTACK CARRIER AVIATION AND NUCLEAR WEAPONS

The Navy emerged from World War II with its new capital ship, the aircraft carrier, already threatened with technological obsolescence from the atomic bomb and the long-range bomber. Future growth and an important role for the surface Navy appeared to depend upon the acquisition of a nuclear delivery capability and nuclear missions for the carrier task forces. To this end the Navy devoted substantial efforts. This chapter describes some of these endeavors and the growing problems the Navy faced in maintaining carrier system effectiveness in a possible nuclear-war environment.

A sense of the scope of the uncertainties of the early post-war years and what they meant to naval planners is conveyed by Captain Carl H. Amme in a subsequent analysis of the period:

At the end of World War II, the largest Fleet in history sailed the Seven Seas with no place to go. The Japanese Navy had been sunk; the Soviet surface fleet was hardly considered a threat. No one could visualize a serious naval threat at any point on the globe. The classical naval strategic concept of the decisiveness of naval battles between opposing fleets was dead as a dodo. Another Coral Sea or Midway could only happen with the strategic confrontation of two great maritime powers. In 1945 there remained but one. The strategic concept which determined the structure of the U. S. Navy was no
longer valid.¹

In the absence of a clearly defined threat which could be identified publicly in 1945, Admiral Ernest J. King vaguely related the Navy to the nation's interests. He told the Congress that the purposes of naval forces were:

- to assure the security of the continental United States
- To assure the security of the Western Hemisphere
- to function in support of United Nations commitments to preserve world peace
- to assure that the sea lanes to occupied areas remained open.²

Within the Navy Department, however, planning for the post-war fleet was somewhat more tailored to the emerging threat than was conveyed publicly. For the purposes of planning fleet composition, Secretary of the Navy James Forrestal posited two basic premises. One was the identification, reportedly as early as 1943, of the Soviet Union as the probable, major threat to the United States

security interests. The other was that airpower was to be the heart of the Navy.³

Forrestal's belief that the Navy should share in the nation's air strength along with the Air Force appears to have rested upon a number of factors. One of these was the role that sea-based aviation plays in regions of United States interest where land bases were unavailable, as often had been the case in the Pacific campaigns.⁴ In this connection, it is entirely possible that as early as 1944-45, Forrestal and others in the Navy already had the Mediterranean in mind for future carrier deployments to counter anticipated Soviet threats.⁵ A second reason Forrestal supported post-war Naval aviation was the fact that a heavy investment had already been made in carriers during World War II. The Navy would represent a force in-being in a post-war period, which the Secretary had reason to believe would be characterized by low defense budgets.⁶


⁴Millis, op. cit., p. 391.

⁵Middle Eastern oil reserves (particularly in Saudi Arabia), the Palestine turmoils, and the Soviet threat to Iran were three potential trouble spots which Forrestal anticipated in connection with the Soviets at least as early as July, 1945. See Millis, pp. 81, 82.

⁶Ibid., p. 358.
A third factor had to do with the developing controversies over the unification of the military services, and Forrestal's fears (in 1945-46) for the loss of "autonomy and integrity for the Navy."\(^7\) Forrestal's misgivings about unification "stemmed from the feeling that even the top command in the Army had no true appreciation of sea power or what control of the sea meant," and that, under an extreme form of unification, naval aviation would be absorbed by the Air Force.\(^8\) Finally, Forrestal envisioned the possibility of a carrier-based nuclear deterrent in 1945 which, under the conditions of an American atomic monopoly, would help to restore the balance of military power by offsetting predominant Russian land power in Europe and Asia.\(^9\)

A part of the above planning assumptions was reflected in the 1945 Annual Report, where the Secretary of the Navy outlined broadly the Navy's plans regarding the comparative emphasis to be given naval weapons:

Air power has the main emphasis in the immediate post-war Navy. A glance at the composition of the active fleet, \ldots\ confirms this fact. The carrier is the spearhead of the modern fleet just as the battleship was 25 years ago. But just as the battleship had to have fleet complements and auxiliaries in terms of cruisers, destroyers, submarines, and

\(^7\) Ibid., p. 169.

\(^8\) Ibid., p. 227.

\(^9\) Ibid., pp. 350-351.
patrol vessels, so the carrier--the modern cutting edge of the Navy--must have its auxiliaries: the fast battleships, the modern cruisers, the long range destroyers, the submarines, and all the vast complex of auxiliary vessels that go to constitute a truly effective Navy.\textsuperscript{10}

The Secretary went on to recommend a post-war fleet of thirteen fast carriers and thirteen escort carriers, although he did not indicate how these particular numbers were derived.\textsuperscript{11}

Identifying the Soviet Union as the threat and centering the Navy on the aircraft carrier dealt with a part of the Navy's post-war conception of their problem of having a meaningful role; the other part was to gain a capability to project sea-based air power against inland targets. At the time, the belief was widespread among the military services that a future war would be nuclear. If the Navy (and the Army) were to have an important combat role, they would have to get into the nuclear delivery business. Secretary Forrestal implied that the Navy was already thinking along these lines in 1945 when he responded to a congressional committee on the effect of the atomic bomb upon Navy programs:

\text{. . . after all, the atomic bomb is beyond any question a weapon of great destructive capabilities, and yet it has to be transported to the place where it is dropped, and we are little inclined to forget that the ability to drop it on Japan is because we had a base from which to fly planes to carry it.}\textsuperscript{12}

\textsuperscript{10}Annual Report, 1945, p. 4.

\textsuperscript{11}Ibid.

\textsuperscript{12}U.S. Cong., H.R., Hearings on the First Supplemental Appropriations Resolution Bill, 1945, p. 31.
Assistant Secretary of the Navy, Artemus Gates' statement before the same Committee was even more indicative of Navy thinking:

"Whatever form this weapon may take, there has to be some platform from which it is launched."\textsuperscript{13} For both the Army and the Navy, acquiring a nuclear delivery capability meant moving into an area which had fallen to the Air Force largely because of the size and weight of the early atomic bombs and the requirement for heavy bombers to deliver them. The Navy approached the problem on a number of fronts. Most important was the development of a new carrier bomber capable of lifting the atomic bomb, and the simultaneous development of plans for a new "supercarrier" which could handle the heavier bomber. Other developments included efforts by Navy spokesmen to build the case before the Congress and the public for carrier aviation in the post-war period, and the very significant opening of a new fleet operating area in the Mediterranean where a growing Communist threat against Greece and Turkey existed.

**Acquisition of a Carrier-Based Nuclear Delivery Capability**

Polemics and declaratory missions. One of the problems which the naval aviators faced in building their case for perpetuating and expanding carrier aviation in the post-war period was to disabuse the Congress and others of the notion that navies existed primarily for fighting other navies. Not only was this an image which

\textsuperscript{13} Ibid., p. 32.
was more appropriate for the battleship navies of the past, but it could be used as a lever for limiting the role of the contemporary and future Navy to targets on or over the sea only. The image had the additional disadvantage of not reflecting accurately the World War II experiences in the Pacific where only 1% of the carriers' total action sorties were flown against the enemy carrier forces, and where the far greater portion of the action sorties and ordnance expenditures were against land targets and land-based aviation. In response to a question of Congressman Clarence Cannon on the idea that a Navy was solely for the purpose of fighting other navies, Admiral Ernest J. King said:

... I might emphasize this as relating to the Pacific and to some degree in the Atlantic, that it was not the line of the Japanese Navy we were confronting. The Navy had many other lines of attack as was best pointed out by what took place at Okinawa. We were not bothered so much by the Japanese Navy as by the Japanese force in the islands, and the Japanese force in the air. So it is not a case of matching navies exactly that measures what a Navy does.

The endeavors to justify the principle of carrier aviation strikes against land targets inevitably alarmed the Air Force which, with some justification saw the Navy's moves to acquire an atomic

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14 See pages 62 and 63 for data on action sorties flown during the Pacific campaigns.

delivery capability as an attempt to take over a part of the "strategic" bombing role. Certainly the Navy's first post-war basic doctrinal publication, Principles and Applications of Naval Warfare, did little to allay Air Force fears, particularly when combined with the development of a new carrier-bomber and a planned new aircraft carrier. Published in 1947, it specifically included industrial centers as part of the target system with which the Navy could be concerned:

441. Objectives: The strike, raid or sweep may be employed, as appropriate, to accomplish one or more of the following objectives:

a) Destruction (attrition) of:

- Enemy naval and air forces
- Enemy shipping and other transport
- Enemy industrial potential

In addition, the document is notable for what it implied about the kind of war which the Navy envisioned in 1947, two years before the Soviets exploded their first nuclear weapon. At a time when the Army planned a long war of attrition, and the Air Force began thinking increasingly in terms of a short war of strategic bombardment with

16 "Strategic" bombing can and has had many definitions. However, what seemed to be meant in this early period was the bombing of industrial and population targets.

nuclear weapons, Navy doctrine emerged somewhere between the two:

310: Objective of War: The fundamental objective of the armed forces in war is destruction of the opposing will to resist. The will of the enemy nation to resist is usually centered in his home territory. The will of the enemy must be attacked by destruction of their means to resist and their means to exist. Hope for a successful outcome of the war must be destroyed or the enemy must be brought to consider continuation of the war as unprofitable. The outcome of war is dependent finally on ability to isolate, to occupy, or otherwise to control the territory of the enemy. 18

Through 1946 and 1947, Navy spokesmen did not publicly lay claim to strategic bombing missions. However, the Navy's carrier and aircraft development programs, post-war carrier-air doctrine, and the beginning deployment of warships to the Mediterranean in 1946 could hardly be called weak support for Air Force suspicions that the Navy was developing a strategic air force. In a speech in January 1948, retired Admiral Chester Nimitz added considerably to growing Air Force concerns when he spoke of a fleet of super carriers capable of bombing the interior of the Soviet Union. 19 However, what really set the interservice cauldron to boiling was the "Gallery memorandum" which was leaked to the press in April 1948. Admiral Daniel V. Gallery's

18 Ibid., pp. 3, 4.

memorandum read in part:

4. For the past two years our defense of the Navy has been based mainly in old familiar arguments about exercising control of the seas. Much has been said about anti-submarine warfare, naval reconnaissance, protection of shipping, and amphibious operations. It has been assumed, at least implicitly, that the next war will not be much different from the last one. This assumption is basically wrong, and if we stick to it the Navy will soon be obsolete. The next war will be a lot different from any previous one. It seems obvious that the next time our Sunday Punch will be an Atom Bomb aimed at the enemy capitals or industrial centers and that the outcome of the war will be determined by strategic bombing. The war will be won by whichever side is able to deliver the Atom Bomb to the enemy, and at the same time protect its own territory against similar delivery. I think "the time is right now for the Navy to start an aggressive campaign aimed at proving that the Navy can deliver the Atom Bomb more effectively than the Air Forces can."

Later in the year, Admiral Gallery again advocated strategic bombing for the Navy by asserting that a carrier-based strategic bombing system would be cheaper than the system of bombers and bases ashore necessary to conduct bomber offensives:

... it would be cheaper and easier for carrier-based Navy bombers to reach the heart of any continent in the world. ... You can get more airpower over a target 6000 miles away per dollar expended on naval

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airpower than you can get any other way.\textsuperscript{21}

In addition to these polemics, a news release concerning the new, heavy carrier suggested that part of the air group would be composed of "more than a score of 100,000 pound, four-engined planes." These were to be turbo-prop aircraft capable of a 1,500 to 2,000-mile combat radius, and would be available by the time the new planned carrier would be completed. The missions which reportedly were advocated for the force were set forth by Hanson W. Baldwin:\textsuperscript{22}

1) Floating base for nuclear bombers.
2) Base for large mine-laying planes.
3) Base for interceptor jet fighters (for defense of the United States).
4) Offensive fighter base for accompanying long range land-based bombers.
5) Anti-submarine warfare.

In a 1948 statement before the Congress, Secretary of Defense Forrestal said that the only assigned aviation missions, though even they were not clearly defined, were anti-submarine warfare for the Navy and strategic bombing for the Air Force.\textsuperscript{23} In an effort


to control and mitigate the dispute, Secretary of Defense James Forrestal brought the Service Chiefs together to produce the Key West Agreement in the summer of 1948. This Agreement served for a time as a sort of declaratory standard on roles and missions. At Key West the Navy agreed not to build a strategic air force, but won the right to use the atomic bomb, to engage in air superiority campaigns and to strike those land targets which could threaten sea control—presumably airfields and naval installations.²⁴

Following the Key West Agreement, how far inland the Navy could strike and what constituted strategic targets probably came to depend less on agreements struck between service-generated doctrinaire positions, and more on existing capabilities, deployments and the character of the opponent's defenses. In any case, by late 1950 the Navy had a rudimentary nuclear capability which it deployed to the Mediterranean area. By the mid-1950's, the sea-based nuclear capability had achieved considerable sophistication and the Navy was assigned "air atomic targets" to include, "submarine pens, air fields, ports, naval airbases, shipyards, petroleum, transportation, and naval forces."²⁵

During the 1948-1949 controversy with the Air Force, the Navy


had been in the position of arguing for a mission for which it did not have a capability at the time. The pressing need was to demonstrate both a capability and effectiveness in the missions for which it was striving. While the task of flying an atomic bomb from a carrier deck was not to prove too difficult, maintaining attack carrier system effectiveness for general nuclear war missions was another matter requiring frequent and costly innovations.

**Developing the carrier atomic-bomber.** In the closing months of the War, Carrier Task Force 38 had engaged in "strategic" strikes against industrial facilities in the Tokyo-Yokohama areas. However, the effectiveness of these raids was probably limited, because of the small ordnance loads of which the carrier planes were capable. Despite the marked increases in size and load-carrying capabilities of both carriers and carrier planes during the course of the war, physical size and capacities tended to limit the usefulness of carrier aviation to "tactical" or point targets. For example, while the heavy carrier aircraft had advanced to the point of carrying one 2000-pound bomb, the B-29 could, and did, carry a bomb load weighing in excess of 22,000 pounds.\(^{26}\)

Recognizing the importance of heavier bomb loadings, and the

possibilities for carrier aviation opened by the atomic bomb, the Bureau of Aeronautics in the summer of 1945 started a program aimed at providing carrier forces with aircraft capable of much larger payloads. The atomic bomb not only added impetus to the development of a larger carrier bomber but defined some of the critical design characteristics of both the airplane and a consecutively-planned, new class of carriers. The problem of delivering the atomic bomb from a carrier deck involved, in the first instance, designing an airplane capable of fitting into its bomb-bay a device 10-feet long and 2-1\(\frac{1}{2}\) feet in diameter (the dimensions of the Hiroshima bomb) and getting airborne with its approximate 9000-pound weight. The AJ aircraft was supposed to meet just such a requirement. While waiting for the AJ program to result in operational aircraft, the Navy started a program under Commander John T. Hayward to adapt the existing P2V Neptune aircraft to carry the atomic bomb. Because of the size and loaded weight of the P2V, operating doctrine called for carrier take-offs but anticipated a crash landing alongside the carriers following an atomic mission.29 Intended as a temporary capability only, the program was abandoned

27 Ibid.

28 The dimensions of the Hiroshima bomb were reported, among other places, in Time, November 13, 1964, p. 47.

when the AJ aircraft became operational and deployed with the Sixth Fleet in 1950.

Indicative of the rapid technological changes during this period was the case of the AJ aircraft. Designed around the 9-10,000 pound bombs of Hiroshima-Nagasaki types, the AJ-1 became operational just at a time when 100 KT yields were packaged in a 3000-pound bomb, and lower yields were in even smaller and lighter bombs. \(^{30}\) By February 1950, a major technological hurdle of gaining an atomic delivery capability for carrier aircraft had been overcome. The Navy succeeded in getting atomic bombs allocated for its use with the Sixth Fleet in the Mediterranean. \(^{31}\)

**Development of the Forrestal class carriers.** The companion to the Navy's new heavy attack aircraft was to have been a 65,000-ton carrier, the USS United States, as the follow on to the war-time Midway Class. Planned in the summer of 1945, it too reflected the need for a capability of handling the heavier aircraft of the future:

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\(^{30}\)Within a period of 15 years, from 1945 to 1960, nuclear weapons were improved in their yield to weight ratios by over a factor of 1000. The current yield to weight ratios are in the region of 1 to 3 KT/lb of warhead; whereas, the Hiroshima-Nagasaki weapons yielded about 2KT/1000 lbs of bomb. Source: Donald G. Brennan and Morton H. Halperin, "Policy Considerations of a Nuclear Test Ban," Arms Control, Disarmament, and National Security, Donald G. Brennan, ed. (New York: George Braziller, 1961), p. 248.

\(^{31}\)Davis, op. cit., p. 579.
For the immediate future, the Midway Class is being adapted to handle the AJ airplane and the large bombs. . . . The next step is the development of a new carrier capable of operating aircraft up to a take-off gross weight of 60,000 pounds. The basic features to be incorporated are as follows: no island, strong flight deck, increased hangar height, heavier arresting gear, higher capacity catapult, bridges—port and starboard, one primarily for ship control and the other primarily for the flag, stacks on both sides, electronic antennae either folded or mounted on small deck-elevators, three means of moving aircraft between flight and hangar decks. . . .

This ship, later to be popularly known as the "supercarrier," was cancelled in April 1949 by the Secretary of Defense, Louis Johnson. Caught up in the post-war polemics over aviation roles and missions, the Secretary gave as his reasons for the stoppage the fact that the Joint Chiefs of Staff had failed to agree on the requirement; and that the carrier represented unsatisfactory duplication of the Air Force's mission since the then existing carrier bombers would not be able to land back on the carriers. In December 1949, Secretary Louis Johnson told the Congress that the primary strategic missions belonged to the Air Force and that the Navy's missions could be accomplished by modernizing the carriers already in the Force.

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He went on to outline the missions:

The Navy must be prepared for sustained combat operations at sea to control vital ocean areas, clear the sea lanes of enemy submarines and other hostile vessels, transport our troops overseas, and insure the uninterrupted flow of supplies and materials to them, to ourselves at home, and to our allies abroad.

Naval aviation is an essential weapon in modern sea warfare. I am convinced of our continuing need for carrier aircraft, and I have directed the Navy to proceed with the necessary arrangements looking to the modernization of two additional carriers of the Essex class.34

Evidently Secretary Johnson viewed the proposed carrier as an unnecessary duplication of Air Force missions. The Navy, on the other hand, saw the carrier as vital to the continuing existence of offensive naval aviation.

The higher defense budgets which accompanied the Korean War combined with the fact that the Navy already possessed a nuclear delivery capability helped clear the way for beginning construction for the new carrier—some 26 months after its cancellation by former Secretary Louis Johnson. The carrier, renamed the Forrestal (CVA-59), had a rather different set of requirements for its justification—requirements which emphasized the benefits of endurance and survivability which the heavier vessels would possess:

1) Larger aircraft necessitate heavier decks and more parking space.

2) Fuel consumption of jet aircraft places a limit on how many can be airborne in a CAP (combat air patrol). Thus there is a requirement for rapid scramble to launch 32 fighters in 4 minutes.

3) World War II experience pointed to the need for armor on the flight deck. The Bikini tests pointed to the need for underwater protection as well.

4) The flush deck carrier will facilitate night and bad weather operations.

5) More storage capacity for ordnance and aviation fuel.35

While the planning for the Forrestal (CVA-59) originally envisioned a flush deck to make the vessel compatible with the larger and faster aircraft, before the carrier was completed in 1953, the angled-deck was introduced. This development made unnecessary the very difficult design and construction problems in a flush-deck carrier and permitted simultaneous landing and take-off operations. In addition, it increased safety and facilitated aircraft handling aboard the ship.

Development of the Sixth Fleet. In addition to changing carrier

-air doctrine and developments enhancing the offensive bombing capabilities of the carrier system, the Navy, with the strong backing of Secretary Forrestal, began deploying warships into the Mediterranean in 1946. This was the period when official Washington was becoming increasingly aware of the post-war Soviet threat to Western Europe in particular, and also to Mediterranean Europe and the Middle Eastern states. Planning was just getting underway for the Truman Doctrine (aid to Greece and Turkey) and the Marshall Plan, both of which were announced in 1947. The Soviet Government had refused to withdraw its troops from northern Iran where they had been placed to help protect the Soviet-United States southern supply lines developed during the war; Greece was seriously threatened by a Communist-backed insurgency; and the Soviets were making threatening demands on Turkey with regard to the Straits and certain Turkish-Soviet border areas. The Cold War was to grow more intense in the coming years with the coup in Czechoslovakia, the Berlin blockade in 1948, the victory of the Chinese Communists in 1949 and the Korean War in 1950. The development of the Sixth Fleet followed closely these events.

In 1946 Secretary of the Navy, James Forrestal, placed naval units into the Mediterranean to make "courtesy calls" and show the flag in the vicinity of Communist-threatened areas. The favorable reception given U. S. warships by the northern Mediterranean states
had a favorable impact in Washington where, in the summer of 1946, a re-evaluation of the intentions of the Soviet Union already was being made by the Cabinet. On September 30, 1946, Secretary Forrestal announced that the Navy would maintain a substantial and permanent force in the Mediterranean to include cruisers, destroyers and occasional aircraft carriers. By 1948, 2 aircraft carriers, the Franklin D. Roosevelt and the Kearsarge, the battleship Missouri, 7 cruisers, 18 destroyers, and 4 auxiliary vessels were operating in the Mediterranean. In June of 1948, the name of the force was changed from U. S. Naval Forces, Mediterranean to the Sixth Task Fleet and, in February 1950, when the atomic bomb was first deployed to the region, it became the Sixth Fleet.

By the late 1950's the Sixth Fleet had grown to more than fifty ships of all types (including the mobile resupply ships and their 9 or 10 screening destroyers), almost 30,000 men and about 200 aircraft.

Naval forces have been present in the Mediterranean since 1946 providing a limited, tactical-air capability three years before the

36 Millis, op. cit., p. 211.


38 Davis, op. cit., p. 579.

formation of NATO and five years before the "ring" of SAC bases was developed. The Sixth Fleet's military potential during the early Cold War years must certainly have strengthened the Navy's case for a nuclear-delivery capability. With the subsequent development of land-based air covering NATO's southern flank, and with the later introduction into the region and coverage of the region by sea and land-based missile systems, the Sixth Fleet may have become increasingly redundant. It almost certainly became increasingly vulnerable with the marked growth of the Soviet nuclear capability, along with submarine, aviation and missile delivery systems.

Carrier Effectiveness in Nuclear War

The vulnerability problem. The World War II solution to the problem of task-force formation appeared to be outmoded with the prospects of an opponent armed with atomic bombs and a large and modern submarine force. The uncertainties which had plagued the carrier force commanders in the early years of the war emerged anew in the post-war period. The difficulty for a surface Navy stemmed from the divergent requirements of defense against an aerial attack on the one hand and a submarine attack on the other. While the best defense against a submarine attacking with conventional torpedoes appeared to require both high speed and a relatively tight carrier task force formation with the destroyers close to the carrier, aerial
defense against an opponent attacking with nuclear weapons seemed to require the wide dispersal of task-force elements. The problem was recognized by the Navy in 1947 before the Soviets had demonstrated a nuclear capability. The Navy's first post-war basic doctrinal publication placed high hopes on future technological solutions to the problem:

Effects on Naval Formation and Tactics—Naval formations and tactics must meet both the challenge of the atomic bomber and new types of submarines, missiles and torpedoes. Our answer to this lies in the future, because whereas the atomic weapon appears to require extended dispositions, the new submarine, with high submerged speed, firing high speed target seeking torpedoes, appears to indicate concentration with a large number of screening vessels. Improvements in air defense or in anti-submarine warfare may resolve these diverging requirements.40

While the problem of task-force organization depends upon the particular mission, threat and the operating area, the dilemma of dispersion for air attack or concentration for submarine attack appears still to exist.

For the Sixth Fleet in particular, the problems of air defense seem to be signally difficult. In addition to a substantial inventory of aircraft capable of a "bombing radius well in excess of 1000 miles," in recent years the Soviets have deployed a large number of IRBM and MRBM missiles which can be, and presumably are,

40 United States Fleet Publication No. 1, p. 11-5.
targeted against ports and naval bases. This Soviet capability along with considerations of surprise attack have led the Navy to provide most of the peacetime logistic support for the Sixth Fleet by underway replenishment ships coming from the east coast of the United States.

The growth of the Soviet military threat through the 1950's spurred Navy efforts to develop more powerful radars, missiles, and high performance aircraft to improve air defense capabilities. Missile-equipped destroyers and cruisers began replacing the conventional anti-aircraft vessels in the carrier task forces in 1958 with the assignment of the first guided missile cruiser. The more sophisticated electronic equipment necessary to counter modern aircraft has added significantly to task-force costs--both in initial procurement and in operations and maintenance. For example, the conversion of the USS Albany, a heavy gun cruiser, to a missile ship cost about $175,000,000--four times the original cost of the ship in 1946. In addition to the cruisers, destroyers assigned to the attack carriers have been equipped with missiles or

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41 Study of Airpower, p. 1004.
42 Ibid., p. 1009.
43 United States Navy Department, Bureau of Naval Weapons, United States Naval Aviation 1910-1960, Serial 00-80P-1, Washington, 1960. A chronology prepared at the direction of the Deputy Chief of Naval Operations (Air), and the Chief of the Bureau of Naval Weapons.
designed originally as missile ships. The switch over to missile ships became so extensive in the early 1960's that some fears were being raised about the Navy's "gun gap" and its inability to defend itself from torpedo boat attacks or to support amphibious operations with ground-fire in conventional, non-nuclear conflicts.

While the cost of the task force missile ships has risen markedly, there is apparently considerable uncertainty as to how effective these ships would be in defending the task force from air attack. With one minor exception during the Korean War, Navy warships have not been brought under enemy air attack in the twenty years since World War II. Judgements on the effectiveness of task force, missile defenses are based upon non-combat tests and exercises.

The Navy is understandably sensitive to charges of increasing vulnerability by critics. In statements before Congress, Navy spokesmen counter that the carrier task force would have to be located before it could be attacked; that the mobility of the carriers, unlike fixed land-bases, makes it difficult for an opponent to pre-target with surface-to-surface missiles; and that an attacker would have to run through the combat air patrol, and defensive missile ships before he could get to the carrier. Furthermore, numerous techniques of electronic deception have been devised to mislead an attacker. Destroyers with reflectors to make them look like a carrier on an opponent's radar screen and other electronic deceptive techniques
have been developed.\textsuperscript{45} However, the ability of the Soviets to locate the carriers at sea and to overfly them has been demonstrated on several occasions in 1964. Soviet land-based bombers have intercepted aircraft carriers more than 3,000 miles from the nearest Soviet airfield.\textsuperscript{46} Their ability to find the carriers "with pin-point spotting from the Soviet Union" is reportedly due to their "'long-range' radio directional apparatus," which picks up the carrier's high frequency transmissions.\textsuperscript{47} While the carrier force was able to detect the Soviet aircraft at a distance of 200 miles and to have the combat air patrol make the intercept at 100 miles out, the ability of the Soviets to locate and track the carriers with radio-directional apparatus remains. Furthermore, the Soviets have an air-to-surface missile capability in their naval air forces. The TU-16, Badger, the very long-range TU-95, Bear, and the new supersonic Blinder all have the capability to carry air-to-surface, megaton-yield missiles, which have ranges in excess of two-hundred miles and some of which are supersonic.\textsuperscript{48} Presumably, this gives them a capability "to deliver homing missiles from ranges outside either a carrier or a

\textsuperscript{45} Massie, op. cit., p. 19.

\textsuperscript{46} Ibid., p. 17.


submarine defense system."\textsuperscript{49} In addition to the air threat, the Navy has long been concerned with the Soviet submarine threat.\textsuperscript{50} A 1964 estimate credits the Soviets with about 400 conventionally-powered and 30 nuclear-powered submarines.\textsuperscript{51} The Soviets' "strategic" or missile firing submarines and their torpedo-attack types represent a threat to the carrier forces. The anti-submarine warfare problem is many-faceted, but to detect, identify, and successfully attack the more modern submersibles present particularly difficult technological problems. Nuclear propulsion allows the submarine to have very extended submerged endurance which complicates the detection problem,\textsuperscript{52} and much greater submerged speed (estimated 25 knots in the case of the Soviet attack submarines) which facilitates submarine attack and evasion.\textsuperscript{53} Their attack submarine force is mostly of the older, conventional type—and hence more easily countered; nevertheless, the Soviets can be expected to continue improving their submarine force. Indeed, the Soviets themselves

\textsuperscript{49} Ibid., p. 271.

\textsuperscript{50} "Navy Calls Problem of Barring Undersea Rockets 'Staggering,'" \textit{The New York Times}, August 12, 1963, p. 3.


\textsuperscript{52} \textit{Study of Airpower}, p. 1008.

apparently regard the submarine as their primary anti-carrier weapon in a nuclear war. According to a 1963 volume on Soviet strategy by Marshal Sokolovskii, preference was given to submarines as the best anti-carrier weapon when nuclear torpedoes or missiles are used. The submarine, in combination with a small number of bombers equipped with nuclear, air-to-surface missiles, is treated as adequate to counter the attack carrier threat.

In addition to the Soviet threat, the Chinese are developing a nuclear capability. A 1965 article in The Wall Street Journal reports that Peking is building missile-firing, long-range submarines at Shanghai and Dairen. This threat, which is estimated to be operational by 1968, could be used against Seventh Fleet ships and bases in the Western Pacific, as well as other target systems, including cities in the United States.

Survivability of the attack carriers in a general nuclear war is doubtful—particularly if United States forces were subjected to surprise attack. In the event of a general nuclear war, the Navy feels that the attack carriers would have performed their missions if they can manage to launch their own nuclear-armed attack aircraft before being struck by enemy forces. The ability to do so is

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55 Ibid.
57Study of Airpower, p. 1005.
sufficiently uncertain, however, to be an important consideration when carriers and alternative missile systems such as Polaris and Minuteman are being compared.

**Obsolescence of the manned bomber in general nuclear war.** An important aspect of the carrier forces' effectiveness in a general nuclear war is the capability of the carrier aircraft to carry out successfully a mission against heavily-defended areas. Since World War II, rapid improvements in Soviet air defenses have placed an increasing burden on aviation planners to maintain the viability of the manned bomber, both land and sea-based. The London Institute for Strategic Studies 1964-65 estimate credits the Soviets with continued expansion and qualitative improvements in their air defense system which includes extensive early warning, three kinds of surface-to-air missiles, and over 6000 fighters. Efforts by Naval and other United States military planners to maintain the offensive capabilities of manned bombers in view of evolving Soviet defenses have led to the taking of measures and countermeasures by both sides.

In the early post-World War II period, when the Navy was developing the AJ aircraft to carry an atomic bomb, it was considered essential that the aircraft be capable of making a high altitude,

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high speed approach as the best means of penetrating enemy defenses.\textsuperscript{59} It was recognized that the limited combat radii of fighter aircraft would normally preclude their accompanying heavy attack bombers. Thus the developmental effort on strategic bombers during the 1950's was concentrated on gaining higher performance at high altitudes where the jet aircraft in particular performed more efficiently. However, the Soviets were able to take countermeasures during the same period. For example, the SA-2 surface-to-air missile is reportedly capable of striking aircraft at altitudes greater than 60,000 feet out to a slant range of about 25 nautical miles.\textsuperscript{60}

In addition to the above, the Soviets are reported to possess a 1965 fleet air arm of some 800 aircraft, of which 400 are estimated to be bombers. These are mostly TU-16 (Badgers) twin-jet bombers with a combat radius well in excess of 1500 nautical miles.\textsuperscript{61} By posing an active threat to the carrier task forces, they have the effect of forcing the carriers to remain far at sea to launch their strikes. This, in turn, cuts down on the effective radius of the carriers' attack aircraft and limits their ability to take evasive maneuvers avoiding fixed, perimeter defenses.

Faced with the increasing "hostility" of the air environment

\textsuperscript{59} Woodhull, p. 26.

\textsuperscript{60} The Military Balance 1964-65, p. 4.

\textsuperscript{61} Ibid., p. 6.
over and around the Soviet Union, aviation planners, both Navy and Air Force, began working on stand-off, air-to-surface, nuclear-tipped missiles to be used against air defense and other targets. The Hound Dog and Skybolt were the Air Force developments and the Corvus missile was the Navy's counterpart. These missiles were intended to allow the bomber either to launch its attack against the target from outside of the defense perimeter, or to attack the defenses and then to penetrate to the target. 62

More recent attempts to counter Soviet defenses are the efforts to give the existing bombers a low altitude capability in order to pass through enemy defenses below effective radar coverage. However, aircraft performance is degraded at low altitude with reduced speeds and almost tripled fuel consumption for a given distance.

The Navy has developed several carrier bombers since the AJ-1 in response to changing aviation, weapons and defense technology. Two of the more notable aircraft designed principally for special weapons delivery are the A3D Skywarrior, and the A3J Vigilante—both capable of an un-refuelled combat radius on the order of 1500 nautical miles.

One pseudonymous commentator on military affairs summarizes,

with some exaggeration perhaps, the factors contributing to the obsolescence of the bomber in general nuclear war missions:

When the smoke clears, it will turn out that the real threat to the strategic bomber comes from the remarkable advances that have taken place in air defense technology since World War II, rather than from any arbitrary decisions in the Pentagon. Both the U.S. and the USSR have developed surface-to-air and air-to-air missiles, some with nuclear warheads, which are guided to their targets by radar or by infrared energy emitted by the bombers' jet engines. These anti-aircraft missiles have remarkable accuracy and a high kill probability, at least under peacetime demonstration conditions. But by the late 1950's, it was clear that for SAC bombers to reach targets in the USSR they would first have to clear out enemy air defenses, with heavy losses.

... In the event of a thermo-nuclear war, bombers would have to fly through clouds of nuclear radiation for minutes or hours with the serious risk that this radiation would knock out electronic navigation and radar equipment upon which the bomber depends entirely to reach and bomb its targets. Radiation from our single high altitude Project Starfish nuclear shot last July knocked out the electronics in most U.S. Satellites, including Telstar.63

In addition to its penetration problems, the manned bomber has become obsolescent in a competitive, cost-effectiveness sense when compared with the growing inventory of land and sea-based missile systems. On the effectiveness side, an important consideration in a general nuclear war in particular appears to be the timing of attacks on certain types of "time urgent" targets. A general nuclear war

fought with the "counterforce" strategy seeks initially to strike enemy military forces--missile sites and airbases in particular--while retaining the capability and the option to strike population centers or other value targets if the opponent initiates a war against population centers.

Since the United States is presumably building a force capable of striking both military and "value" targets, it follows that there is an advantage in striking enemy military capabilities before they are used, if possible. Thus, there is an obvious time advantage which the missile possesses that the aircraft does not. In his fiscal 1964 posture briefing, Secretary McNamara addressed this problem in the following manner:

I think that everyone I know of in the Department of Defense, Senator Robertson, believes that the missiles will deliver warheads more effectively against time urgent targets than manned bombers. I don't think the issue is a question of whether a missile is a more effective weapon than a bomber against a time urgent target. The only issue, and it only affects a certain portion of the strategic task, is the question whether the missiles should be supplemented by manned bombers to take on particular tasks, such as mopping up after the missile attack. This is the issue. 64

The carrier force on-station in forward areas might survive

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long enough to participate in strategic missions fairly early in the course of a general nuclear war, assuming that the force would not be overwhelmed by a surprise attack. Following the outbreak of a nuclear war, the 1956 version of Navy plans apparently called for the remaining carriers, the Second Fleet in the Western Atlantic and the First Fleet in the Eastern Pacific to "go into action immediately against enemy forces wherever they may be. If there are submarines or if there are enemy aircraft approaching our territory, we would go into action immediately and fight our way over to the source of the trouble."65

On the cost side only, manned bombers and particularly the carrier systems, do not compare favorably with missile systems. According to Secretary McNamara, $1.1 billion will purchase and operate for five years (five-year system costs) the following weapons-systems:

1 wing of B-52's with their associated tankers or,
250 Minuteman missiles in silos or,
6 Polaris submarines.66

These costs compare with the approximate $1 billion that a single carrier task group (1 CVA and air wing, 1 DLG, 3 DDG's and auxiliary

65 Study of Airpower, p. 1005.

ships) costs for five years. 67

High cost of the carriers when compared with missile systems; the uncertainty surrounding survivability of the carrier in a general nuclear war; and the capability of missiles to perform better than carriers and other aviation systems against time urgent targets in particular appear to have been the major considera-
tions behind the decision to remove the carriers from their strategic alert retaliatory assignments in Fiscal 1966. 68 The Air Force's strategic bombers (mostly B-52's and a few B-58's) will retain their general nuclear war assignments in the coming years. However, they too, presumably will be phased out of this class of missions to be replaced by missile systems. The last B-52 production line was shut down in 1962. 69

Apparently the carriers will continue to possess a nuclear capability as a back-up in general nuclear war and for possible use in limited wars. 70 However, it is not at all clear that carrier

67 This figure for the carrier is based on roughly $200 million annual system costs which includes $800 million for initial procure-
ment of the warships and auxiliaries; $800 million for initial procurement costs amortized over 20 years; $150 million air wing procurement costs amortized over 5 years; and about $130 million annual operating and maintenance costs for ships and air


70 Of a number of works on the Navy in tactical nuclear war one of the most explicit arguments advancing carrier aviation in this connection is Commander Malcolm W. Cagle, USN, "A Philosophy for Naval Atomic Warfare," United States Naval Institute Proceedings, March 1957.
requirements should be based upon possible limited war, nuclear
delivery missions since missiles with nuclear warheads might be able
to do the same job much cheaper. Depending upon how they are used,
missiles can be either tactical or strategic weapons, in the same
way as a manned aviation system.

Conclusions

Following World War II, it appeared to the Navy that if the
carrier task forces were to survive as a major offensive weapon,
the Navy would have to get into the strategic bombing business.
The acquisition of an atomic delivery capability along with the
assignment of air atomic targets was realized in about 1950.

At the same time the Navy was developing its capability to
air-deliver atomic bombs, Secretary of the Navy James Forrestal,
with the backing of the Truman Administration, began deploying naval
forces into the Mediterranean in 1946. The Navy thus opened a new
fleet deployment region which had the potential of allowing carrier
air to be brought within range of significant targets in the Soviet
Union and Eastern Europe.

In the first few years the carriers were deployed to the
Mediterranean, sea-based aviation enjoyed considerable uniqueness by
virtue of the geography of the region. However, with the develop-
ment of the United States alliance structure and overseas air-bases,
the carriers began sharing that particular region of the world with
land-based aviation. In addition, by the early 1960's the changing
technology of warfare permitted land and sea-based missile systems presumably to take over the carriers' general nuclear war targets. 71

For the Navy's carrier aviation, the prospective loss of a principal role in general nuclear war signals the closing of a class of missions towards which they have devoted a great deal of effort and resources since 1945. The progressive technological obsolescence of the bomber is not without ironies for both the Navy and the Air Force, who appear to be faced with overwhelming competition from Polaris and Minuteman. However, competition between the two military services continues, particularly for the missions and systems for conventional limited wars.

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CHAPTER V

ATTACK CARRIER AVIATION AND LIMITED WAR

The development and deployment of Polaris and Minuteman missile systems in the mid-1960's have had the effect of releasing those attack carriers assigned general nuclear war missions for deployment in limited war missions. Among other things, this means that the Navy, in matters of planning and deployment for the carrier force, will be concerned principally with those conflicts at the lower end of the conflict spectrum. The change has implications for operating areas, tactics, ordnance loads, and air wing composition. More importantly for the Navy and the nation, however, the change means that the fifteen attack carriers will be in competition for defense resources and missions with the Tactical Air Command's planned 24 fighter wings.¹

From the point of view of the nation's decision-makers on defense matters, the problem posed by two tactical air forces--one sea-based and the other land-based--is one of finding a basis for

¹ The two tactical air forces hold these principal missions in common: (1) Interdiction of enemy supply lines; (2) Air superiority over battle areas; (3) Air reconnaissance; (4) Close air support.
deciding how to allocate defense resources between the two limited-war forces. Looking ahead to the early 1970's at least, this problem does not seem to imply one tactical air force to the exclusion of the other; rather, it implies the question of how many carrier wings and how many land-based wings are needed for the nation's security. Given the high annual system costs for the nation's land and sea-based tactical aviation, it is likely that competition between the Services for missions and resources will continue; and that neither the Navy's nor the Air Force's desires for resources will be met simultaneously.2

The problem of deciding on the "mix" of the two systems involves an understanding of their comparative effectiveness under a wide range of limited-war circumstances. Accordingly, it is the objective of this chapter to examine comparatively some of the principal features of effectiveness of the two systems. Giving particular attention to the attack carrier system and using relevant historical data

2Shifts in the relative sizes of TAC and the CVA force are apparently already in official plans. Secretary McNamara announced before the Senate's Defense Appropriations Subcommittee conducting hearings for fiscal 1965, that there would be an increase in TAC wings from the 21 in 1964 to 24 in the near future. At the same time he indicated a possible reduction in the 15 CVA force, though an official figure for the future size or when the reduction would take place was not announced at that time. Later, unofficial information held that the carrier force would be reduced to 12 or 13 sometime after 1970. See, Senate Hearings, Department of Defense Appropriations, 1965, pp. 125, 138; Hanson W. Baldwin, "McNamara Faces Budget Decisions," New York Times, October 18, 1963, p. 2; Jack Raymond, "Attack Carriers Will be Retained," New York Times, December 4, 1963, p. 6.
where available, sea and land-based aviation are compared in terms of the following:

1) Political attributes
2) System costs
3) Operational and vulnerability differences.

**Tactical Aviation Systems—Some Political Considerations**

Different advantages and costs are associated with land-based and sea-based tactical aviation systems as a result of international political considerations. The acquisition, retention, and freedom to use foreign-owned, overseas bases, and the problem of overflight rights are of particular importance in this connection.

Both the Navy and the Air Force rely on overseas bases to maintain forward, tactical aviation. However, each overseas base on foreign territory has certain political limitations and prescriptions for the use of that base which are agreed to by both the host-state and the tenant-state. These limitations arise from the context of

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3 There is a growing body of literature dealing, from a number of perspectives and with varying degrees of specificity, with the problem of overseas base rights, alliance problems and diverging national interests. The four which have been drawn on more heavily than others for the purpose of this discussion are: George Stambuck, *American Military Forces Abroad* (Columbus: Ohio State University Press, 1963); George E. Taylor, *The Philippines and the United States; Problems of Partnership* (New York: Frederick A. Praeger, 1964); Donald E. Nuechterlein, *Iceland Reluctant Ally* (Ithaca, New York: Cornell University Press, 1961); Arthur P. Whitaker, *Spain and Defense of the West* (New York: Harper, 1961).
differing or coextensive national interests and are usually anticipated and embodied in the base rights agreements and protocols; or they can be imposed by the host-state on an ad hoc basis during a crisis. As a consequence, military actions from a foreign base or the threat of military actions which are not in the interests of the host-state, risk constraints eroding the usefulness of the base or could result in the loss of the base.

While the problem of politically-imposed constraints on military operations from foreign territory would appear to be as much a Navy problem as an Air Force problem, the Navy argues that it has "flexibility" and considerable freedom from bases.\(^4\) One reason for this is that a carrier system can operate at great distances from major bases through the use of mobile logistic support shipping and underway replenishment ships, though the costs increase with the distance from the base.\(^5\) Another, and less obvious, reason is that a foreign host's political sensitivities may be lower in geographically-limited conflicts where the base is in support of naval combat operations rather than land combat operations. The distinction made is between indirect support and direct support of combat operations where the relationship between the host-state's facilities and the activities


\(^5\) See pages 176-179 for a discussion of the costs associated with carrier operations distant from support basing.
in a combat area becomes far more obvious in the latter case. Thus, for political reasons peculiar to the Philippines, as a case in point, the Filipino Government may be willing to provide naval logistic support facilities for conducting combat operations against another Southeast Asian country, but would be unwilling or reluctant to allow land-based combat aircraft to make direct combat sorties from Philippine-located land bases.  

The only bases which the United States has actually "lost" due to political pressures are those in North Africa and specifically the Air Force bases in Morocco. Of course, the threat of further losses is an ever-present fact of diplomatic life, although the threat may or may not become a reality. The Navy, however, sees base erosion as a problem which may be less unfavorable to the Navy than it is to the Air Force. Admiral David L. McDonald seemed to make this point before the Congress in 1965:

> U.S. airbases ashore on foreign soil exist at the pleasure of the host country. Unfortunately, in recent years a number of host countries have terminated or withdrawn our base rights. In this situation, it is fortunate that our mobile air bases at sea are, in effect, U.S. soil. They are subject only to orders by our President. Aircraft carriers, in these circumstances become increasingly important to us. That has been the case in the past 5 years or more; it may be expected that this trend will continue, and that carriers will have increasing importance in the years ahead.  

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6 Taylor, op. cit., p. 239.

Secretary of the Navy, Paul Nitze, sees the carrier force as insurance against the loss of overseas bases.

As you are aware, the inventory of U.S. air bases overseas has been declining, and the future availability of such bases is subject to political uncertainties. Our carrier force provides insurance against reductions in our overseas airbase structure, and the significant contribution which this force makes to the Nation's tactical aviation posture continues to grow in importance as well as in military capability.8

The idea of "insurance" can be taken in at least two ways. One is that the carriers provide an alternative form of tactical airpower after the loss of a base. The other is that the mere existence of an alternative form of airpower may serve to strengthen diplomacy for retention of a politically-threatened base.

There is another point and one that is closely related to the above argument for a sea-based capability. Situations may arise where it is desirable for the United States to conduct a military operation entirely independently of an ally—even though land-based facilities may be available. An example of this was the use of the carriers in what was apparently the first air strike against North Vietnam in August 1964. Not only did this strike indicate that the United States would retaliate when attacked, but that it had the

8 Ibid., p. 847.
capability to do so independently of South Vietnamese facilities.\textsuperscript{9}

An independent capability not only avoids placing third party states in a possibly difficult diplomatic situation, but the unilateral application of force can be used to communicate very particular messages to an opponent. In the "gamesmanship" of limited wars, it may be desirable to have the communication channels as well as the content of the message as unambiguous as possible, assuming the opponent can distinguish between sea-based and land-based air.

Another difficult political problem which bears on comparative tactical aviation systems is the problem of moving forces through, around, or over flying another's sovereign territory. In a world which has seen the number of independent nation-states more than double between 1945 and 1964, transit-right problems for military forces seem likely to increase. Most of the major powers have encountered transit and over-flight difficulties since World War II--including apparently the Soviet Union in their attempts to get material across China into North Vietnam in April 1965.\textsuperscript{10}


\textsuperscript{10}The British have had difficulty in moving troops and supplies east of Suez on a number of occasions since 1957 when the Nasser-led Arab states denied both over-flight rights and Suez transit. The United States has experienced problems in obtaining over-flight rights in a number of instances, including the Lebanon crisis in 1958 and again in 1964 during the when certain NATO and West African facilities were denied to cargo aircraft involved in the Congo operation. Lt. Col. DeWitt C. Armstrong, III, "The Changing Strategy of British Bases," (unpublished Ph.D. thesis, Princeton University, December 1959); "Nasser's Strength," \textit{Foreign Report} (published by the Economist Newspaper Limited), London, July 15, 1965, p. 6.
attack carrier provides an alternative which is capable in most cases of by-passing political and geographic barriers to the movement of forces in the Nation's interests.

In the 1958 Lebanon crisis, for example, the two carriers with the Sixth Fleet were able to move to the Lebanese coast and provide tactical air cover for the Marines within twelve hours of the issuance of the President's order. From July 16 until September 5, the carriers maintained the responsibility for air cover. During the same period, the Air Force was experiencing difficulty in getting land-based, tactical aviation stationed in Western Europe to bases in the vicinity of Lebanon because of the diplomatic problems which arose concerning over-flight and landing rights. 11 Chief of Naval Operations, Admiral David L. McDonald, specifically referred to the Lebanon crisis in connection with rapid carrier movements:

Top level decisions to move naval forces prior to commitment have not been required because they were operating in international waters. Permission from a foreign country has never been necessary to proceed to the scene of a crisis, whereas U.S. land based planes en route to Lebanon and the Congo required overflight clearances, sometimes a time consuming requirement. 12

At least a partial solution to the problem of over-flight rights

12 Ibid.
for the land-based system may come about with the F-111 (TFX) aircraft which has a very long ferrying range. Provided it has base facilities in the region of the objective, the F-111 could fly around sovereign states hostile to over-flight of their territory.

Another Navy argument for the carrier system is a postulated requirement for force coverage of Latin America, the African littorals and the Indian Ocean. This region is sometimes described in various naval periodicals as the Afro-Asian Ocean power vacuum. These Southern Hemispheric regions may not be sufficiently threatened to justify establishing and maintaining an overseas base, yet may require, on occasion, the threat of or use of, tactical air power for short periods to protect American interests. The Navy argues that a sea-based, mobile system has an advantage over a land-based system in these regions because it would not violate the political sensitivities of the new nation-states the way a land-based system might. Furthermore, the argument goes, a mobile system could move to

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the crisis area, and not be burdened with the problem of trying to locate a base in advance of a crisis, or to negotiate base rights on an ad hoc basis with each crisis, as would be required for a land-based system.

To summarize, the two tactical aviation systems have different political implications and uses as instruments of foreign policy. In regions of high U.S. security interests such as Western Europe where land bases are available, the bases, along with the forces, are a physical manifestation of the United States' commitment to the defense of the region. At the same time, however, forces based on foreign-owned territory are likely to be constrained to operations which are mutually acceptable to the host-state and the tenant-state. In some situation sea-based aviation systems seem better suited, from a political point of view, for carrying out those tasks which are in the unilateral interests of the United States, than land-based tactical aviation systems. Finally, in a world which is increasingly fragmented into nation-states anxious to demonstrate sovereignty over their sea, air and land areas, the carrier system provides an important alternative for moving airpower in the protection of United States interests.

**Comparative Cost Categories: Land and Sea-Based Tactical Aviation**

One of the important considerations in arriving at a judgment of the "mix" between land and sea-based aviation systems is their comparative costs. Apparently the Navy has been taking a close look at the
problem, judging from a 1965 statement before the Congress by the Chief of Naval Operations, Admiral David L. McDonald:

We in the Navy have made an exhaustive study on the land-based/sea-based mix within the overall needed requirement total. We have looked particularly at the relative vulnerability and costs of each system. Our conclusion is that when both forces are used in a reasonable way, the costs to achieve a given capability are of the same general order of magnitude.\(^{14}\)

While details of the Navy study were not released, it is apparent that carrier costs can vary greatly depending upon the situation and the location of the deployment. Detailed breakdowns of system costs are not generally available; however, the following scheme establishes some of the major elements to be costed and, using available data, discusses some of the comparative cost considerations. It is assumed that two wings, one sea-based and one land-based, both nearly equivalent forces in numbers of attack capable aircraft, are committed in a forward overseas deployment.

### MAJOR ELEMENTS IN ONE FORWARD-DEPLOYED SEA AND LAND-BASED TACTICAL AVIATION WING

<table>
<thead>
<tr>
<th>Category</th>
<th>Sea-Based System</th>
<th>Land-Based System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>2 or more aircraft carriers and 1 or more advanced naval bases</td>
<td>2 or more overseas land bases</td>
</tr>
<tr>
<td>Base Defense</td>
<td>4 destroyers per aircraft carrier</td>
<td>Anti-aircraft missile units as required</td>
</tr>
<tr>
<td></td>
<td>Defensive carrier aircraft</td>
<td>Combat infantry as required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shelters for aircraft as required</td>
</tr>
<tr>
<td>Aviation Systems</td>
<td>2 or more carrier wings</td>
<td>TAC wing</td>
</tr>
<tr>
<td>Logistic Support</td>
<td>Underway replenishment groups</td>
<td>Logistic shipping (MSTS)</td>
</tr>
<tr>
<td></td>
<td>Mobile support groups</td>
<td>Airlift and Tankers as required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Port and Base Infrastructure.</td>
</tr>
</tbody>
</table>

**Sea base costs.** From the point of view of comparative system costs, one of the most unfavorable features of the sea-based system is the requirement for two or more carrier task groups (carriers and screening vessels) to maintain one carrier task group continually on station. The exact number required is a function of the distance from the supporting naval base to the operating area and the endurance of the carriers.\(^{15}\) Long, sustained deployments without return to a major support base are, in fact, operational attributes which the Navy can purchase at an

\(^{15}\) This point is developed in the section on the analysis of the size of the carrier force. See Table XV.
increasing price the more distant the operation gets from a base. As a consequence, in order to conduct carrier operations distant from the United States, the Navy tends to rely on overseas bases and facilities wherever possible for purposes of resupply, repairs and crew rest.

Because of the relationships between distance and force back-up requirements, the Navy probably would not use carriers in prolonged distant deployments without basing facilities in the operating region. In such a case, bases become much more attractive economically. For example, a 1960 estimate of the naval base at Rota, Spain, placed its construction costs at $120 million, which is approximately one tenth of the 5-year system costs of a single carrier task group. For this reason, a base becomes a very attractive trade-off when its location permits a reduction in the number of forces required as back-up.

For the purpose of this cost comparison of sea and land-based systems, two aircraft carriers and some portion of the costs of one naval base are considered necessary to maintain one carrier wing on a forward station. Assuming that one half the resources of a $120 million naval base can be allocated to one carrier task group and adding the costs of two Forrestal class carriers at $280 million each,

16 See Table XVII.

17 Whitaker, op. cit., p. 65.
the basing costs for the two-carrier system totals $620 million.\textsuperscript{18}

**Land-base costs.** While one aircraft carrier accommodates one carrier wing (about 85 aircraft of mixed types on board), a Tactical Air Force Wing, consisting of 75 combat aircraft, will frequently be dispersed to two or more airfields.\textsuperscript{19} The construction costs of an airfield can vary considerably depending upon the permanency, threat, and requirements for the installation. Judging from the $100 million reported costs of the Strategic Air Command base at Torrejon, Spain, TAC base costs would probably not exceed $100 million and might very well run as low as $10 or $20 million.\textsuperscript{20} For the purpose of this comparison, two land bases are assumed to cost $20 million each for a total of $40 million.

Without considering any of the other elements for the moment, the difference in basing costs between the sea-based and land-based systems is quite substantial—$620 million versus $40 million in this example.


\textsuperscript{19}Using April 1965 Air Force deployments in South Vietnam as an example, the equivalent of 2 TAC fighter bomber wings were dispersed and operating from three airfields. See, "The Vietnam War, Part I," Aviation Week and Space Technology, April 26, 1965, p. 31. A TAC wing's combat aircraft varies in number. The assumption here is that it consists of three squadrons of 25 aircraft each.

\textsuperscript{20}Whitaker, op. cit., p. 63.
Comparative defense costs. One of the frequent charges levied against the carrier system is that it costs more to defend than does equivalent land-based air. However, it is not at all clear that this is in fact the case. An advanced land base may cost a great deal to defend, or very little to defend, depending upon the nature of the conflict and the proximity of the threat. At the Da Nang and Ton Son Nhut airbases in Vietnam, for example, base defense costs have to be reckoned in terms of Hawk missile battalions, some portion of Marine and Airborne brigades along with their backup, rotational units in the United States or the Western Pacific. Another consideration is the cost of possible aircraft shelters or hardening facilities to provide a modicum of protection from guerrilla-type attacks on the ground or possible air attacks.\(^{21}\)

For the sea-based system the problem is again the requirement for backup forces to maintain one on continuous deployment. Typically, four destroyer types are assigned as permanent screen for one aircraft carrier providing both submarine and air defenses. With the postulated requirement for two carrier task groups to keep one on station, eight destroyers would have to be costed against the system. Depending upon the type, destroyer costs can range from $35 million for a destroyer

\(^{21}\)According to testimony by Secretary of Defense, Robert McNamara, the estimated cost of a proposed land-based aircraft shelter for protection against conventional weapons is $100,000 per aircraft. U.S. Cong., Senate, Department of Defense Appropriation, 1965, Part 1, p. 107.
escort up to $75 million for the guided missile frigates. In addition, a portion of the carrier's air wing is used in flying purely task group defensive missions. A measure of the defensive sortie effort is available from World War II and Korean War data. The summary data indicate that 23% of the total combat sorties flown from the carriers in each of these wars were defensive. This contrasts with 3% base defensive sorties flown by TAC air in the Korean War. Finally, the carriers also use overseas bases which might have to be defended from sabotage or guerrilla attacks. While most naval bases tend to be intermediate with respect to location between the United States and an operational area and thus do not normally border a conflict area, they nevertheless could accrue substantial defensive costs, such as has been the experience at Guantanamo Bay, Cuba, and could be the case if a mainland naval base is established in Southeast Asia.

Comparative aviation costs. Depending upon whether it is a fighter or a bomber and upon the avionics equipment, modern tactical, combat, jet aircraft cost $1 to $8 million, regardless of whether they

22 For World War II data see: WSEG No. 4, p. 57. For the Korean War data see: Chief of Naval Operations, Combat Activity of Naval Aircraft (Korean War) (Declassified OPNAV INST 5500.30 dated July 17, 1964), p. 71.

are land-based or sea-based aircraft.\textsuperscript{24} However, because of the need for two or more complete carrier task groups to maintain one continuously on station, the sea-based air-wing is likely to cost twice as much as a land-based air-wing. Other cost differences stem from the different numbers of aircraft in the two wings (a carrier wing has more) and the different types of aircraft.

A carrier wing has a broader range of capability than does the unsupported TAC wing. In addition to its attack and fighter aircraft, the carrier wing has photo-reconnaissance aircraft, electronic-countermeasures aircraft, early-warning aircraft, and some heavy-attack aircraft capable of being configured and often used as aerial refueling tankers. A TAC wing could be expected to add these capabilities by drawing from other units the more specialized types as needed. Another additional cost to a TAC wing would be the aerial tankers necessary to move a wing of aircraft from the United States to deployment areas.

\textbf{Comparative logistic support.} A carrier task group requires a number of auxiliary supply ships to carry ammunition, aviation fuel, black oil, food and dry stores. Typically, underway replenishment ships consisting of an oiler, an ammunition ship and a cargo ship

\textsuperscript{24} The cost of the Navy's A-6, a new, all-weather, jet attack aircraft is reported to be $4 million. This contrasts markedly with the carrier-based, propeller driven, A-1 attack aircraft at $285,000 each. See: Hanson W. Baldwin, "Vietnam Problem: A Plane Shortage," \textit{The New York Times}, April 24, 1965, p.1.
will be continually moving between the carrier task group and storage area for supplies. In addition, the logistics shipping often will be accompanied by screening destroyers. The naval logistics ships used in underway replenishment will tend to be more expensive than the more conventional cargo and tanker types used in point-to-point shipping because of the requirement for high transit speed and special off-loading gear and equipment for transferring materiel at sea.

A land-based system in a peacetime deployment will tend to make use of Military Sea Transport Shipping and commercial shipping for its resupply. However, if the sea lanes or the approaches to the operating area are threatened, then essentially the same defensive destroyer escorts would have to be used as the sea-based system uses. With the exception of black oil for the naval ships, the land-based system would require approximately the same consumable supplies as does the sea-based system.

Depending upon TAC deployment plans, the locale, and the urgency of the situation, a very significant variable and added expense to the land-based system would be the cost of the necessary transport/cargo aircraft to move a TAC wing. These aircraft probably would add considerably to the cost of a TAC wing. If the land-based aviation system were already deployed as in Western Europe, then airlift requirements would be much less than if it were a CONUS-based system for deployment to regions as needed. Finally, and in addition to
shipping and airlift costs, the land-based system's infrastructure--the pipeline and road nets necessary to move materiel, fuel, etc., from the port of entry to the bases--would have to be considered in a comparison.

Some limited inferences can be drawn from the foregoing. First, the sea-based system pays a price for its mobility, which makes the base far more expensive to procure than an equivalent land base. Secondly, it is not necessarily true that a sea-based system is always more expensive to defend or supply than is a land-based system. The relative costs would appear to be very sensitive to whether it is a peacetime deployment or a wartime deployment being compared. Further, it would depend upon the type and locale of the conflict.

Thirdly, a sea-based system does not appear to gain a relative cost advantage over an equivalent land-based system the more distant an operating area is from the United States. Indeed, without intermediate or forward naval bases, the relative costs may be increasingly unfavorable for the sea-based system the further away the operating area is from the base. Finally, the sea-based system's costs are due in large part to the fact that it is a system designed, supplied and deployed in a peacetime environment for wartime use to a greater extent than a comparable land-based system. This is to say that the carrier system has on its routine peacetime deployments more of the integral, systemic components that it would actually use in wartime than does the TAC system. If this is the case, then one of the
important reasons for the carrier system is its contribution to transitional periods from peace to conflict and transitions in a tactical combat situation where rapid movement may make land bases untenable or where amphibious operations need to be conducted. This point of having a system well adapted to transitional situations will be examined in more detail in the following section on the comparative operational attributes of the two systems.

**Some Comparative Operational Characteristics in Limited War**

Despite the fact that the Navy built its attack carrier force with nuclear war as a preeminent consideration, the carriers in fact have been used to fight limited wars and to respond to limited crises. Since World War II, carriers have been employed in at least twelve international crises of varying degrees of violence.\(^{25}\) An examination of some of these past employments should help to clarify the capabilities of the system in limited wars.

**Rapid response capability.** One of the Navy's principal arguments for the carrier system concerns their ability to move airpower rapidly to a crisis area. Two of the most frequently cited cases are the Lebanon crisis in 1958 and the crises in the Straits of Taiwan in 1955 and again in 1958. It was to these examples and the limited war role of the carriers in forward deployments that Secretary of Defense, Neil

\(^{25}\) See Figure 3 on page 143.
FIGURE 3

INTERNATIONAL CRISIS INVOLVING THE MOVEMENT
OF AIRCRAFT CARRIERS, 1950 - 1965*

<table>
<thead>
<tr>
<th>Date</th>
<th>Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 1950</td>
<td>Korea War</td>
</tr>
<tr>
<td>February 1955</td>
<td>Evacuation of Tachen Islands</td>
</tr>
<tr>
<td>October 1956</td>
<td>Suez Crisis</td>
</tr>
<tr>
<td>July-August 1958</td>
<td>Lebanon Crisis</td>
</tr>
<tr>
<td>August-December 1958</td>
<td>Quemoy-Matsu Crisis</td>
</tr>
<tr>
<td>July 1960</td>
<td>Congo Crisis</td>
</tr>
<tr>
<td>November 1960</td>
<td>Guatemala-Nicaragua Crisis</td>
</tr>
<tr>
<td>February-April 1961</td>
<td>Laos Crisis</td>
</tr>
<tr>
<td>January 1961</td>
<td>Dominican Republic</td>
</tr>
<tr>
<td>May 1962</td>
<td>Laos Crisis</td>
</tr>
<tr>
<td>October-December 1962</td>
<td>Cuban Missile Crisis</td>
</tr>
<tr>
<td>August 1964-?</td>
<td>Vietnam War</td>
</tr>
</tbody>
</table>

McElroy specifically referred in requesting funds for a new carrier for the Congress in 1959:

We put the carrier in only after a great deal of soul searching, not only in our own Department but in other parts of the Executive branch. This decision was made at the very highest level of Government and after the most thorough examination. So I can say the Administration feels this carrier is an integral part of the defense program. The importance of the carrier as a means of projecting our military power for a limited war situation into the peripheral areas of the world was very clearly demonstrated in both Lebanon and Taiwan. When I say peripheral I refer principally to those areas which are reachable best by sea.\textsuperscript{26}

The ability of the carriers to respond rapidly in these cases was due to their forward deployments in the region, to the lack of restricted waterways and sovereignty barriers, and to the fact that they were unopposed. The lack of opposition was an important factor which may not be present in future cases and could affect rapid responsiveness as it did in the case of Korea.

In the Korean War, nine days elapsed from the time of the North Korean attack until the first strikes were flown against the North Koreans on the 3rd and 4th of July from the carrier, Valley Forge. For the Navy, which is building its case for the carrier in limited war in large part on its rapid responsiveness, this was not a

particularly good example for a task force which was only two days steaming distance from North Korea on June 25. The immediate reasons for the slow response, however, were in part beyond full Navy control and rested on decisions which had to be made between the Administration in Washington and General MacArthur's Headquarters in Tokyo. These decisional problems which helped delay the commitment of the carrier were due to questions concerning the significance of Korea and the possibility of larger Soviet intentions. The conflict was only hours old when the Seventh Fleet's Commanding Officer received the following communication from Secretary of State, Dean Acheson:

Possible that Korea is only first of a series of coordinated actions on part of Soviets. Maintain utmost vigilance and report immediately any positive or negative information. . . . 27

The uncertainties which troubled Washington as to Soviet and Chinese intentions had their direct corollaries bearing on the carrier vulnerability problem as viewed by the Admirals on the spot in the Western Pacific. The historian, James A. Field, describes some of the problems in this connection which troubled Admiral Turner Joy with Task Force 77:

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27 CDR. Malcolm W. Cagle and CDR. Frank A. Manson, The Sea War in Korea (Annapolis: United States Naval Institute, 1957), p. 34.
What of the northern neighbor, whose airfields at Vladivostok and Port Arthur flanked the Korean peninsula and were less than two hours flying time from Japan? What of the estimated four-score submarines based in the Vladivostok area? For the air threat which had caused Admiral Joy to divert the Seventh Fleet to Buckner Bay (a diversion from the Taiwan Straits to Okinawa rather than go directly to Korea), FEAF's fighter strength provided some counter, but the submarine sightings, ranging from Okinawa to the Sea of Japan, and while most were doubtless in error they at least posed serious questions. . . . What were the intentions of the Communist Chinese? In Korea their capabilities could for the moment be largely disregarded, but ComNavFE had been instructed to use the Seventh Fleet to neutralize Formosa, and to prevent attack in either direction across Formosa Strait. . . .

The point to be made in connection with the issue of rapid responsiveness is that uncertainties as to weapons, belligerents, and the "limits" of the war did in fact impede carrier employment early in the Korean conflict. Furthermore, it seems likely that future limited wars, particularly those involving some elements of surprise, will also be surrounded by uncertainties as to who will fight and with what weapons. While the Navy of the 1960's has more carriers in the force and more deployed forward than the Navy of the early 1950's, there is no reason to believe that a task-force


29 This is not to deny that there were other reasons for lapse of nine days. Certainly the fact that only one carrier was in WestPac, and that underway replenishment and mobile support were lacking, all contributed to a reluctance to risk unnecessarily the carrier when it might be used more advantageously at a later time.
commander will be any less cautious than was Admiral Turner Joy in committing carriers very early to a conflict surrounded by great political and military uncertainty. Navy doctrine as yet says nothing about treating the attack carrier as expendable in a limited war.\textsuperscript{30}

The Air Force is working to improve its response time. In an effort to bolster its capability to provide tactical airpower rapidly beyond the effective combat radius of existing U.S. airfields, the Air Force has hopes for the F-111 fighter/bomber. This long-range aircraft could provide a rapid response capability if an airbase in the vicinity of military operations were available and if the necessary ordnance and fuel for combat consumption could be provided. An air wing--sea-based or land-based--requires an enormous logistics effort in fuel and ordnance at sustained combat consumption rates.\textsuperscript{31} The problem for the land-based system in a rapid

\textsuperscript{30}By way of contrast, Naval aviators tend to regard the carrier as expendable in a general nuclear war. If all-out war develops, the Navy's main concern is to get the nuclear strike aircraft launched on their general war missions before the carrier gets hit. See p. 119 of this thesis and footnote 65.

\textsuperscript{31}A sense of the logistics effort required to supply jet combat aircraft can be conveyed by examining the F4C fighter/bomber which has a payload in excess of 20,000 pounds (divided, say, at 8,000 pounds of ordnance and 12,000 pounds of fuel). If there were a requirement for a wing of 75 F4C's to fly a modest 50 combat sorties per day for 60 days, the daily consumption would amount to 200 tons of ordnance and 300 tons of fuel. Over a 60-day period 30,000 tons of both ordnance and fuel would have to be supplied. Jane's All the World's Aircraft, 1962-63 (New York: McGraw Hill, 1964), p. 243.
deployment may not be the speed of deployment, but supplies of fuel, ordnance and spare parts after the first day or two of operations. This could be a significant problem in Asia or other less developed regions.

Another possible alternative to rapid responsiveness by tactical aircraft in remote areas is the Marine Corps development of a SATS field (short airfield for tactical support). This is a 4,000 foot, aluminum-matting field; in 1964 it was tested in air amphibious exercise. At the end of six days of construction, 43 sorties were flown from the SATS field. The difficulty with the SATS field is the probable requirement for tactical air before and during the construction of the field. The problem with the Air Force's rapid deployment concept is: (1) Airfield availability and (2) The logistics for follow-on sorties once initial strikes had exhausted supplies. Neither the SATS development nor the rapid deployment of Air Force fighter-bombers appear to be completely equivalent to the sea-based system in a rapid response situation. Rather the three systems appear to be supplementary designed for different situations or times in the evolution of a campaign.

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Availability of tactical airpower in transitional situations.

Another operational attribute of the carrier system which stems from its mobility and sea-keeping qualities is the capability to provide air power in support of land campaigns which for any of a number of reasons may be beyond the effective operational radius of tactical, land-based aircraft. This was an important use of the carrier during the World War II amphibious operations in the Pacific. It was again demonstrated in the landings at Inchon, Korea, the amphibious withdrawals at Hungnam, Korea in 1950, and the Tachen Island evacuation in February 1955. In Korea, the rapid advances by the North Korean forces to the Pusan perimeter forced the withdrawal of all Air Force fighter-bombers to Japanese bases. This, in turn, reduced the payloads and loiter time of the Air Force's F-80's for close support missions because of the aircraft's limited range capabilities. 34 During this time, for limited periods, the single United States aircraft carrier deployed in the Western Pacific was operating off the coast of Korea. 35 Later, in the December 1950 amphibious withdrawal at Hungnam, Korea, as a result of the Chinese entry into the Korean War, the Air Force was again forced out of

34 Field, op. cit., pp. 60-62.

35 Ibid., Field makes the point that carrier aviation effectiveness in close air support at this time was limited. Both the Air Force and the Navy had not developed sufficient doctrine, communications equipment and procedures for providing effective close air support.
its forward operating bases and fell back on bases south of Taegu and in Japan. During this same period, carriers continued to operate off both coasts and provided all the air cover at Hungnam during the latter stages of the withdrawal.\(^{36}\)

<table>
<thead>
<tr>
<th>Date</th>
<th>Land-Based Aircraft at Hungnam</th>
<th>Sea-Based Aircraft at Hungnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 December</td>
<td>96</td>
<td>184</td>
</tr>
<tr>
<td>10 December</td>
<td>72</td>
<td>288</td>
</tr>
<tr>
<td>16 December</td>
<td>0</td>
<td>318</td>
</tr>
<tr>
<td>23 December</td>
<td>0</td>
<td>398</td>
</tr>
</tbody>
</table>

The unique operational qualities of the carrier system have been demonstrated in situations such as those cited above. The carrier appears to be particularly useful for quick reaction problems; e.g., problems involving rapid transition from conditions of relative peace to violence and problems where the quickly changing fortunes of conflict outrun available land-based air power. It is situations such as these that provide content to what the Navy calls the carrier's "flexibility."

**Comparative levels of effort.** While the sea-based system has proven to be useful in certain situations beyond the range of land-based air, once a conflict has started and land bases are available, the Air Force has demonstrated the ability to mount an overall

\(^{36}\)Ibid., p. 300.
heavier effort than the carriers in both combat sorties flown and ordnance delivered. In Korea, for example, of all the combat sorties flown, 75 per cent were Air Force and 25 per cent were Navy carrier based. In part the capability to mount a heavier effort has been due to the greater numbers of land-based aircraft operating in both World War II and Korea. However, it is also due to the different characteristics of the two systems. The land-based fighter or bomber was designed for larger and heavier payloads than the sea-based aircraft which, in the past, was designed to be compatible with carrier size and operations.

Finally, weather and sea conditions trouble carrier operations more than land-based operations, detracting somewhat more from the former's effectiveness. While poor visibility affects all aviation operations, it is particularly dangerous to make carrier landings when the visibility is below certain levels. In addition, a sea condition that causes the carrier deck to pitch makes landings hazardous and can stop all operations or exact a high penalty in accidents. In

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37 See Table XI and Table XII.

38 Comparative inventory of combat aircraft available in Korea are taken from USAF Historical Division Liaison Office, USAF Tactical Operations World War II and Korean War, May 1962; and Chief of Naval Operations, Combat Activity of Naval Aircraft (Korea):

<table>
<thead>
<tr>
<th></th>
<th>FEA</th>
<th>Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1950</td>
<td>172</td>
<td>75</td>
</tr>
<tr>
<td>Dec. 1951</td>
<td>345</td>
<td>188</td>
</tr>
<tr>
<td>Dec. 1952</td>
<td>553</td>
<td>247</td>
</tr>
<tr>
<td>July 1953</td>
<td>616</td>
<td>257</td>
</tr>
</tbody>
</table>
### TABLE XI

**KOREAN WAR COMBAT SORTIES**

*(25 June 1950-27 July 1953)*

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Based</td>
<td>157,086**</td>
<td>25%</td>
</tr>
<tr>
<td>Land Based</td>
<td>461,554</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>618,640</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*Data from USAF Tactical Operations World War II and Korean War: Combat Activity of Naval Aircraft.*

**The summary figures for Navy sorties include flights from all carriers--attack carriers, light carriers and escort carriers.**
<table>
<thead>
<tr>
<th>Mission</th>
<th>Sea Based</th>
<th>Land Based</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Number</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>% of Sea</td>
<td>% of Land</td>
<td>% of Total</td>
</tr>
<tr>
<td>Interdiction &amp; armed recon.</td>
<td>71,043</td>
<td>220,168</td>
<td>291,211</td>
</tr>
<tr>
<td>Close Air Support</td>
<td>28,363</td>
<td>92,603</td>
<td>120,966</td>
</tr>
<tr>
<td>Counter Enemy Air</td>
<td>7,420</td>
<td>73,887</td>
<td>81,307</td>
</tr>
<tr>
<td>Reconnaissance</td>
<td>13,765</td>
<td>60,971</td>
<td>74,736</td>
</tr>
<tr>
<td>Defensive</td>
<td>36,495</td>
<td>12,931</td>
<td>49,426</td>
</tr>
<tr>
<td>Strategic</td>
<td>---</td>
<td>994</td>
<td>994</td>
</tr>
<tr>
<td>Totals</td>
<td>157,086**</td>
<td>461,554</td>
<td>618,640</td>
</tr>
</tbody>
</table>

*Data from **USAF Tactical Operations World War II and Korean War: Combat Activity of Naval Aircraft**.

**The summary figures for Navy sorties include flights from all carriers—attack carriers, light carriers and escort carriers.
general, if naval aviators have any expectation that environmental conditions might make landing back on a carrier more difficult than usual, they are likely to assure themselves a larger fuel reserve upon the completion of the mission in order to make the extra passes over the carrier in the event the first landing attempts fail. This is tantamount to a decrease in loiter time over a target or a decrease in the number of passes over the target that the attacking aircraft can make. Under these conditions, sea basing is a constraint on effectiveness. The land-based aviator can return from a mission with a smaller fuel reserve confident that he will not have to expend fuel looking for a moving base nor be faced with the difficult problem of landing on a pitching deck. On the other hand, it should be noted that weather conditions can arise, such as in Southeast Asia, where conditions over South Vietnamese land areas preclude flight operations from land bases; while, at the same time, the weather over North Vietnam and at sea may be perfectly clear or with clear places. Under these conditions, the sea-based system has an advantage over the land-based system in that it can move around and look for clear weather breaks to conduct flight operations. 39 These are some of the operational problems which affect the performance of the two different tactical aviation systems. There are others more directly linked with considerations of

vulnerability which are discussed in the following section.

Vulnerability in limited war. From the close of World War II through 1964, United States carriers had not been brought under known enemy attack. Despite this fact, the Navy has continued to demonstrate concern with the problem of vulnerability and effectiveness in limited war environments—particularly in light of the growing capability possessed by even some of the lesser Communist or neutral states. For example, Cuba, China, Indonesia, and Egypt, in addition to the Warsaw Pact states, are known to have large numbers of Soviet-built IL-28 Beagles, bombers which are capable of striking carrier task forces with a 4,400-pound bomb load at a combat radius of about 800 nautical miles. Moreover, the Soviet Union has distributed at least some of their 1500-2000 TU-16 Badgers, a bomber used principally by the Soviet Navy for the anti-surface shipping missions. The Badger, known to have been supplied to China and Indonesia, can carry two air-to-surface missiles or a 7,000-pound bomb load to a radius in excess of 1500 nautical miles. China-based

\[40\] Possible exceptions are the attack by North Vietnamese torpedo boats on 7th Fleet destroyers in the Gulf of Tonkin in 1964, and the damage by guerrilla action to an airplane transport tied up to a dock in Saigon. By way of contrast, Air Force bases have been attacked, damaged or evacuated in Korea in 1950-1953, and in South Vietnam in 1964.

Badgers are reported to be capable of reaching all the major U.S. bases in the Western Pacific including those in Japan, the Philippines, Okinawa, and Southeast Asia. 42 Large numbers of the early MiG series (17's and 19's) and a few of the more recent MiG 21's have been made available to Communist satellites and some neutral states. These aircraft also constitute a threat to carrier forces as well as to forward-located land bases.

In addition to high performance aircraft, the Soviet Union has distributed a number of its Whiskey Class long-range conventional submarines to several satellite and neutral nations. The submarine forces of some of these nations are estimated in 1964 to be: 43

<table>
<thead>
<tr>
<th>Communist China</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>4</td>
</tr>
<tr>
<td>Egypt</td>
<td>8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>12</td>
</tr>
</tbody>
</table>

Carrier aviators regard the air threat as more probable than the submarine threat in a limited war. However, there are spokesmen within the Navy, including Vice Admiral John W. Thatch, who feel that the Soviet Union may be setting the stage "for the commitment of submarines

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to limited war missions." Although the Soviets have not been very informative on how they plan to counter the carrier task forces in limited wars, recent publications have given more attention to the carrier than was evidenced in earlier works. The more recent writings assume the use of nuclear weapons, "giving preference to submarines as the best anti-carrier weapon when nuclear torpedoes or missiles are employed," and secondly, assigning an important role against carriers to the naval air arm and long-range aviation using air-to-surface missiles with nuclear warheads.

Effectiveness of the carrier task forces in limited war employments appears to be closely tied to the problem of vulnerability, which in turn is conditioned by the "rules" or "limits" by which the war will be fought. Not only is the Navy likely to employ its carriers at the outbreak of a limited war with something akin to the caution demonstrated in the early months of the Korean War; but it also is likely to hedge against a possible escalation by an opponent during a conflict, which could change the "rules" and thus the conditions of vulnerability. Both of these conditions potentially attenuate effectiveness.

44 Ibid., p. 59.

Threats of escalation, such as the introduction of submarines or attack bombers by an already identified opponent or by a new opponent, can diminish carrier effectiveness:

(1) By forcing carriers to stay far at sea thus diminishing the fuel available to the aircraft for combat purposes.46

(2) By requiring continual movement of the carriers from area to area rather than stay in one locale to provide continual air support or interdiction sorties.

(3) By diverting potentially offensive sorties to defense of the task force.

In the early months of the Korean War, the threat of submarine attack was a sufficient concern that the Navy's anti-submarine forces carried out live attacks against suspected Communist submarines in the Straits of Taiwan, along the coasts of Korea and in the vicinity of the Ryukyu Islands. All the ASW attacks had indeterminate results and, in post hoc analysis, were classed as "doubtful" (submarines).47 They were, nevertheless, sufficient to divert considerable carrier resources and attention for a period.

46 67% of the combat sorties from carriers in the Korean War were flown at a radius of less than 200 nautical miles.

47 "Early in the Korean War, Admiral Joy had advised his forces that unidentified submarines may be attacked and driven off by any means available in self-defense or when offensive action against our forces is indicated, and that continued submergence of a submarine in position to attack ... is considered to indicate offensive action." Field, op. cit., p. 395.
In addition, the demands which a continuous interdiction campaign, in particular, places on the carrier task force are at odds with task force commander's need to hedge against attacks on the task force. In describing the carriers' efforts in the Korean War, James A. Field touches on this problem:

... there was the further difficulty that the employment of carrier aviation in interdiction was not contemplated in current naval thinking. On the one hand the interdiction of land communications calls for continuous effort; on the other, it was felt that logistic considerations and the dangers of air and submarine attack made it undesirable for carriers to operate for more than two days in the same location. By autumn when concern over air and submarine opposition had greatly subsided, and when underway replenishment had improved, the carriers would be operating for protracted periods in the same locality. But autumn was far away, and in the intervening period of emergency things would become worse before they became better.48

In summary, vulnerability (and effectiveness) of both the carrier task force and land-based aviation appears to be closely tied to considerations of limited war "rules" and the possible escalation of a limited war. The kind of limits which prevailed during the Korean War (and in Vietnam through 1965) affected carrier employments, and constituted one of the principal differences from the way the carriers were used in World War II.

World War II and Limited War Carrier Operation--Some Comparative Speeds

The Korean War (and the Vietnam War through 1965) differed from

48 Ibid., p. 111.
World War II with respect to carrier employments primarily in the lack of a serious challenge to United States sea and air superiority. In the Pacific campaigns of World War II, Japanese sea and air power had to be overcome in a series of campaigns which covered most of the Western Pacific. Of the World War II combat sorties flown from carriers in the Pacific, 40 per cent were for the purpose of gaining and maintaining sea and air superiority. 49

By way of contrast, in Korea (and in Vietnam through 1965), carriers operated close to the geographically-limited combat areas without having to gain sea and air superiority. In World War II and in the Korean War, most of the carriers' combat missions were flown against interdiction targets.

Possible future challenges to United States sea and air superiority in a limited war probably would signal a big step up the escalation ladder depending upon the source and basing of the forces attacking. Small attacks and surprise raids might be mounted for a short period by a country such as North Vietnam or North Korea, conceivably damaging or sinking some of the carrier force. However, it is safe to say that the opponent's inventory of forces and bases would be quickly eliminated. Sustained attacks on a carrier task force, on the other hand, could be mounted only by a power such as the Soviet Union and, possibly, Communist China. Such attacks, whether

49 See Table XIII, p. 161.
### TABLE XIII*

DISTRIBUTION OF CARRIER COMBAT SORTIES BY TARGET
TYPE WORLD WAR II AND THE KOREAN WAR
(% Combat Sorties)

<table>
<thead>
<tr>
<th></th>
<th>World War II</th>
<th>Korean War</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdiction/Armed Reconnaissance</td>
<td>44%&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45.2%</td>
</tr>
<tr>
<td>Close Air Support</td>
<td>16%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Enemy Air/Airfields</td>
<td>40%&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.8%</td>
</tr>
<tr>
<td>Reconnaissance</td>
<td>-- c</td>
<td>8.7%</td>
</tr>
<tr>
<td>Defensive</td>
<td>-- c</td>
<td>23.2%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

*The data in this table have been taken from two sources:
World War II data from WSEG No. 4; Korean War data from Chief of Naval Operations, Combat Activity of Naval Aircraft.

<sup>a</sup>Includes 39% sorties flown against "other military installations" and 5% against enemy transportation systems.

<sup>b</sup>Includes the Pacific carrier battles which came to .9% of the total combat sorties.

<sup>c</sup>Because of differing categories for recording data in WWII and the Korean War, the defensive and reconnaissance sorties for WWII are included in the above three classes.
against carrier aviation or land-based aviation, could go unchal-
enged only at the risk of defeat for United States forces. A
limited war campaign against either the Soviet Union or Communist
China to gain the necessary sea and air superiority would probably
resemble the Pacific campaigns of World War II. The tactics would
be more in the nature of surprise raids against those targets which
must be hit first to gain the necessary sea and air superiority--
the airfields, ports and submarine pens. Once air and sea superi-
ority had been attained, then interdiction of communications and battle-
fields on a sustained basis could be resumed or begun. It is diffi-
cult to see how a war of this kind could be kept limited in terms of
geography, belligerants, and weapons.

Summary

Both sea-based and land-based, tactical aviation systems have
sufficiently different political, cost and operational attributes to
preclude their being entirely equivalent forces. The degree of
equivalency, or complementariness will depend upon the specific situa-
tion to include the geography of the operating area and the capabili-
ties of the opponent. Furthermore, changes during a conflict may
alter significantly the comparative usefulness of either the carrier
or the land-based systems.

Politically, the attack-carrier system provides the United
States with a capability to act unilaterally in a crisis to project
airpower quickly to regions where bases are limited or unavailable for any of a variety of reasons. The carrier system is particularly useful during transitions in military operations such as amphibious attacks and withdrawals. Since the carrier has its own mobile logistics, system effectiveness is likely to be less sensitive than land-based aviation to fluctuations in a land campaign or to requirements for opening operations in remote areas where ordnance and fuel are not readily available in quantity.

Most of the carriers' usefulness when functioning in support of a land campaign during a limited war appears to be significant only under conditions of little or no submarine or air opposition. It is a matter of some doubt that the carrier force could continue providing combat sorties in support of a land campaign if the task force commander had to worry about air or submarine attacks. However, it is also a matter of some doubt that such a war could be kept limited to a particular belligerent or geographic locale if United States' sea and air superiority in a limited war were seriously challenged.
CHAPTER VI

ATTACK CARRIERS, MISSIONS, AND FORCE SIZE

Justification for the attack carrier force depends upon the Navy's sharing with the Air Force in the nation's tactical aviation requirements for limited wars. The Navy's combat experiences in Korea and Vietnam, as well as Cold War involvement in lesser crises since World War II, demonstrate that the carrier has been a useful and often unique weapon. However, recognition of the carrier's usefulness is one thing; the requirement for fifteen is another. For Secretary Robert McNamara and analysts in the Department of Defense, the basis for the requirement of fifteen carriers through a changing strategic environment apparently has proved to be elusive. The Secretary and others have questioned whether or not the carriers are of sufficient importance under the conditions of the 1960's to justify a force of this size, costing $5.0 billion per year to operate.¹

This chapter examines the question of force size with particular attention on those operational features of the carrier system which affect the number of carriers in the force. In addition, a

¹The $5 billion figure was cited by Asst. Sec. of Defense for Systems Analysis, Alain Enthoven in 1963 (Missie, op. cit.).
summary treatment is made of the Navy's views of present carrier missions as well as possible future missions to meet what the Navy sees as an evolving threat. Finally, brief attention is given to the issues of nuclear propulsion and vertical-take-off and landing aircraft, two technological developments which could change further future carrier systems.

Present and Possible Future Missions

The number of attack carriers required in the active force depends upon the missions of the force. At least the Navy must demonstrate that a mission exists as a first step in sustaining the case for the carriers. With the apparently imminent loss of the carriers' general nuclear war missions, the Navy is re-emphasizing the advantage of having sea-based airpower in forward areas of current U.S. military commitment where land bases may be of limited usefulness, if available at all. In addition, Navy spokesmen have begun calling attention to what they (and others) see as a growing Soviet maritime threat and Soviet capability to project military power to Africa, Asia and Latin America.

Current limited war missions--a recapitulation. In a 1965 statement which seemed unusual for its public candor, Chief of Naval Operations, Admiral David L. McDonald spoke of the carriers as an alternative tactical air force for use against land targets. He told the Congress:
Basically these operations (limited war operations as in S.E. Asia) call for tactical air power. It is academic to the target whether this tactical air power is applied from airbases ashore or airbases afloat, that is, aircraft carriers. But, having an airbase close enough to the target to be effective, and having aircraft capable of the particular mission available at that airbase are of very great importance to our operations.\(^2\)

This view of the carrier force as a tactical aviation system for striking land targets accords far better with the historical record than does the view that the primary mission of the carrier force is control of the sea. With respect to weight of effort on types of targets, the historical record indicates that the de facto primary missions have been interdiction, close air support and, in World War II, air superiority.

The Navy's case for sea basing a tactical air force appears to rest on three distinct geographic situations:

1. In regions, such as Africa, South America, and South Asia when land bases (airfields) are not available the carrier system would be unique.

2. In regions such as Southeast Asia, Scandinavia, and the Mediterranean littoral where some land bases are available but for a variety of political and military reasons may be of limited usefulness, the carrier system is complementary to the land-based system.

3. In regions where land bases are available and land-based aviation is deployed in force such as in Northwestern Europe, sea-based aviation is marginal or redundant.

Where land-based aviation systems are available in force (such as in Western Europe), the Navy deploys its carriers in a manner which tends to reflect an acceptance of the predominance of land-based aviation.3

It is in those cases where both land and sea-based aviation are available (the second of the situations listed above) that present the difficult peacetime planning problems on the appropriate "mix" of the two systems. The reason for this is that the force structure that a defense planner recommends is sensitive to the scenarios postulated in the planning. Since the number of plausible limited war scenarios is very great, a wide range of Air Force or Navy forces could be justified. This is a peacetime or a priori problem. When a conflict such as Korea or Vietnam arises, it should and does provide concrete examples of the comparative usefulness of the two systems, although there have been, and presumably will continue to be, varying interpretations of what a

3 The Navy apparently does not normally deploy carriers in the Atlantic off Western Europe, except as a possible back-up in a potential nuclear crisis. The Sixth Fleet in the Mediterranean on the other hand is concerned with the southern flank of NATO and those targets in the Warsaw Pact Region which can be reached from the sea. Thereby, the Sixth Fleet is presumably complementary to limited land-based aviation located on a very few and politically vulnerable bases in the Mediterranean region.
particular set of "facts" mean. In the case of Vietnam, Navy spokesmen are stressing the complementary efforts of carrier aviation with those of land-based aviation. This Navy assessment of the carrier role in Vietnam received support from a somewhat unexpected quarter when the then Secretary of the Air Force, E. M. Zuckert told the Congress in 1965:

... Take for instance, the problem of tactical aviation from carriers and tactical aviation from land bases. It seems to me you could envision situations where both or either might be the one that you would want. A particular situation for example is Vietnam. The tactical air operating off carriers to my mind makes a lot of sense. Also, it is not a replacement for land-based air.

It is in those regions (situation 1 listed above) where United States forces are not presently committed that the Navy sees a growing Communist threat and therefore an added use of seapower. Apparently the Navy has considered opening a new fleet deployment area in the Indian Ocean to counter an anticipated, emerging Communist threat. Unless better ways to keep carriers on-station for

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4 In Korea, for example, one of the early Navy and Air Force controversies arose over the comparative effectiveness of strikes by both services on the Wonson oil refineries in July 1950. Field, op. cit., p. 113.


6 Ibid., p. 847.

longer periods of time can be found, and assuming a continuation of the 1964 carrier commitments in the Western Pacific and in the Mediterranean, any new fleet deployment areas in which attack carriers were used, would probably require an expanded carrier force.

The Navy appears to be building a case for future carrier missions on what could be called coverage of threatened areas. In addition to the Western Pacific and Mediterranean, some Navy spokesmen envision deploying carriers and other naval forces to meet anticipated and growing threats to states in the Indian Ocean and South Atlantic region in particular. The assumption is that for communist states to expand, they will have to project their power across the seas where it will be subject to interdiction by U. S. naval power. In 1963, former Secretary of the Navy, Fred Korth, described the threat this way:

In order to expand any further geographically, the Communist Bloc would have to move into these areas which are directly and immediately influenced by sea power. They are no longer able to increase their holdings without use of the seas and possible face-to-face confrontations with American naval forces. Because such confrontations would occur in international waters or in the air above these waters, they would not be influenced by the political, economic, or psychological considerations affecting land operations from fixed bases. The presence of American naval forces in these international areas offers an unusual opportunity to preserve order and achieve peace.8

8Department of the Navy, SECNAV INSTRUCTION 5720.33, p. 2.
Two years later, in 1965, Admiral David L. McDonald also stressed what he saw as a growing Soviet capability to project power over sea areas:

... Over the past several years the Soviets have evidenced a growing awareness of the importance of a maritime strategy, and have increasingly used seapower in expanding their influence. Their efforts at sea include research, reconnaissance, commerce and fishing. They have invested increased funds in their navy. It is a good navy though still apparently concentrated on the submarine, surface elements have not been neglected. There has been increasing use of overwater air operations. The conclusion is clear that we must prepare for the increasing projection of Russian naval power and effectiveness in the years to come.9

While Soviet intentions to project military power to Africa, South Asia and Latin America are unknown, there is sufficient evidence in this direction to give the Navy's threat-assessment added plausibility. For example, Thomas W. Wolfe of the Rand Corporation wrote in 1964:

Should Soviet policy hereafter move toward intervention in distant conflicts, the country's military capabilities would need expanding in a direction already partly evident. Among relevant developments in recent years are: the presence of Soviet military personnel in such places as Cuba, Indonesia, and parts of the Middle East; the extensive military assistance programs in a number of nations outside the Soviet bloc, which have yielded useful experience in training and handling military forces under unfamiliar

geographic and climatic conditions, and which might conceivably pave the way for future logistic bases abroad; a renewed interest in amphibious landing capabilities; and the recent rehabilitation (after their virtual eclipse) of the Marines, whose role in special landing operations has been emphasized.

These developments do not necessarily point to a fully articulated and implemented Soviet doctrine of local war. They do, however, suggest a recognition that the Soviet Union might be well advised to enhance its capabilities for projecting military power into remote areas in support of local conflicts.10

In addition, 1965 London "intelligence" sources expect the Soviets to move increasingly in the direction of military involvement in Africa, the Middle East and in states along the Indian Ocean littoral.11 Not only do the London sources cite as evidence the rebirth of a Soviet marine unit 3000 strong, but they also point to the construction of an 11,000-foot runway at Tamale, Ghana; reported Soviet plans to base an amphibious force at an Indonesian port which would also use facilities in Ceylon; and a contemplated Soviet aircraft carrier program.12

Until such time as Soviet policy firmly moves in the direction of an active military involvement in Afro-Asia, the United States Navy's possible case for deploying attack carriers in these


12 Ibid., pp. 1, 3.
remote regions does not appear to make much sense.\textsuperscript{13} What national purpose could be served by a sea-based tactical air force of about 85 aircraft on a regular peacetime deployment around the littoral of Africa? The Indian sub-continent? South America? If and when the Soviet Union or possibly Communist China were to develop a substantial military capability in one of these areas, then the threat might merit one or more attack carriers probably along with other United States military forces, including land-based air and ground forces. In the meantime, it would appear that there are much less costly and probably equally effective ways to provide an American naval presence, if one is necessary, to show the flag, evacuate American nationals from crisis areas and to maintain area surveillance.\textsuperscript{14}

The missions for the attack carrier force appear to be mainly in the areas of major military threat if for no other reason than that's where the targets are. For better or for worse the attack carrier must probably derive its missions from some "mix" with

\textsuperscript{13} This region was described by former Secretary of the Navy, Fred Korth, as "the vast expanse of a new strategic area from the South Atlantic around Africa through the Indian Ocean to Australia." \textbf{SECNAV INSTRUCTION}, 5720.33, p. 1.

\textsuperscript{14} An example of such a force might be a carrier of the Essex class which would have a hybrid force consisting of say 8-10 A-4 and A-1 aircraft, a company or two of Marines with helicopters, 2 or 3 aerial/photo reconnaissance aircraft and one or two screening destroyers. Such a force might cost one fourth to one half as much to operate as CVA force and would seem to be much more appropriate to the regions in question.
land-based air, both of which provide United States tactical aviation coverage in the Western Pacific, the NATO region and the Caribbean. These are the deployments which historically have supported the requirement for fifteen attack carriers.

Factors Determining the Size of the Carrier Force

Typically, Navy spokesmen assert that carrier force size is derived from the nation's foreign policy and security requirements. Yet, linkage between foreign policy requirements and a particular number of carriers is rarely detailed beyond the general need for maintaining control over the sea. The fact that the Navy has apparently not demonstrated how its force size has been determined since World War II lends validity to those critics who claim that the criteria which the Navy uses have little relationship to the strategic environment, the nation's defense commitments, and the weapons of other military services. Some support is presented below for the contention that the Navy has fixed upon the number "15," tailoring the missions to fit the force rather than the other way around. While this contention may be true in part, there are other considerations--operational and strategic--which bear on the subject of the carrier force size and to which the following analyses are addressed.

Fifteen as a "magic" number. Throughout the considerable history of a changing strategic environment, the number of active aircraft
carriers has remained remarkably consistent. In the nineteen-year period from 1946 through 1964, the modal size of the carrier force was fifteen, though it went as low as eleven in 1950 and as high as eighteen in 1953. Moreover, according to Secretary of the Navy, Paul Nitze, the Navy plans to retain fifteen carriers until 1970. Beyond that time, the planned size of the force is probably still a matter of study, though unconfirmed reports indicate that Secretary of Defense, Robert McNamara, had planned to reduce the force to twelve or thirteen.

Because of its frequent recurrence, the number fifteen has acquired some halo of mystery. In fact, it has a considerable tradition going back four-and-a-half decades as the size of the Navy's capital ship fleet; since from 1921 until 1941 the Navy maintained fifteen battleships continually in commission. However, the conditions which made the number fifteen meaningful in the 1920's and 1930's have long since passed, as has the battleship. The number,

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15 See Table XIV on page 175. The size of the force in any one year can vary slightly depending upon what month the measure is taken. Differences arise because of lags between the time a ship is taken out of commission for overhauls or modernization and the time another takes its place.


18 For a discussion of the origins of the number 15, see Chapter II of this thesis.
<table>
<thead>
<tr>
<th>Year</th>
<th>Atlantic/Mediterranean</th>
<th>Pacific</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1946</td>
<td>7</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>1947</td>
<td>9</td>
<td>6</td>
<td>15</td>
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<tr>
<td>1948</td>
<td>7</td>
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<td>1949</td>
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<td>5</td>
<td>12</td>
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<td>1950</td>
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<td>2</td>
<td>11</td>
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<tr>
<td>1951</td>
<td>9</td>
<td>6</td>
<td>15</td>
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<tr>
<td>1952</td>
<td>10</td>
<td>7</td>
<td>17</td>
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<td>1953</td>
<td>9</td>
<td>9</td>
<td>18</td>
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<tr>
<td>1954</td>
<td>9</td>
<td>8</td>
<td>17</td>
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<td>1955</td>
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<td>1963</td>
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<td>15</td>
</tr>
<tr>
<td>1964</td>
<td>6</td>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>

*See Appendix A for complete listing of carrier force by ship type.*
however, continues to exist independently of the conditions which originally gave rise to it. In a 1965 statement before a House subcommittee, the Chief of Naval Operations denied the "magic-number" hypothesis and went on to explain the size of the carrier force in terms of the nation's need for tactical air forces:

Another subject in which I know you are vitally interested in is the required number of attack carrier groups. In addressing this subject let me say first, we are not talking about certain numbers of ships simply because we are wedded to those numbers. We feel that the role of the Navy in the national defense must be the determining factor. Although our attack carriers always have a residual strategic capability, they are basically mobile tactical airfields. The need for carriers is, therefore, directly related to our country's overall need for tactical air forces.19

However, Admiral McDonald's statement adds little to help clarify the problem of force size since the number of tactical air force wings which the nation needs is not resolved; or, if it has been resolved, the information has not been made a matter of public record.

**Operational factors affecting carrier force size.** Ships at sea have been likened to birds in flight, in that they too must eventually return to the land for rest and replenishment. Aircraft carriers need bases to provide the necessary repairs, supplies,

rest and recreation for the crews. This operational characteristic helps define carrier force size once the requirements for carriers on-station are determined. Some of the operational considerations which determine the number of carrier task groups required to maintain one on forward deployment can be demonstrated from Navy practice.

Since about 1958, the Navy with its fifteen carrier force has maintained, more or less continuously, five carrier task groups in forward deployment areas. This is a ratio of two to one (two back and one forward), and it appears to be a fairly representative standard which has evolved. Some of the factors which determine this particular ratio (as distinct from 1:1, 3:2, or 4:2) are the transit times (speed and distance) from the supporting base structure to the deployment areas and the return; the size and state of repair of the task group ships; the overhaul schedules; endurance of the crews; number and types of support shipping including the underway replenishment ships; and the requirements for rotating carriers to train replacement personnel and to conduct fleet exercises. In an emergency the Navy could probably mount, from its fifteen carrier force, six, seven, or possibly more carriers to be kept on station simultaneously for limited periods of time. But this would be done at the cost of depriving some of the other functions which may be postponed, rescheduled but not ignored. In short, most of the operational constraints detailed above are
capable of some variation and manipulation within certain limits.

Changes in the base structure, or changes in technology affecting ship endurance or transit speed could alter the 2 to 1 ratio to 1 for 1 on station or 3, 4 or 5 for 1 on station, depending upon the size and direction of the possible changes. The following example demonstrates changes in the number of carriers required to maintain one on station as a function of distance from supporting base to the operating area.\(^{20}\) The two parameters, dealing with at-sea endurance and transit speed, are taken from typical World War II employments.\(^{21}\) The postulated cycle time is 60 days consisting of 50 days at-sea time and 10 days in port for upkeep and rest.\(^{22}\) The transit speed from the base to operating area and return is postulated as 15 knots. These parameters lead to the following carrier task groups required to maintain one continuously on station. (See Table XV) From this table it can be seen that in order to maintain one carrier task group on station

\(^{20}\) The writer is grateful to Mr. James R. McReynolds of the Institute of Naval Studies, Center for Naval Analyses, Cambridge, Massachusetts, for first pointing out the relationships between distances from base support facilities to operating areas and the number of carriers required for backup.

\(^{21}\) WSEG No. 4, p. 97.

\(^{22}\) Carrier endurance can vary considerably. By using underway replenishment techniques, one carrier task group was able to remain at sea in an operating area for 77 consecutive days during World War II. More typical peacetime at-sea endurance is on the order of 2 to 4 weeks.
TABLE XV
FORCE REQUIREMENTS AS A FUNCTION OF DISTANCE
FROM BASE TO OPERATING AREA

<table>
<thead>
<tr>
<th>Distance Base Operating Area</th>
<th>Roundtrip Transit Time, 15 Knots</th>
<th>On Station Days/60 Day Cycle</th>
<th>On Station Time % of Total Cycle Time</th>
<th>No. Carrier Task Groups Required for One on Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 n.mi.</td>
<td>5.4 days 33.4 days</td>
<td>44.6 days 20.4 days</td>
<td>74% 34%</td>
<td>2 3</td>
</tr>
<tr>
<td>3000 n.mi.</td>
<td>16.6 days 20.4 days</td>
<td>33.4 days 11.2 days</td>
<td>56% 19%</td>
<td>2 5</td>
</tr>
<tr>
<td>5000 n.mi.</td>
<td>29.6 days 20.4 days</td>
<td>33.4 days 11.2 days</td>
<td>34% 19%</td>
<td>3 5</td>
</tr>
<tr>
<td>7000 n.mi.</td>
<td>38.8 days 11.2 days</td>
<td>33.4 days 11.2 days</td>
<td>19%</td>
<td>5</td>
</tr>
</tbody>
</table>

for a period of time—say, six months—the requirement for back-up forces rises markedly with increases in the distance from the base to the operating areas. It should be noted that this particular model makes no allowance for contingencies such as breakdowns by task group ships. Actual practice would probably require more forces to meet training and other commitments.

The major deployment areas are the Western Pacific, where the Navy has kept three of its nine Pacific fleet carriers, and the Mediterranean, where it has kept two of the six carriers in the Atlantic fleet.23 The three in the Western Pacific mount an air

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force comprising about 255 fighter and attack bomber aircraft. They have a role in the protection of Formosa, currently provide sea-based tactical air for combat in the Indo-Chinese peninsula, and presumably are available for deployment elsewhere in the region if the need for tactical air should arise. In addition, they have a residual strategic capability. The two attack carriers in the Eastern Atlantic/Mediterranean mount about 170 fighters and attack bombers, and presumably are oriented toward the Warsaw Pact states. Possible additional fleet operating areas, such as the Indian Ocean, would necessitate a much larger carrier force if the commitments of the early 1960's were maintained. Depending upon the basing facilities, an Indian Ocean fleet might require four or five task groups to maintain one on forward station. The costs probably would be enormous.

In summary, there does not appear to be any objective standard which justifies or completely explains the size of the peacetime attack carrier force. The criterion for determining the number of battleships prior to World War II has not been meaningful for the post-war Navy. If the assignment of general nuclear war targets in the late 1950's ever provided a basis for determining the number of carriers, it would no longer be applicable for the limited war missions. One standard, which seems to define a minimum carrier force, is Naval aviation coverage of threatened areas. If the Navy sees a need for keeping at least one carrier on forward
deployment in two or three ocean areas, then the overall size of carrier force can be determined by taking account of the necessary back-up rotational units, training requirements, overhaul and repair time, and the location of the supporting bases. However, post-World War II deployments indicate that the Navy prefers to operate with at least two carriers in the forward areas. Presumably this way of operating provides on-station back-up and mutual support. For example, the Navy must be anxious to avoid a repetition of the early Korean War experience where the one carrier in the Western Pacific was committed to the defense of Taiwan and the early support of South Korean forces.

Navy coverage of threatened areas perhaps is a partial standard for carrier requirements; however, it is vague and is of little help in determining the extent to which sea-based and land-based aviation should share tactical aviation missions.

Despite the apparent lack of well understood criteria relating carriers to the nation's security interests, Administration spokesmen have indicated support for a fifteen carrier force, at least until 1970. The search for a better understanding of carrier requirements will continue within the Navy and the Department of Defense. Carrier system costs are enough to assure the search for alternatives and to stimulate endeavors by the Navy to make carriers more

effective or less costly. Two proposals to make carriers more effective and possibly less costly are nuclear propulsion and vertical take-off and landing aircraft. For example, one Naval officer proposed that the higher sustained cruising speeds which nuclear power made possible might permit carriers to operate without escorts, thus reduce costs by eliminating three or four destroyers as well as oilers. However, nuclear power promised to add more to the costs of the carrier force without permitting any reduction in required ships. As a result of higher costs, the issue of nuclear propulsion has become a subject of considerable controversy.

The Issue of Nuclear Propulsion

For the American Navy, whose peacetime history has not always been characterized as innovative, the rapidity with which it backed nuclear propulsion for surface ships was unusual. After less than three years of trials with the first nuclear-powered surface ship, the Enterprise (CVAN-65), the Navy overrode its earlier reservation and recommended in the Korth-Anderson Memorandum (former Secretary


\[26\] In contrast to peacetime changes, the Navy has demonstrated remarkable capacities for innovation under wartime conditions and in post-World War II efforts to gain a nuclear delivery capability for carriers.
of the Navy, Fred Korth, and former Chief of Naval Operations, George A. Anderson) of April 1963, that "all major naval vessels of 8000 tons or more be built henceforth with nuclear-powered engines." This included all cruisers, carriers and frigates, but ruled out most destroyers. Prior to this decision, at least one of the issues contributing to the early reluctance of the Navy to adopt nuclear power centered on comparative costs of nuclear versus conventionally-powered ships. The Navy had concluded in 1960-61 that three conventionally-powered carriers would be purchased for the cost of two with nuclear power. This issue, more carrier decks for equivalent dollars, was reminiscent of the 1930's when the issue was more small or fewer large carriers for a given budget.

The change in the Navy's position favoring nuclear power was reported to be due to anticipated lower costs of nuclear propulsion and to operational advantages. These included "longer cruising time and reduced support requirements," since "conventionally-powered ships require large overseas depots and long lines of supplies."

The Navy decision to adopt nuclear power occurred about the same time as Secretary of Defense Robert McNamara had undertaken a

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28 Ibid., p. 16.
29 Ibid.
comprehensive review of naval strategy in general and of carrier requirements in particular. The Secretary's review of the carrier apparently was combined with the nuclear-power issue, since his questions to the Navy on the added effectiveness to be gained from nuclear power required an answer on the effectiveness of the conventionally-powered carrier. 30

The different approaches to the problem of nuclear propulsion on the part of the Secretary of Defense and the Department of the Navy are indicative of the requirements problem in an hierarchial organization. The Navy looked upon nuclear propulsion as a natural progression from black oil, just as oil had followed coal and coal had followed the sail. Nuclear power was expected to enhance the capabilities of the carrier force whose role the Navy was not prepared to question. Secretary McNamara, on the other hand, saw the issue of nuclear propulsion in the context of the overall role of the surface Navy, the carrier force and the nation's tactical air forces. Not only was he trying to understand the operational benefits to be derived from the additional $126 million a nuclear carrier would cost over a conventional carrier, but he was trying at the same time to understand the carrier. As a consequence, at least one of the proponents for nuclear power felt that McNamara was using

the issue to reduce the size of the surface Navy. Admiral H. G. Rickover told the Congress in response to a question on McNamara's reluctance to back nuclear power:

It may be that the Secretary of Defense thinks that the surface Navy should be drastically reduced and if we build this ship as a nuclear carrier, we enhance the chances for a new surface Navy.\(^{31}\)

Navy studies to demonstrate the case for nuclear propulsion apparently were not sufficiently persuasive, as the Secretary of Defense vetoed the Navy's requests for nuclear power in CVA-66 (the America) and later in CVA-67 (the John F. Kennedy) on the basis that "the Navy study was not specific enough on the possible advantages of money savings or effectiveness."\(^{32}\) The Secretary had earlier told the Congress:

We have carefully considered the question as to whether the new carriers should be conventional or nuclear powered. Our studies indicate that a nuclear-powered carrier costs about one-third more to construct and operate than a conventionally-powered carrier of otherwise equivalent characteristics. The operational benefits to be derived from the nuclear-powered carrier, particularly in limited war operations, do not, in our judgement, justify the higher costs.\(^{33}\)


The arguments for and against nuclear power which have since emerged in the public record are summarized below.

Arguments for nuclear propulsion:

1. **Endurance.**—Nuclear power frees the carrier from reliance on oilers and allows former oil storage spaces on the carrier to be used for aviation fuel and ordnance. Thus, the nuclear-powered ship is relatively less tied to its resupply ships and bases than is the conventionally-powered ship.

2. **Higher Sustained Speeds.**—On conventionally-powered ships, oil consumption increases exponentially with speed. Therefore, the conventional ships cruise at a lower average speed than do the nuclear-powered ships in order to economize on fuel. Higher sustained speeds of the nuclear ships impart operational advantages as a passive defense against submarines, and by reducing the transit time from base to operating area thus allowing more time on station.

3. **Facilitates Aviation Operations and Ship Defenses.**—A nuclear ship does not have stack gases and smoke which can interfere with carrier landings. Since there is no need for air intakes, the nuclear ship has better protection from possible gas and radiological warfare attacks. Finally, the nuclear reactors generate sufficient power to operate the high-powered radars and other electronic equipment on board.

Arguments against nuclear propulsion:

1. **Cost.**—The nuclear carrier costs about one third to one half more than the cost of a conventional carrier. Thus, more airpower can be made available with conventional carriers at equivalent costs. Furthermore, the nuclear carrier would still need escort ships—particularly in a limited war environment.
2. Endurance.--The endurance claims are somewhat bogus unless the entire force is nuclear. Oil is not as serious a resupply problem as is ordnance and aviation fuel which must be resupplied frequently if air operations are being conducted regularly. Crew rest and need for shore leave are also an important limiting factor, particularly on peacetime deployments.  

By late 1964, advances in nuclear reactor technology evidently promised a reduction in the costs of building and operating a nuclear-powered surface ship.  

As a consequence, the major objection which Secretary McNamara had raised to nuclear power seemed to be diminished. This, combined with the added operational advantage of higher transit speeds was sufficient for the Secretary to indicate that the tentatively-planned carrier for 1967 would probably be nuclear, if the newer, cheaper reactors became available. However, Secretary McNamara's decision appeared to be based more on the economical nuclear reactors than on an understanding of the alleged greater effectiveness of the nuclear ship.

The Issue of Carrier Size and VTOL Systems

World War II experiences quieted, for a time, debates within 

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34 The points in the arguments for and against nuclear propulsion have been taken from U.S. Cong., H.R., Department of Defense Appropriations for 1965, Part 3, pp. 396-398.


the Navy which went back to the 1920's on the issue of carrier size. In the post-war period, a consensus appears to have developed within the Navy on the advantages of larger carriers over those of pre-World War II vintage and of the Essex class. It was a consensus which rested upon operational experiences in World War II and upon an anticipated need for future carriers large enough to handle the much bigger and heavier aircraft which the Navy wanted to carry atomic bombs against distant land and sea targets. The result was that the Midway Class carriers, which represented a 66 per cent tonnage increase over the earlier Essex Class, were themselves surpassed in size by the Forrestal and Enterprise Classes. However, since the carrier force has become principally a limited war weapon, the issue of carrier size has arisen again within some realms of the Navy and within the Congress.

Critics point to what they call growing "gigantism" of naval ships in general and carriers in particular. They argue that the size of the Forrestal Class ships make them about $100 million more expensive to construct than a carrier equivalent to the size of the Essex. Furthermore, while the number of aircraft that can be

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37 For comparative carrier sizes see Table IV on page 46 of this thesis.


39 Ibid.
operated from a carrier of Essex Class size is somewhat less than from a Forrestal Class (about 10-15 of comparable aircraft), a larger number of carriers could be purchased for equivalent dollars. Finally, the "big ship" critics say that the smaller carriers can handle adequately the propeller-driven aircraft of the A-1 type and the smaller jet attack and fighter aircraft (A-4's and F-8's), which have proven very useful in Vietnam.

The advocates of the larger carrier, including Secretary McNamara, cite the following arguments:

1. The need for a capability to handle the F-4's and F-111B's high performance fighter bombers which are planned for carrier air wings.

2. The added fuel and ordnance-carrying capacities of the larger ships.\(^{40}\)

3. Lower aircraft accident rates.

4. Better sea-keeping qualities of the heavier ships which permit more aircraft-operating days in adverse weather and rough seas than can be attained by an Essex Class carrier.\(^{41}\)

Secretary McNamara's concurrence with Navy decision-makers on the matter of carrier size combines with a considerable history of ever larger carriers to support the inference that the planned


carrier for 1967 will be of Forrestal size or larger.

The alternative carrier sizes that have been discussed have been confined mostly to the Forrestal and Essex sizes. There have been very few serious proposals for carriers smaller than an Essex ship to operate modern jet aircraft. Reportedly, the reasons for this are that the angled deck requires minimum hull lengths on the order of 800 feet, and the forward catapults also require a minimum length to launch the heavier jet fighter-bombers.\textsuperscript{42} However, the advent of vertical-take-off and landing aircraft (VTOL) has spurred proposals that the Navy look into the possibilities for VTOL aircraft carriers which presumably could be made much smaller than the present-day attack carriers. As of 1964, the Navy's position on VTOL seemed to be a wait-and-see attitude toward the developmental work that was in progress in the United States as well as in other countries. One of the principal objections to VTOL was that the aircraft could not take off with combat loads which were competitive with the present and programmed aircraft without the use of the catapult.\textsuperscript{43} As a consequence, the Navy did not see any particular operational advantages to be gained from a VTOL system; nor did it see any significant cost reductions in either the aircraft or the carrier. Since catapults would be required anyway, savings in

\textsuperscript{42} Ibid.

\textsuperscript{43} "Noah's Ark Royal," The Economist, August 3, 1963, p. 440.
carrier size would have to be taken at the expense of some other sub-system.

British experience with VTOL appears to bear out the validity of the Navy's attitude. In August 1963, the British announced plans for a new 50,000-ton aircraft carrier to be equipped with VTOL aircraft of the Hawker P-1154 type then under development. At that time the requirement for a capability to launch combat-loaded aircraft was cited as the reason for the carrier's large size which was nearly 10,000 tons over anything they had in the force:

The fact that the new ship is to carry short-takeoff planes might have led one to suppose that this would mean a real reduction in the size and space necessary for flight decks, catapults, and so on. But the new ship is to have a massive flight deck and two catapults. The reason given is that thus aircraft will be able to be launched at full capacity in fuel and weapons.

In November 1964, the British apparently had second thoughts on equipping their planned, new carrier with VTOL aircraft, and were ordering the F-4 (Phantom) from the United States instead. However, the size of the planned ship was to remain approximately the same since the larger carrier could carry more planes and supplies:

One of the reasons for the size of the new carrier is conditioned more from reasons of storage capacity than flight deck requirements. Cost-effectiveness studies by the naval department of the Ministry of Defence showed that a 50,000 ton carrier would accommodate twice as many aircraft as a 35,000 ton vessel, but would cost only 25 percent more, assuming a 20 year life span from 1972, 73 onwards. 46

The technology for vertical-take-off and landing aircraft has not yet developed to the point where the United States Navy is seriously considering it as an alternative to the more conventional aircraft presently in the force and programmed for the near future. However, it is possible that VTOL aircraft could be "back in the picture in the mid-1970's," competitive both cost-wise and pay-load-wise to the more conventional aircraft.47 Even so, it is not at all clear that their carrier bases would or should become smaller so long as the carrier system is to be used as a tactical air force.

Conclusions

The uniqueness which the aircraft carrier enjoyed during the Pacific campaigns in World War II stemmed from the range advantages which derived from sea basing. Land-based aviation was hampered by the lack of forward airfields and limited combat radii of tactical


aircraft. To a large extent both of these conditions have been overcome or can be overcome. In the early 1960's both carrier and land-based aviation systems have been deployed in forward areas of major United States military commitment. However, there remain military and political attributes of sea-based airpower which continue to make the carrier an attractive weapon system. In particular, the carriers' freedom from ground attacks, and sabotage, and their ability to project tactical airpower at great distances from available overseas bases are features which complement land-based aviation and strengthen the nation's tactical aviation. On the other hand, if the carrier system were subjected to the threat of imminent submarine or air attacks, there is some doubt that it could remain as an effective limited war weapon; just as there is considerable doubt that lengthy submarine and air superiority campaigns could be kept limited in participants, weapons, and targets.

Relating the Navy's attack carrier requirements to the nation's security interests has proved to be one of the more intractable problems for the nation's defense decision-makers. Secretary McNamara accepted the Navy's estimate of their force requirements in 1963 pending studies "of naval requirements comparable to those now available for ground forces and tactical air forces." By the spring of 1965, the problem of the mix of land and sea-based tactical aviation requirements had still not been resolved. This issue
will continue to be an object of study and controversy in the coming years. If the issue is narrowed to only one additional or one less carrier task group on forward station, the stakes are on the order of one billion dollars a year, possibly 6-10 per cent of the nation's annual expenditures for tactical air forces. The sum is not trivial and certainly should fall within the purview of the instructions to Secretary McNamara, from Presidents Kennedy and Johnson:

Develop the force structure necessary to our military requirements without regard to arbitrary or predetermined budget ceilings.

Having determined that force structure, procure it at the lowest possible cost.
APPENDIX
APPENDIX A

UNITED STATES ACTIVE CARRIER FORCE 1946-1964
By Type and Fleet

<table>
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<tr>
<th></th>
<th>Atlantic</th>
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*a*CVB's and CV's redesignated as CVA along with the newly constructed Forrestal.

*b*All data taken on January of each year except 1954 which are April figures.

*c*With new construction additions to CVA force, older CV's were converted to an ASW role and designated CVS.
## APPENDIX B

### NAVY EXPENDITURES, 1920-1962

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Navy</th>
<th>Army, Navy &amp; Air Force</th>
<th>Total Navy</th>
<th>Fiscal Year</th>
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<td>$736,021</td>
<td>$2,357,974</td>
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<td>1942</td>
<td>$8,579,589</td>
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<td>476,775</td>
<td>934,531</td>
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<td>1944</td>
<td>26,537,634</td>
<td>75,975,964</td>
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<td>730,252</td>
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<td>1945</td>
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<td>80,537,254</td>
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<td>322,249</td>
<td>689,266</td>
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<td>1946</td>
<td>15,164,412</td>
<td>43,151,181</td>
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<td>1947</td>
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The St. Louis Post Dispatch, January 6, 1963.


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