

U. S. NAVAL AVIATION
in the
PACIFIC



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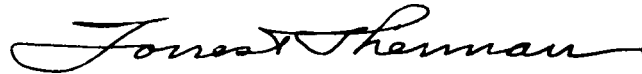
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PREFACE

The purpose of this review, which was prepared by officers on duty in the Operations Division, including Air Combat Intelligence officers with extensive service in the Pacific, is to analyze the relation between air and sea power. It is based upon the experience of naval aviation in the war against Japan as recorded in the files of the Navy Department. Reports of the United States Strategic Bombing Survey have also been consulted and the chart of the progress of the war has been taken from one of them.

The danger inherent in any report confined to one aspect of the war is that it may mislead the reader into forgetting that the conflict was won by a combination of ground, naval, and air forces, each of which carried its share of the common burden. All operated within the framework of strategic plans, and it is the aim of this analysis to show how naval aviation fulfilled its part of those plans.

Since it is from the lessons of experience that plans for the future must be derived, the report is presented in the hope that it will prove of some value to those responsible for the future security of the United States.

A handwritten signature in cursive script that reads "Forrest Sherman".

FORREST SHERMAN,

Vice Admiral, U. S. N.,

Deputy Chief of Naval Operations.



FIRST LINE OF DEFENSE

I MISSION AND ORGANIZATION OF NAVAL AVIATION

The wartime mission of the Navy is control of the sea. Twice in the twentieth century the United States Navy has accomplished this mission with enemies overseas. Each time it has been able to move troops, equipment, and supplies wherever it desired and to draw vital raw materials from all over the globe. Although complete destruction of enemy naval units was not possible, and although areas close to hostile shores remained under enemy control, such supremacy was attained as to permit United States and Allied forces freedom of movement and to deny the same faculty to the enemy as well as to cut him off from strategic resources.

In two wars with Germany this meant maintenance of an effective blockade and holding the submarine menace within bounds. Against Japan the naval war was vastly more complex and difficult because in the opening stages Japan gained control of the Western Pacific in the area north of Australia from the Indian Ocean to the Gilbert Islands. When the Japanese failed at the Battle of the Coral Sea to extend their sway southward and at the Battle of Midway to extend it to the Eastern Pacific, they, in effect, lost the war. Behind the shield of sea power the United States built the ships, planes, and equipment; it trained the land sea, and air forces that ultimately beat down the enemy's navy, drove him from strategic bases, cut off his supplies of raw materials, and placed Allied forces in position to launch final air and amphibious offensives against his homeland. Having lost control of the sea and of the air, the Japanese found themselves open to mass bombing and unable to replace their nearly exhausted supplies of fuel and industrial materials. Rather than wait for the inevitable defeat on land, they surrendered—an eloquent testimonial to the effectiveness of the

Allied campaign based on sea power and on air power supported by water-borne transport.

The activities of the Navy had no other purpose than to obtain or maintain control of the sea. First, it was the function of the Navy to destroy enemy submarines, war vessels, and aircraft by any means, including the capture or destruction of the bases from which they operated. Second, the Navy sought either to sink and capture or to contain in port the enemy's merchant vessels so as to deprive him of raw materials and to prevent him from transporting his troops and supplies. Third, the Navy protected its own and Allied ships engaged in carrying men, equipment, and raw materials. Fourth, if the accomplishment of other objectives required it, the Navy by amphibious landings seized and developed advanced bases. Fifth, when offensive land operations were made against hostile shores, the Navy provided transportation for troops and equipment and supported landing forces until a bridgehead sufficient for the operation of land-based air and artillery had been established; and the Navy continued to assure the safe arrival of ships with supplies and replacements. Sixth, the Navy rendered enemy garrisons on bypassed islands ineffective by cutting off supplies and bombarding installations and prevented the removal of personnel to other theaters. Seventh, the Navy furnished the necessary facilities for the logistical support of its own units. Eighth, the Navy provided for the collection of intelligence, the rescue of personnel, and such other services as needed to keep it operating efficiently.

In all these activities aviation played a part and in none did it have an independent role. For example, the destruction of enemy submarines was accomplished by surface vessels,

aircraft, and friendly submarines. Enemy war and merchant vessels were attacked by surface ships, aircraft, and submarines operating either independently or in cooperation. Aircraft were shot down either by other aircraft or ships' gunfire. Accurate information on enemy movements came from patrolling aircraft, submarines, and surface vessels. Amphibious operations required close support of ground troops both by plane and naval gunfire, and the neutralization of bypassed islands was accomplished through air and surface bombardment. In the course of a campaign—sometimes during a single day—naval units carried out two or more of these operations in rapid succession. The same carrier whose planes supported ground troops might attack enemy fleet units, search out a hostile submarine, or intercept an enemy air raid.

Naval aviation had no separate mission and no separate operational organization. It was an integral part of the naval forces contributing to the control of the sea in cooperation with surface vessels, submarines, and Marine ground troops. For operations aviation units were assigned to task forces. The naval task force was simply an assemblage of naval units of the right type and in sufficient numbers for the accomplishment of an assigned task. Such a force could emphasize whatever element was best suited to carry out its mission and might well have consisted of carriers with supporting surface vessels or it might have been a force built around heavy battleships with the necessary air support. In amphibious operations all elements supported the landing troops who became the primary responsibility. A task force was customarily composed of numbered task groups which were further subdivided into task units and so on right down to the individual aircraft squadron or ship, which also received a task designation. A group, unit, ship, or squadron might be withdrawn at any time that it had fulfilled its task and be reassigned to another mission. With the completion

of the over-all task, the entire force could be reorganized and a new task given it. The essence of the system was integration and flexibility which permitted the maximum efficiency in the assignment of all components, including aviation.

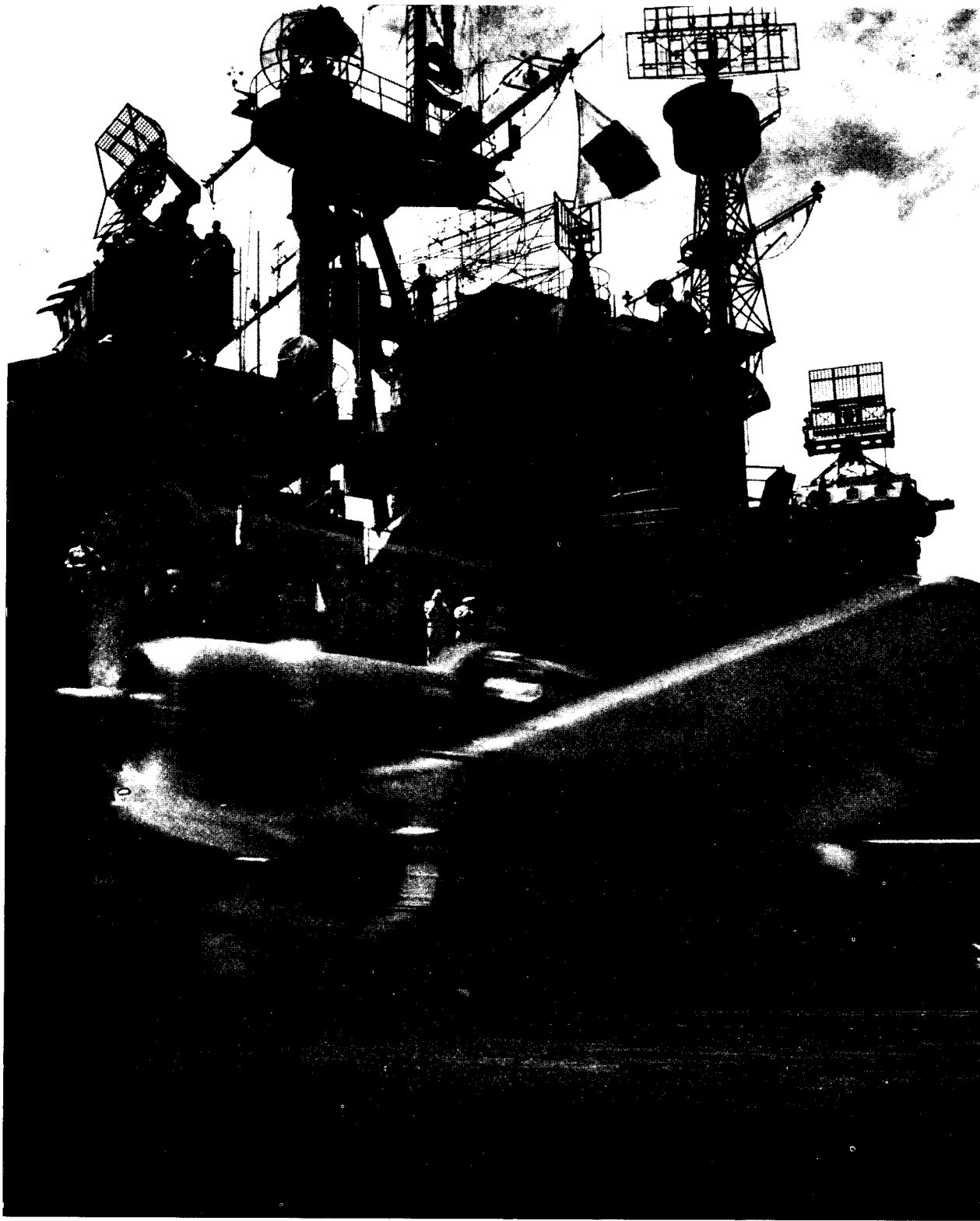
The task-force system assumed that all units of a given type were similar in equipment and training. An analogy to the formation of a task force may be found in building with prefabricated units. Just as in any piece of construction a definite number of units of specified design are required, so a task force was composed of ships, aircraft, and ground troops each in sufficient number for the mission assigned.

To assure uniformity was the function of type commands of which there was one for each kind of ship. Prior to the war the situation in aviation was not so simple. Combat units were divided into two categories—carrier and patrol planes. Utility planes were organized separately, and battleship and cruiser aircraft came under the type commanders for the respective classes of ships. In the Pacific theater a single type command was established on 1 September 1942, and given the title of Air Force, United States Pacific Fleet. This command provided a permanent administrative organization for the handling of aviation personnel, equipment, and ships. It received planes from the Bureau of Aeronautics and men from the aviation-training commands and assigned them to squadrons, provided for squadron training and the shakedown of ships, and saw that all units were maintained in a state of combat readiness. Although utility squadrons and battleship and cruiser aviation remained administratively apart from the type command, both depended upon it for logistical and material support. The Atlantic Fleet adopted a similar organization on 1 January 1943. The uniformity of training and equipment and the administrative stability assured by the type commands guaranteed to the task-force

commander that a unit assigned would be of a known size and capable of the predetermined kind of operation for which it had been trained.

For purposes of command the system provided admirably for all types including aviation. Commander Air Force, United States Pacific Fleet, was a naval aviator who had charge of technical matters pertaining to aviation and served as advisor to the Commander in Chief of the Pacific Fleet. In operations air units were

always under the direct command of aviators. When an operation was expected to be conducted largely through the air. i. e., a series of raids by a fast-carrier task force, the Commander was a naval aviator. In support of a landing the same carriers would be integrated into a task force under an amphibious-force commander who indicated the part that aircraft should play and issued orders which were then carried out by the air units under direct control of aviators.



A HELLCAT EAGER FOR BATTLE

A Carrier Strike Is Launched

II COMPONENTS AND WEAPONS OF NAVAL AVIATION

Both combat and noncombat activities were carried on by naval aviation. The first included carrier, Marine, and patrol aviation and two lesser types: battleship and cruiser aviation, consisting of small seaplanes used primarily to direct ships' gunfire and coastal-patrol aviation employing small land and seaplanes to protect port areas and coastal convoys against submarine attack. Noncombat functions were performed by utility squadrons and the Naval Air Transportation Service. In addition, the Coast Guard operated as part of the Navy during the war, and its air units were employed in antisubmarine warfare and air-sea rescue work.

Carrier Aviation

Carrier aviation may be considered in three parts: the fast-carrier striking forces, the escort-carrier forces, and Marine-carrier aviation.

The functions performed by the fast carriers included offense, defense, and reconnaissance against enemy aircraft, warships, merchant vessels, and beachhead targets. They were primarily an offensive weapon used to gain control of vast sea areas and to destroy enemy forces which threatened friendly fleet or amphibious operations. These functions required mobility, flexibility, aerial power, and defensive armament.

The fast carriers included both large, fast, 100-plane carriers and light, equally fast 33-plane carriers. Fighter, dive-bomber and torpedo-bomber squadrons were organized in carrier air groups and trained to operate together as coordinated striking units. Specialized night-fighter aircraft and high-speed photographic planes also flew from fast carriers.

Fast carriers were normally operated in task groups of 3 to 5 carriers, 4 to 6 battleships and

cruisers, and 12 to 20 destroyers, all under a single command. Two to five task groups composed a fast-carrier task force, such as Task Force 58. The fast-carrier task force which made the first assault on the Philippines in September 1944 had 730 planes; for the Leyte landings a month later, 1,060; and for the Tokyo raid of February 1945, 1,220.

Escort carriers provided air and antisubmarine defense of invasion convoys and beachhead areas and close support of invasion troops until such time as these functions could be taken over by shore-based aircraft. The carriers themselves were smaller, slower ships of about 30-plane capacity, on which were based squadrons of fighters and torpedo bombers. In amphibious operations escort carriers were normally employed in formations of 4 to 7 carriers with 6 to 12 destroyers and destroyer escorts. but single carriers with fewer escorts were used for specialized antisubmarine or convoy-escort operations. The invasion of Leyte was supported by a task group of 18 escort carriers in 3 task units with a total of 500 planes. The group for the Lingayen landings had the same number of carriers but was divided into a larger number of units with a total of 570 planes.

Marine-carrier aviation was of two kinds. In the first place, the marines were expected to act as a reserve for naval aviation, and, although this function was not exercised in the early part of the war, a few Marine Corps pilots were aboard an escort carrier off Attu in May 1943, and, beginning in December 1944, a number of Marine fighter squadrons were used on the fast carriers. In the second place, during the same year, the decision was made to employ marines from escort carriers in support of amphibious operations, and the first two such carriers were

present during the Okinawa campaign in the spring of 1945. Training and techniques were identical with those employed by Navy squadrons engaged in the same sort of work.

The aircraft used in carrier aviation were of three major types. Designed primarily for combat with enemy aircraft, fighter planes equipped with machine guns, bombs, and rockets were also employed as offensive weapons against ships and land targets. Dive bombers participated in coordinated attacks with fighters and torpedo plane and were the most accurate of all bombers. Torpedo planes made torpedo attacks only occasionally and were more often used as versatile light bombers capable of carrying a ton of bombs plus rockets. Because of their inherent characteristics, they proved valuable for short-range search and sea patrol particularly against submarines.

Marine Aviation

Marine aviation was organized administratively as part of the Marine Corps. The basic unit was the squadron of 12 to 32 planes, 2 or more of which constituted a group. Likewise 2 or more groups with headquarters and service units made up a wing. Although it was originally planned that each division of ground troops should have a supporting wing bearing the same number, the exigencies of war made it impossible to carry out this scheme, and Marine aircraft, like all others, were assigned where they were most needed. For logistical and material support, Marine air units depended upon naval commands.

Besides its carrier functions, Marine aviation served ashore both in support of Marine ground troops and as a garrison air force to protect bases and other installations. Although the latter was more properly the task of the Army, the marines took it over because the Army Air Forces, concentrating on the primary strategic objective in

Europe, had insufficient planes available for the Pacific theater. Such a substitution was in accord with the agreement of 1935 between the Army and Navy which specified that when needed each service would operate in lieu of the other. Similarly Marine air units supported Army ground troops on Guadalcanal and in the Philippines, where they won the highest praise of Army officers. As an extension of its work as a garrison air force, Marine aviation conducted numerous raids on enemy installations at New Britain and in the islands of the Central Pacific to prevent by-passed Japanese garrisons from interfering with Allied communications. While engaged in their many activities, shore-based Marine squadrons shot down over 1,900 Japanese planes.

Because of their position as a fleet reserve, the Marines used the same types of aircraft as the Navy and received similar training with increased emphasis on close air support. The assumption of garrison air force duties resulted in the addition to Marine plane types of a two-engined bomber, the Mitchell (Army B-25, Navy PBJ), which was employed for search and interdiction.

Patrol Aviation

Patrol aviation had as its basic function to discover and report the location, nature, and movements of enemy forces. By a natural extension this came to include photographic missions against enemy installations in advance of carrier and amphibious operations. Whenever it was possible and would not interfere with the basic reconnaissance duty, patrol planes attacked enemy shipping. This was especially successful against unescorted surface vessels and submarines. In the Atlantic, and to a lesser degree in the Pacific, antisubmarine warfare became a highly specialized activity that called for intensive training and complicated equipment. Pa-

trol aviation also acquired many other miscellaneous functions including air-sea rescue, mine-laying, defensive patrols around surface forces far at sea, and diversionary, harassing attacks against enemy bases and islands.

Prior to the war the Navy depended upon large flying boats for patrol work. All these aircraft were distinguished for range, relatively slow speed, and light armament. Since flying boats could be based upon tenders anchored in harbors, sheltered coves, and open sea, they possessed great mobility and were employed in advance positions before the capture or construction of airfields was possible. Between 1939 and 1941 the neutrality patrol demonstrated the need for land-based aircraft to operate in northern latitudes during winter weather, and the first months of the war indicated the need for more speed and armament in a plane that was expected to operate singly in close proximity to enemy airfields. Since it was impossible to provide the necessary characteristics in seaplanes, the Navy obtained land types from the Army. Before an Army high-altitude bomber could be effectively employed for search and reconnaissance, however, 50 percent of its internal arrangements had to be altered and special equipment installed. Because this modification required virtually as many man-hours as the construction of a new plane, the Navy began designating new patrol aircraft to meet its special requirements.

As in other types of naval aviation the basic unit was the squadron. Since the planes usually flew alone and were frequently operated in three- or six-plane detachments from tenders, the squadrons remained largely an administrative unit. Squadrons were organized into Fleet Air Wings which also included coastal-patrol squadrons and headquarters and service units. Patrol squadrons were assigned to task groups and forces for operations and since it was common practice to employ wing commanders in the task

organization, Fleet Air Wings acquired operational as well as administrative and logistical functions and were closely integrated with other elements of the fleet.

Noncombat Aviation

Created immediately after the outbreak of war in the Pacific, the Naval Air Transport Service adapted the methods of commercial air lines to meet the demands of the Navy's forces the world over. Familiarly known as NATS, it played a major role in the Pacific War. The cargoes it carried sent damaged ships and submarines back to sea weeks before surface transport could have delivered the required materials. It supplied fighting units throughout the Pacific with critical implements of war and brought as much as 1,000 pints a day of life-giving plasma and whole blood to forward areas. It evacuated casualties from the active fighting fronts. At Okinawa beginning 6 days after the initial landing, 9,871 patients were moved in 329 flights. The importance of such service was only partly measurable in statistics; it also lay in the shortened convalescence and improved morale of each casualty and in the lightened burdens and responsibilities of medical units in the battle area.

A measure of the size and scope of NATS activities can be gained from the following statistics. In August 1945 NATS flew a total of 39,732,000 miles carrying 11,400 tons of cargo and mail and 85,000 passengers over a network of 63,251 route miles. Four hundred and twenty-nine aircraft and a total personnel of 26,604 were involved in this enterprise.

Utility squadrons supplied the fleet with special aircraft services. Before Pearl Harbor it had become obvious that, if gunnery training were to keep abreast of new developments in fire-control, the utility squadrons would have to expand and increase their scope of operation.

Radio-controlled target aircraft were developed and personnel trained to place this target at the disposal of ships in training. Aircraft better adapted to towing target sleeves were obtained. Throughout the first war years new squadrons were formed to bring these devices to the fleet and shore establishments.

Utility squadrons moved into forward areas with their tow equipment and radio-controlled drones to give advanced training to ships, bases and fighter aircraft. These services were provided not only for Navy and Marine Corps but also for Army units in the Southwest Pacific.

Other activities included coverage of submarines engaged in training, aerial mapping and surveys, local rescue work, and itinerant air transport.

Utility squadrons everywhere in the Pacific contributed to the effectiveness of antiaircraft fire. Nowhere did the practice afforded the gunners better reveal its usefulness than during the long campaign for the capture of Okinawa. The ability to shoot down Kamikazes that had slipped through the protective screen of fighters helped immeasurably in the ability of the fleet to stay until the troops no longer required its support.

III SPECIAL ASPECTS OF THE AIR WAR

Naval warfare included more than the contacts between rival fleets and their air components. It involved constant surveillance of enemy movements and bases, destruction of shipping, and capture of strategic land areas. Air-sea rescue, which kept personnel losses to a minimum, preserved that element of military power most difficult to replace and bolstered the morale of all fighting men. In all these activities aviation participated and for their accomplishment developed special techniques, a knowledge of which is necessary to an understanding of victory in the Pacific.

Naval Air Search and Reconnaissance

Pearl Harbor showed the need for air patrols. The Japanese Fleet whose planes did such damage on the morning of 7 December 1941, were within range the evening before. Had enough Catalinas been out, the fleet might have been discovered, but the ability of United States forces to surprise the enemy on many occasions later in the conflict indicated that more than planes in the air were needed to conduct an adequate search. Above all it required special radar equipment and thorough training which American forces did not possess in 1941. Admiral Hart in the Philippines commented on the vast amount of misinformation he received over the warning net. Before that ill-fated campaign in the East Indies had ended, the patrol-plane pilots and crews had learned their business the hard way. During the latter stages of the Japanese advance the only information available to Allied commanders came from the Catalinas of Patrol Wing 10 operating from tenders whose almost daily moves enabled them to service their planes

after landing fields had been knocked out. The lessons learned were applied elsewhere as fast as aircraft, equipment, and trained crews could be obtained.

Although naval search planes were not available for the Battle of the Coral Sea in May 1942, the following month at Midway a Catalina was the first to report the Japanese fleet. When the same type of flying boat was used in the Solomons, its limitations rapidly became apparent. The surprise and sinking of four Allied cruisers at Savo Island on the night after the landings on Guadalcanal might have been avoided if reconnaissance had been complete. In the weeks that followed, concentration of enemy fighters made impossible the use of Catalinas in the area north of Guadalcanal. Although Army Flying Fortresses were employed for patrols, lack of special equipment and training restricted their usefulness. Late in 1942 the Navy began receiving Liberators, which after extensive modification and time for training the naval crews appeared in the Solomons early the following year. This plane had both the range to reach the centers of enemy activity and the firepower needed to operate singly.

The possession of such a plane also made possible the development of photographic reconnaissance. Because the Japanese had for years excluded foreigners from military areas and especially from the mandated islands, Allied intelligence knew very little about the nature or extent of installations. In the spring of 1943 the first photographic squadron, accompanied by expert personnel for processing and interpretation, reached the South Pacific. From that time forward, extensive photographic reconnaissance was made in advance of every major operation. In addition to specially equipped units, every

search plane carried a camera and was able to supplement visual sighting with photographic evidence. The camera and radar enormously increased the effectiveness of naval patrol aircraft.

Although the first function of patrol aviation was to sight and report, naval planes frequently discovered enemy merchant shipping alone or with only light escort. Since the aircraft carried machine guns, bombs, and, in the latter part of the war, rockets and guided missiles, they made successful attacks on cargo vessels and contributed to the effort that ultimately strangled Japanese industry.

Antishipping operations also possessed direct military importance. In the South and Southwest Pacific areas the enemy frequently attempted to move troops and supplies at night in small vessels and barges, ducking in and out among the numerous islands and hiding in coves by day. In detecting these clandestine shipments, the slow speed of the Catalinas became an asset and darkness provided adequate protection for their vulnerability. With special paint and equipped with radar they became Black Cats searching out enemy vessels and barges wherever they could be found. Not only did they themselves strike but they also worked out techniques for guiding motor torpedo boats, destroyers, and other light vessels to Japanese convoys. The Black Cats made reconnaissance a 24-hour-a-day job.

In the Atlantic, patrol squadrons devoted their principal effort to antisubmarine warfare. Because the Japanese directed many of their underwater craft to supply garrisons on bypassed islands, antisubmarine activities were overshadowed by other phases of patrol aviation in the Pacific. All squadrons, however, were given instruction in the special techniques of this type of warfare, and although patrol planes were instrumental in sinking only five Japanese submarines, vigilance was never relaxed and a

high degree of proficiency maintained through training.

As the United States offensive moved across the Pacific, patrol aviation accompanied it. Search and photographic planes checked and rechecked enemy installations and movements. When the carrier forces moved against an objective, they desired to achieve surprise. If Japanese search aircraft encountered carrier planes, they could have inferred the presence of carriers and transmitted the fact before being shot down. In the invasion of the Marianas and later operations, Navy Liberators flew along the flanks and in advance of the carrier force, shooting down enemy search planes. Prior to the landings in the Philippines they knocked off Japanese picket boats east of Formosa.

During the critical periods when amphibious forces were establishing a beachhead, naval commanders needed accurate knowledge of approaching enemy units. For this purpose tenders accompanied the invasion fleet and commenced operating seaplanes immediately. Although this remained a dangerous activity so long as the enemy had aircraft and fields in use it was necessary and by 1943 the Navy had available the Mariner (PBM), a faster, longer-ranged flying boat with more firepower than the Catalina. At Okinawa the Mariners conducted their first searches at the main objective even before the troops went ashore and on 7 April 1945 had an opportunity to demonstrate their value. A United States submarine the previous day sighted a Japanese force built around the *Yamato*, the world's largest battleship, headed toward our invasion fleet. Search planes immediately took off and some hours later spotted the enemy and guided carrier planes into the attack which resulted in the destruction of the *Yamato*, a light cruiser, and four destroyers. The Mariners not only maintained continuous contact but landed on the open sea to pick up the personnel of carrier planes shot down during the action.

The last 6 months of the war saw the culmination of patrol aviation. New plane types became available in increasing numbers. To avoid the duplication of labor inherent in building a plane and then modifying it extensively, the Navy designed a version of the Liberator to meet its special requirements and gave it the nautical name Privateer (PB4Y-2). A two-engine land plane, the Ventura (PV-1) originally developed for antisubmarine work in the Atlantic was also employed in the Pacific, and a new model named the Harpoon (PV-2) appeared in 1945. In preparation, but not ready in time for war operations, was the Neptune (P2V) one of which startled the world in 1946 by flying from Perth, Australia, to Columbus, Ohio, a distance of over 11,000 miles and the longest flight on record. What a plane with that range and ease of operation would have meant in 1941 may easily be imagined.

By the spring of 1945 the Navy operated searches that literally covered the Pacific from the Aleutians to Australia, from Seattle to Singapore. Especially important was the area between the Philippines and the mainland of Asia through which vital supplies from the East Indies passed to Japan. To sever these lines of communication, patrol planes proved particularly useful not only sinking ships themselves but guiding submarines to likely targets and even calling up Army bombers to dispose of one convoy too large for a single patrol plane to handle. This coordinated campaign reduced Japanese shipping to such a thin trickle that by summer the big planes were crossing to French Indo-China where they went after the railroads which were the last link in enemy communications with the southern regions. Farther north other naval aircraft, based on Okinawa and Iwo Jima, were conducting patrols along the coast of China as far as Korea and around the coasts of the Japanese home islands. They also attacked ship-

ping with bombs, rockets, and guided missiles and laid mines in the principal shipping lanes. At the extreme top of the Japanese Empire, search planes from the Aleutians regularly visited the Kurile Islands.

The effectiveness of this reconnaissance in terms of area covered can be seen from the charts on pages 12 and 13 which compare the searches in effect at the end of the war with those at the time of the Guadalcanal landings. The effectiveness in terms of results achieved is indicated above. All of this was accomplished with the greatest economy. At no time did the Navy have in operation in the Pacific area more than 500 search planes of all types.

Rescue at Sea

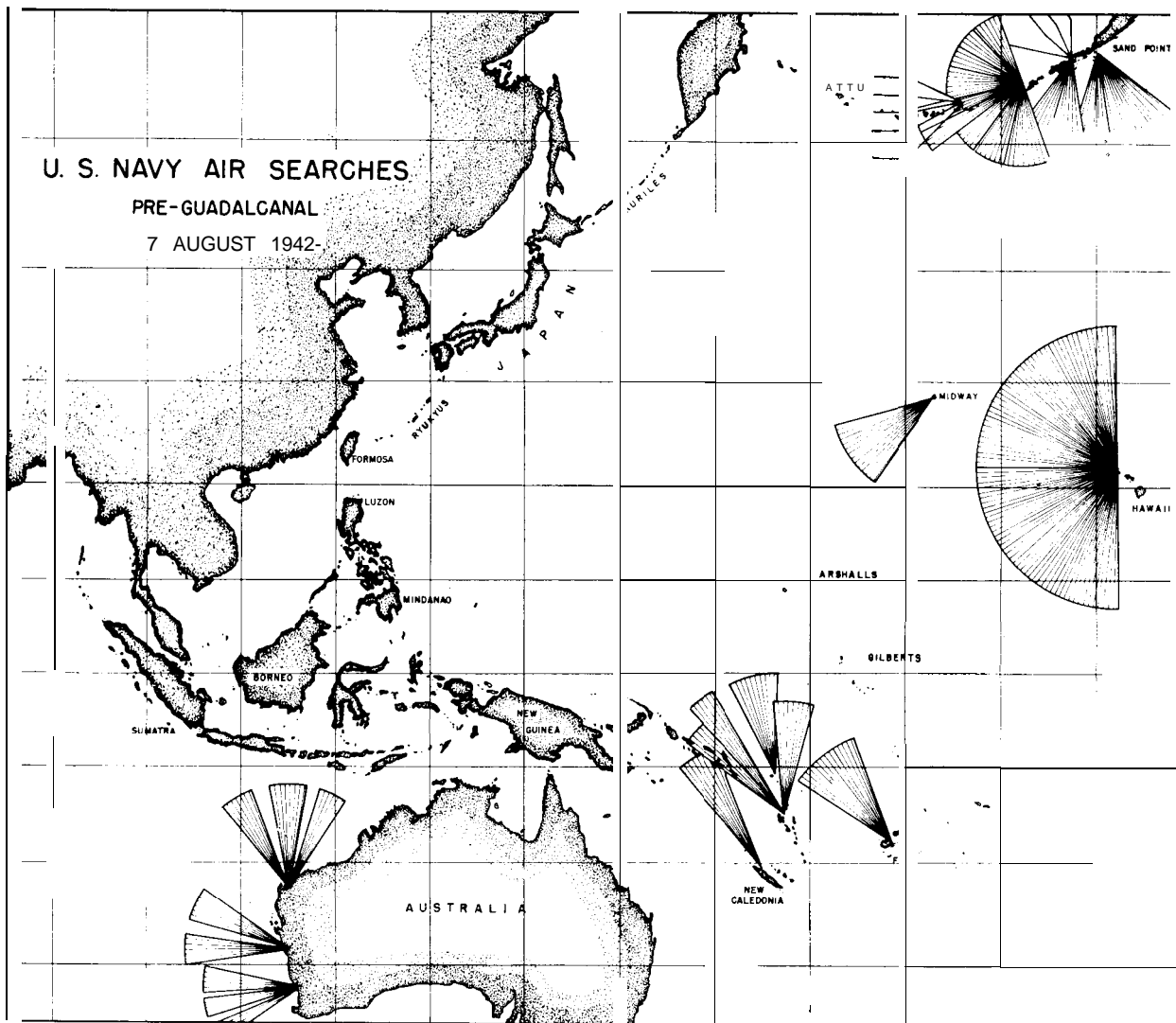
At the outset of the war, operating procedure for the rescue of pilots and air crews was undeveloped. On the other hand a number of basic safety devices had been provided permitting a pilot to survive the unexpected failure of his plane. The parachute, the inflatable life jacket popularly known as the "Mae West," and the rubber life raft with its emergency survival and signalling gear were standard equipment. During the war, safety gear was steadily improved and the probabilities of survival were all in favor of the flyer, whether the trouble was simple engine failure or being shot down in flames. In the first half of 1942 many pilots survived crashes in combat areas but frequently little or nothing could be done to effect their recovery. A number of rescues, however, were made usually as the result of individual initiative, and after the battle of Midway, Catalinas picked up many pilots.

Organized rescue operations developed in the Solomons campaign. Catalinas, popularly known as "Dumbos," were dispatched to pick up personnel who had been shot down. At first this was an incidental duty assigned as the occa-

sion arose, but it later developed to a point where Dumbo circled near the scene of a raid. Positions were reported as planes went down, and the Dumbo, often protected by planes from the strike, recovered the personnel. The bravery of the rescue crews in landing in positions exposed to enemy shore fire became legendary. It was fortunate that no rescue personnel were lost in such operations.

By 1944 in the Central Pacific the problem of making rescues in open-ocean areas first became

acute. Since only the most skillful and experienced seaplane pilots could land and take off again in the enormous swells, the job required as much seamanship as airmanship, and it became standard practice to avoid open-sea landings unless conditions were favorable and there was no other rescue agent available. Ships, usually destroyers, made the recoveries wherever possible. Catalinas continued not only to be used extensively to search for survivors, to drop emergency gear, and to circle overhead until a



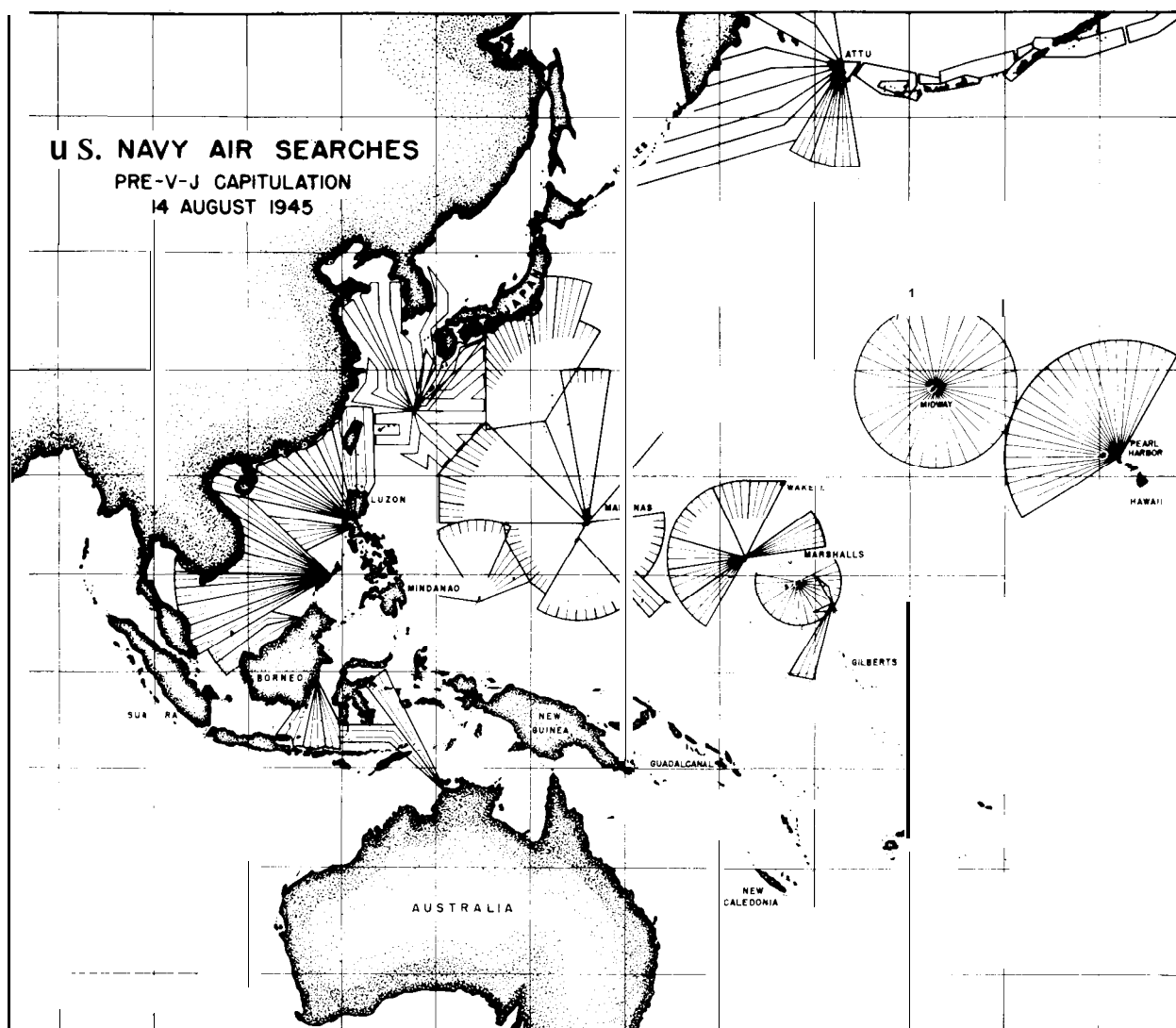
Recoissance, 1942. —Early in the war, United States naval forces far from the heart of the Japanese Empire were able only to patrol areas near Australia, Guadalcanal, Hawaii, and Alaska. Inadequate as these searches were, they were all the aeronautical service could perform, limited as it was in men and aircraft available.

ship could arrive but also to make rescues in fair conditions and in protected lagoons.

The tendency toward specialization observable in the creation of photographic squadrons in 1943 also appeared in the creation of rescue squadrons in 1944. Equipped with Mariners modified to permit carrying newly developed rescue gear and with pilots and crews given special training in the techniques of air-sea rescue, these squadrons effected rescues under conditions impossible to Catalinas. During the Okinawa

operations a 6-plane rescue squadron made 76 landings and rescued 183 survivors of all services. Such special units were employed only in areas where the intensity of operations made calls upon their services frequent; elsewhere in the Pacific patrol planes continued to provide Dumbos as all adjunct to their other duties.

Because fast-carrier operations were generally deep in enemy waters, the only rescue facilities were the seaplanes from the battleships and cruisers, the ships of the task force itself, and



Reconnaissance, 1945.—As VJ-day neared, naval aviation had reached such strength and power that it literally patrolled the Pacific. Patrols were designed to prevent enemy use of sea lanes, to watch bypassed garrisons and to guard approaches to United States bases. This control of the Pacific led to final victory.

submarines. Lifeguard submarines were stationed at each objective to rescue flyers forced down in the vicinity and after standard procedure had been devised, rescue operations were highly successful. On one occasion the submarine *Tang* recovered 22 flyers off Truk. Although several submarines received damage, none was lost on rescue missions. In atoll lagoons, shallow waters, and mine fields, where our submarines and ships could not go, the small seaplanes carried by battleships and cruisers of the carrier task forces provided a satisfactory answer to this problem.

In the vicinity of a carrier task force, screening and picket destroyers performed rescues. The attack on the enemy fleet during the Battle of the Philippines Sea cost 20 United States planes shot down and another 55 force by lack of gas to land on the water before reaching their carriers. Of approximately 180 personnel involved all but 16 pilots and 22 aircrewmen were recovered, the majority by destroyers before dawn.

Many types of rescue operation required close coordination between commands that normally operated more or less independently. Such coordination reached its high point in connection with bombing of Empire targets by B-29's. A chain of ships and submarines, each with a supporting plane circling overhead, was provided along the route from the Marianas to the target. Submarines were stationed from the Empire coast to about 400 miles out and destroyers or similar ships the rest of the way. When a plane went down, the assigned air-sea rescue plane, which on the most remote stations was usually a specially equipped B-29 "Super Dumbo" and on nearby stations a Navy seaplane, searched for the survivors and directed the comparatively slow-moving ship or submarine to the scene. With this system most B-29 survivors, no matter at what point on their 1,200-mile over-water route they went down, were recovered in a

short period, sometimes within a few minutes.

Air-sea rescue activity in the Pacific shows naval units of all types being successfully employed to meet every kind of combat rescue problem. During the last year of the war, a total of 2,150 flight personnel of all services was recovered by these agencies. The value of air-sea rescue transcended the total of lives saved. Everywhere it bolstered morale and encouraged flight personnel to greater efforts against the enemy. Since it took longer to train air crews than to build planes, personnel were more difficult to replace than aircraft; economy and sentiment both contributed to the development of air-sea rescue.

Aerial Mining

The offensive mine-laying campaign waged against Japan was little publicized but the results were highly successful. At least 649,736 tons of shipping were sunk and another 1,377,780 tons damaged, of which 378,827 were still out of use at the end of the war. The total sunk and damaged represented one quarter of the pre-war strength of the Japanese merchant marine. In addition 9 destroyers, 4 submarines, and 36 auxiliary craft went down as the result of mine explosions; and 2 battleships, 2 escort carriers, 8 cruisers, 29 destroyers or destroyer escorts, a submarine, and 18 other combatant vessels were damaged. In the course of the war 25,000 mines were laid, 21,389 or 85 percent by aircraft. From a total of 4,760 sorties, only 55 mine-laying planes failed to return.

Although surface vessels and submarines were also employed, airplanes proved particularly adapted to mine-laying. They could penetrate enemy harbors and repeat the operation without being endangered by mines previously sown. Much of the work could be carried on at night with relatively little loss of accuracy and with increased secrecy as to the exact location of the

mines, which added to the Japanese difficulty in sweeping. All United States and Allied air services participated, using practically every type of bombing plane from the Avenger (TBF) to the Superfortress (B-29), and, of course, the ever-present Catalina. The mines themselves were developed, produced, supplied and serviced largely by the United States Navy with a few British types being employed in Burma and the Southwest Pacific. Naval mine-warfare officers collaborated in the planning and execution of all operations.

Although mining resulted in the destruction of large numbers of vessels, it had other important effects not so easily determinable. It forced the Japanese to close ports until they could be swept, thereby causing the loss of valuable ship time. Even with relatively few mines at a time often repeated attacks resulted in the abandonment of many harbors. To prevent the enemy from staging his fleet through certain anchorages they were mined when important operations were in progress in adjacent areas. Shallow waters were mined to force shipping into the open sea where United States submarines could attack. In the last month of the war the mining campaign was extended to home waters to cut off the last Japanese connection with the mainland.

In the outer zone, particularly though the East Indies, mine laying was highly selective with comparatively small numbers being used against strategic objectives. The campaign was carried on by Royal Air Force, Australian, and United States Army aircraft operating from bases in the Southwest Pacific, China, and India. It prevented the Japanese from using such important ports as Rangoon to reinforce their troops in Burma and greatly curtailed their obtaining supplies of oil from such places as Surabaya and Balikpapan. In the South and Central Pacific, Navy planes used mines for tactical purposes to keep the Japanese Fleet from using certain harbors while amphibious operations were

being conducted in nearby areas.

Over half the naval mines expended during the war were laid by the Superfortresses of the Twentieth Air Force in and about the home islands, particularly in the straits of Shimonoseki and around the Inland Sea. This forced the Japanese to carry goods from the Asiatic mainland to ports in northern Honshu from which adequate distribution by rail was impossible. To complicate the enemy's problem Navy Privateers from Okinawa mined the shores of the Yellow Sea as far as the southern coast of Korea. The movement of ships of over 1,000 tons was stopped altogether. Careful mine-laying prevented the use of all but three of Japan's merchant-marine shipyards, thus preventing the repair of vessels already damaged. Cut off from the East Indies by air and submarine action, the enemy saw his last link with the Asiatic mainland severed by aerial mines. American and Allied services working in close collaboration completed the strangle-hold on Japanese industry.

Air Support of Amphibious Operations

The primary missions of air support were local defense and direct support of troops ashore. Defense included combat air patrols to ward off enemy air raids, antisubmarine patrols flown constantly around the approaches to the objective area, and special missions such as the silencing of heavy coastal batteries. Direct troop support consisted principally of attacks with bombs, rockets, machine guns and incendiaries on enemy troops and defenses. In order to be effective, both defensive and offensive air operations required a high degree of coordination and control. This was practically impossible to secure through the normal task-group communication channels because in a major amphibious operation as many as thirty different carrier air

groups and land-based Marine air units might be jointly engaged in operations. The task-force and task-group organization involved too many echelons of command to permit prompt action on requests for air support.

The need for the development of air-support doctrine was apparent in the landings on Guadalcanal and Tulagi in August 1942. Three carriers supported this operation, and their air groups reported to a support air director in the flagship of the amphibious commander and prior to the landings carried out missions assigned by him. Although the Navy had foreseen the need for liaison parties ashore with the troops and had occasionally employed them in peacetime maneuvers, on Guadalcanal inadequate communications and lack of experience handicapped the direction of support missions after the Marines had landed.

The air defense for this operation also left much to be desired. The plan called for a combat air patrol of fighters directed by a shipborne controller known as a fighter director. His function was to receive information from ships' radars of enemy air raids and the position of friendly fighters, to relay this information to the patrolling fighters, and to direct them to a point where they could make visual contact with enemy planes. As the radar of the cruiser on which he was embarked failed to detect the three enemy air raids, the fighter director was unable to carry out his mission.

After the first two days the carriers were obliged to withdraw, leaving the amphibious force and the troops ashore entirely without local air support until a captured airfield on Guadalcanal could be completed and supplied with land-based aircraft. The tragic history of the weeks that followed, during which planes available for defense and for troop support were pitifully few, clearly demonstrated the importance of maintaining a continuous supply of carrier-based air power during the critical period between the

initial assault and the eventual establishment of land-based aircraft ashore.

It was late in August 1942 before land-based support operations actually got under way. Use was made of radio for communicating requests from troops to supporting planes, and from this experience came a realization of the tremendously increased effectiveness gained from having liaison officers who worked constantly with the troops and knew the special problems involved. As a result, the Navy organized a number of air liaison parties which, unlike the officers who went ashore on 7 August, were especially trained to accompany front-line troops and to relay their requests to the controlling command. Such parties were successfully used at Kiska, the Gilberts, and in subsequent operations. Eventually, their functions were taken over by units within the Marine and Army ground organization.

In the assault on Tarawa on 20 November 1943, there appeared for the first time the overwhelming concentration of air power that characterized all landing operations in the Central Pacific. A total of 17 aircraft carriers with a complement of 900 planes participated. Eight were the new, comparatively slow escort carriers assigned exclusively to tactical air support, a mission for which they were well fitted and which permitted the release of the fast carriers for use against enemy air bases and other distant targets. As escort carriers become available in increasing numbers it was possible to expand enormously the volume of air support.

During the Gilberts campaign use was also made of a specialized troop-support control unit afloat equipped both to receive and filter the requests for help and to assign offensive support missions to the aircraft overhead. In each succeeding operation air-support control units grew in size, number, and complexity, eventually assuming complete control of every air-borne plane in the objective area. These units func-

tioned first on battleships and later on command ships. The latter were converted transports with the necessary concentration of radar and radio-communications equipment. These ships were used as joint headquarters by the amphibious, shore, and air commanders.

Fighter direction, the control of defensive air support, was conducted in the Gilberts from designated ships in the landing fleet, but there was little coordination between such ships. After the experience of this operation control of all amphibious fighter-director teams was centralized in the existing air-support control organization, so that all support aircraft, both offensive and defensive, received direction and coordination from a single command. The two activities were thereafter physically located in adjacent control rooms on a command ship, which was in constant communication with subordinate control units or teams whether on other command ships, picket destroyers, or ashore.

In January 1944 the amphibious forces of the Central Pacific invaded Kwajalein. The pattern of tactical air support in Pacific amphibious operations emerged clearly. Although later operations brought increasing complexity and refinement in technique, no important departures from this pattern were made.

In the Marianas assault of June 1944 air-support control employed three command ships with additional standbys available. The development of standardized techniques made it possible to pass control of the air-support operations without interruption from one ship to another. Similarly, as land-based aircraft became established ashore, it was found feasible to transfer elements most closely integrated with troop movements to a control center on the beachhead while retaining afloat fighter direction, anti-submarine patrol, and air-sea rescue. Another new technique developed in the Marianas was the coordination of shore-based artillery, naval gunfire, and air support. By placing the sepa-

rate controllers on the same ship it was possible to select the most effective type of weapon (air, naval, or artillery) for each request from the ground troops.

In September 1944 came simultaneous landings at Morotai and the Palaus. Escort carriers provided the direct support for both. While the Morotai landing was virtually unopposed, fanatical resistance from underground positions and caves was encountered at Bloody Nose Ridge on Peleliu. In hand-to-hand fighting precision attacks by support aircraft were provided as close as 100 yards from front-line positions, a feat that would have been impossible without the rigid air discipline and concentrated control system developed in earlier operations.

In the campaign for the recapture of the Philippines, Army, Navy, and Marine aircraft participated together in tactical air support. Landings in the Leyte-Samar area were made on 20 October 1944 by forces under the command of General of the Army MacArthur. Although after softening-up by air and ship bombardment the landings were successfully made without too much ground opposition, Japanese sea and air resistance developed on an all-out scale. In the ensuing Battle for Leyte Gulf, the Air Support Commander carried his control to the point of diverting aircraft from troop-support missions to strikes against enemy surface forces. This was an outstanding example not only of the versatility of carrier aircraft but also of the flexibility of air power made possible by the type of air-support organization developed and perfected in the Pacific war.

In the Lingayen Gulf landing in January and the assault on Iwo Jima in February, air support followed the established pattern. The increasing use of Kamikaze attacks by the Japanese, however, emphasized the defense function of the air-support control units.

The largest amphibious operation of the Pacific war, the assault and occupation of Okinawa,

saw air support at its highest level. From 20 to 31 carriers provided tactical air support for 1,213 ships and 451,866 combat and service troops. As landing fields on Okinawa were captured and activated, a total of over 400 shore-based Marine and Army planes were added progressively to the carrier-based aircraft.

The statistics are impressive and indicative of the scope of the support function of aircraft. During 88 days, 1,904 direct-support missions were flown involving a total of 17,361 individual offensive sorties. An average of 560 planes was in the air each day on all types of missions, including defensive patrols. These aircraft expended 7,141 tons of bombs, 49,641 5-inch rockets, 1,573 wing tanks containing 260,000 gallons of napalm, the blazing gasoline jelly, and 9,300,000 rounds of 50-caliber ammunition.

Okinawa provided a crucial test for amphibious fighter direction. As in the Philippines, the intensity of Japanese opposition increased the importance of air defense. With an area of approximately 7,850 square miles to cover and with the majority of the enemy air strength based only 350 miles away in Kyushu to the north and in Formosa to the southwest, the magnitude of the centralized air-defense responsibility is apparent. During the first 54 days, 18,675 fighter-plane sorties were flown for the protection of the amphibious force alone, while in addition the fast and support carriers provided their own combat air patrol. In the 82 days during which the amphibious forces air-support control unit was responsible for the defense of the objective area, the Japanese dispatched 896 air raids involving more than 3,089 planes. Of these the centrally controlled combat air patrol over the objective area shot down 1,067 planes, including 50 shot down by night fighters. Antiaircraft fire and suicide dives destroyed at least 948 more, making a total of 2,015 Japanese planes. These figures do not include Japanese planes shot down by the combat air patrols over the

carriers and by the antiaircraft guns of the carrier forces which were not under air-support control.

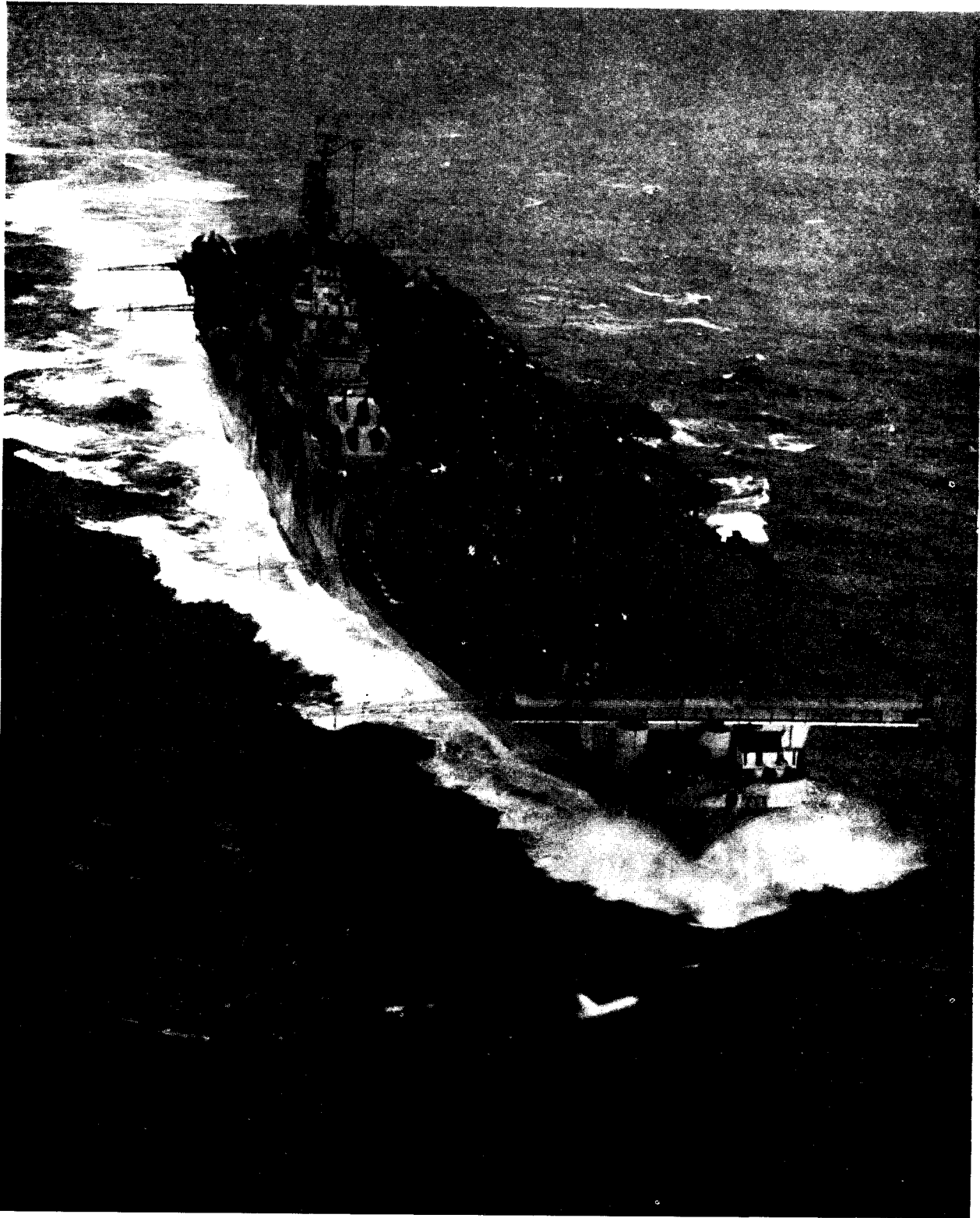
Enemy air tactics had been foreseen and 15 radar picket stations, located from 20 to 95 miles from the center of the area, had been established to cover paths of approach. Each station was manned by a radar-equipped destroyer or smaller vessel with a fighter-director team aboard. These teams were linked with the central air-defense control organization. They directed fighter patrols assigned to their sectors and passed control and information to other units as the raiders left their area. The picket line was so effective in intercepting enemy raids that the Japanese switched tactics and began to concentrate on picket vessels which heretofore had been neglected for larger and more profitable targets. Despite the pounding these picket stations received, which resulted in 7 destroyers sunk, 18 seriously damaged, and 6 damaged slightly, fighter-director ships were still on station when responsibility for air defense was transferred ashore to the Air Defense Commander 82 days after the original landings.

Air-support control as it functioned in the Okinawa campaign had grown to include more than aircraft. It provided for the integration of all available weapons -- land, sea, and air. For limited forces operating far from bases, economy in the use of weapons became mandatory. The control system provided for defense with a minimum of fighter planes, releasing others for support missions. It made possible the use of aircraft only against targets susceptible to air attack and saw that naval gunfire or field artillery was used where more efficient. Such an economical use of power grew from the Navy's concept of organization which treated all elements of the naval forces as integral parts of the whole complex required for control of the sea. Each should be used in the manner best suited to its inherent characteristics and all

should be formed into a unified operating machine through the task-force system. The air-support control units were themselves a specialized adaptation of the task-force pattern for the accomplishment of a well-defined mission.

Although the surrender of Japan made un-

necessary the final amphibious assault on the enemy homeland, the Okinawa operation demonstrated the ability of the United States to transport its forces over vast sea distances and to land them on a hostile shore. The possession of this technique altered the world's strategic picture.



IN BATTLE ARRAY
An Essex-class Carrier Plows Through Pacific Waters

I V THE JAPANESE OFFENSIVE--PEARL HARBOR TO MIDWAY

The nature of the area with its island bases and long lines of water communications made the conflict with Japan essentially a naval war. The advent of the airplane revolutionized the methods of attack but did not alter the basic concepts of strategy or decrease the necessity for controlling the sea. As an island empire, Japan was peculiarly susceptible to any interruption of its water-borne supply system and particularly to any action that would sever the connection with the East Indies whence came indispensable raw materials.

The actual conflict may be divided into three phases: the Japanese offensive from 7 December 1941, to 5 June 1942; the offensive-defensive from 7 August 1942, to 19 November 1943, during which Japan had lost the initiative but the Allies commanded resources only to mount limited operations and the United States offensive from 19 November 1943, to 15 August 1945.

Japan's decision to launch a war was based on the assumption that the conflict in Europe would render Russia and Great Britain negligible factors in the Far East. It was based on the further assumption that the United States, already committed to near belligerency in the Atlantic could not, even if finally successful in that theater, mount an offensive in the Pacific in less than 18 months to 2 years and would not in any case be willing to pay the price of total victory in the Pacific.

The Japanese set out to conquer the Philippines, the Dutch East Indies, Malaya, and Burma, which they appropriately called the Southern Resources Area. Judging that their principal enemy was the United States, the Japanese planned as initial objectives the destruction of a part of the United States Fleet and the acquisition of a line of military bases to rein-

force their existing positions in the Marshalls. Attainment of these objectives was to be followed by economic development of the Southern Resources Area and consolidation and strengthening of their newly acquired defensive perimeter in the Central and South Pacific. Japanese carrier forces operating from interior lines and supported by a land-based air force would be able to meet the United States counterattack if, and when, it came. The limited nature of these objectives was apparent in the failure to include seizure of the principal United States naval base in the Pacific at Pearl Harbor or damage to the Panama Canal and the ports on the west coast of the United States.

The Japanese recognized that control of the air was an essential condition to amphibious operations. The Japanese Fleet was therefore built around a striking force of 6 carriers to be drawn from a total of 10 available and 7 more under construction or being converted from merchant hulls.

With a high degree of tactical success this force struck Pearl Harbor on 7 December 1941, employing 360 of 414 embarked aircraft. Half the attacking force was directed against airfields in the Hawaiian Islands; half against fleet units in Pearl Harbor. Nineteen warships were hit among which were 5 battleships that came to rest on the bottom.

The Japanese then proceeded to the conquest of the Southern Resources Area which they completed in an incredibly short time. The combined aircraft strength of the Japanese Army and Navy, carrier- and shore-based, was approximately 2,625 units. These were opposed by approximately half that number of land-based aircraft widely dispersed among the various United States and Allied bases in the Far East.

At the points of conflict the Japanese achieved by virtue of the mobility inherent in a properly employed carrier force a numerical superiority of at least 4 to 1. To this factor must be added the intangible value of surprise, superb training, and combat experience. With the exception of three destroyers sunk by Allied submarines, not **one** Japanese major combat vessel was lost and very few were damaged. Their air, ground, and shipping losses were equally insignificant, while the United States, Great Britain, the Netherlands, and Australia lost the majority of sea, land, and air forces engaged. April 1942 found the Japanese with their empire greatly enlarged, their fleet intact, and morale at a high level.

Between 7 December 1941 and 9 April 1942, the Japanese carrier striking force had operated across a third of the earth's circumference, from Hawaii to Ceylon, and conducted strikes against ships and shore installations at Pearl Harbor, Rabaul, Ambon, Darwin, Tjilatja, Colombo, and Trincomalee. Allied losses to Japanese carrier air included five battleships, one aircraft carrier, one cruiser, and seven destroyers sunk or very heavily damaged; three battleships, three cruisers, and one destroyer damaged and thousands of tons of auxiliaries and merchant ships sunk. Hundreds of Allied aircraft, as well as docks, hangars, and base facilities, were destroyed or captured. The enemy force was seldom sighted and never effectively attacked. Control of the Western Pacific and its island and coastal perimeter lay in Japanese hands until such time as forces to challenge them could be constructed and assembled. The Japanese had not, however, brought to action the carrier forces of the United States Pacific Fleet, which remained the sole immediate threat capable of striking through their newly acquired defensive perimeter and of turning further amphibious advance into defeat.

Encouraged by the ease with which they

achieved their initial objectives in the first five months of the war and perhaps influenced by the carrier-launched Doolittle raid, the Japanese undertook the extension of their original defensive perimeter. At the cost of delaying the development of their newly acquired bases, they determined to cut the lines of communication between the United States and Australia by seizing Port Moresby, the last important Allied foothold in New Guinea, New Caledonia, the Fijis, and Samoa, and to improve the defensive perimeter on the east and north by the capture of Midway and the western Aleutians.

The Japanese then embarked on a three-pronged offensive. The first advance was directed against Port Moresby. In early May 1942, an amphibious force supported by three carriers, steamed south into the Coral Sea. A United States task force including the carriers *Lexington* and *Yorktown* discovered the transports on 7 May and sank the light carrier *Shoho* by air attack. Throughout the rest of the day both Japanese and United States carrier forces searched unsuccessfully for each other. Early the next morning contact was made and simultaneous air attacks launched. A Japanese carrier, the *Shokaku*, received severe damage from hits by dive bombers. The *Yorktown* took light damage; the *Lexington* with uncontrollable gasoline fires was abandoned and sunk by United States destroyers.

With their control of the air at the objective in serious doubt, the Japanese retired. The engagement, the first of four carrier duels to take place during the next 6 months, was tactically indecisive but of considerable strategic consequence. Japanese occupation of Port Moresby by sea was deferred to July and finally abandoned following the Battle of Midway. The Japanese Army thereafter attempted the conquest of Port Moresby over the Owen Stanley Mountains without air support. The result was the disaster at Buna.

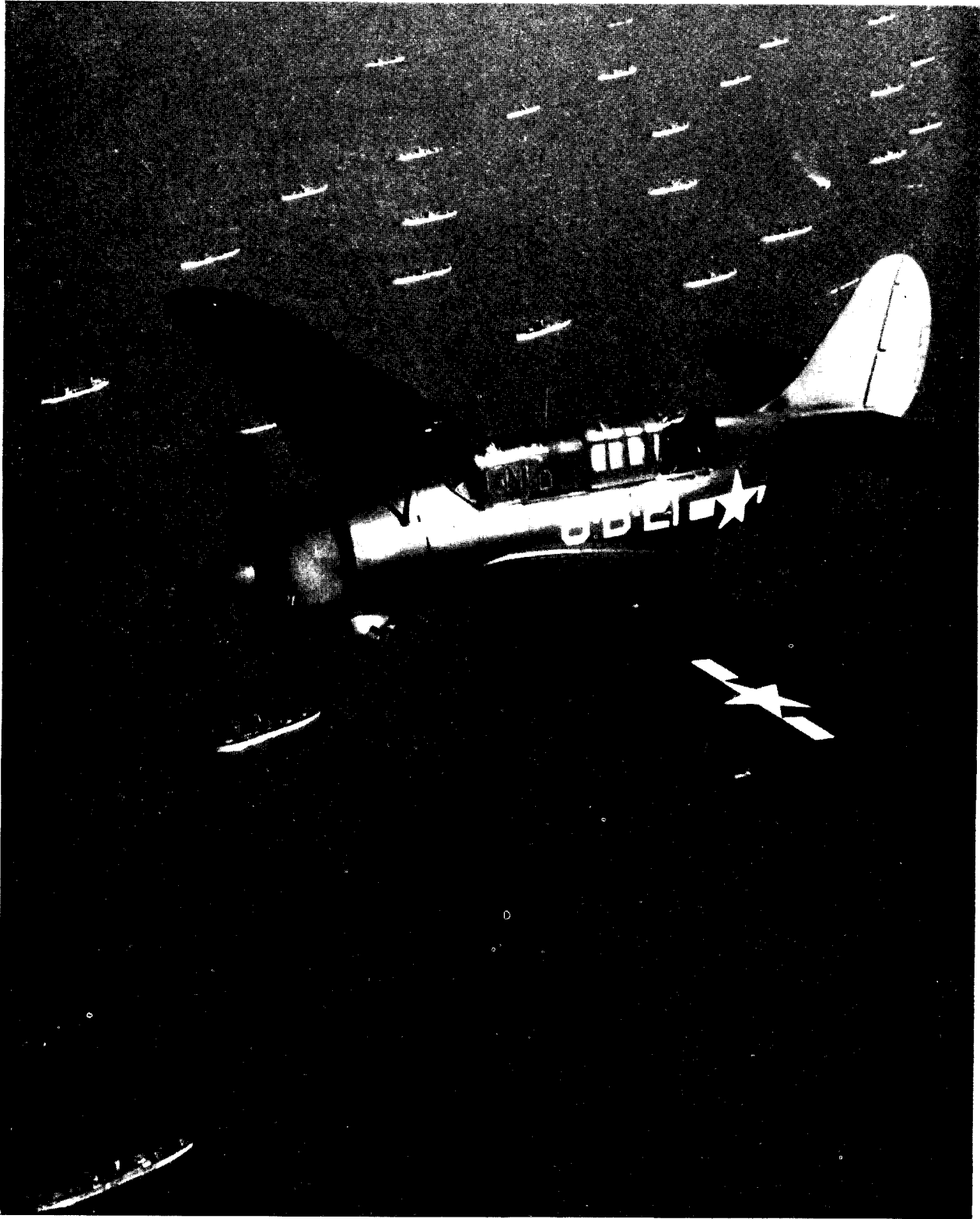
Aware of the fact that available United States carrier strength had been in or enroute to the South Pacific as late as 8 May, the Japanese designated 6 June as the date for the occupation of Midway to be preceded by a diversionary carrier strike on Dutch Harbor in the Aleutians. Against Midway was sent a transport force covered by the main strength of the Japanese Fleet including four carriers. A group of two carriers and escorts was assigned the task of raiding Dutch Harbor; this attack was to be followed by the occupation of Adak, Kiska, and Attu in the Aleutian chain.

On 3 June naval patrol planes made initial contact with the southern transport force steaming east toward Midway, and early on 4 June the main body of the Japanese Fleet was discovered. Concentrating on the destruction of the Midway air group, composed of Marine and Army aircraft and naval patrol planes, and diverted by torpedo-plane attack, the Japanese carriers were taken by surprise and fell before the dive bombers of a hastily assembled American carrier task force composed of the *Enter-*

prise, Hornet, and Yorktown. Three Japanese carriers were sunk. A fourth, seriously crippled, was finally destroyed by the Japanese themselves. In a counterattack the *Yorktown* was heavily damaged by aerial torpedoes and the following day sunk by an enemy submarine.

As at Coral Sea, with control of the air irretrievably lost, the Midway invasion force turned back. The Japanese, nevertheless, landed on Kiska and Attu on 6 and 7 June but canceled the occupation of Adak.

Two important naval actions had been fought without the forces themselves engaging in opposing surface gunfire. Aviation had demonstrated its latent power as the principal offensive element of the new American Navy. The loss of four of their finest aircraft carriers weakened the powerful striking force with which the Japanese had achieved their conquests. Battleships and seaplane tenders were withdrawn from the fleet for hasty conversion to carriers, but the Japanese Navy never regained the position it lost at Midway. The initiative had shifted to the United States.



ON GUARD
A Helldiver Escorts a Convoy

V

OFFENSIVE-DEFENSIVE—GUADALCANAL TO BOUGAINVILLE

The war plans in effect at the outbreak of the war were predicated on fighting the axis powers simultaneously. Since Germany was regarded as the more dangerous, it was made the preferred objective of United States efforts. Forces in the Pacific were expected to protect Allied territory and to limit the Japanese expansion as much as possible.

With the creation of the Joint Chiefs of Staff in January 1942, a more definitive strategic concept was devised, and in April 1942 revised war plans were adopted. The Pacific was divided into two theaters of United States responsibility, the Pacific Ocean Area and the Southwest Pacific Area. Forces assigned had the general tasks of containing the Japanese in their respective areas, protecting their own communications, and supporting operations in the adjacent theater. Although the victory over Germany remained the primary objective, nevertheless, as forces became available in the Pacific the strategy was gradually to become offensive. The Allies were ultimately able to conduct major campaigns in both theaters of the global war.

On 7 December 1941, the United States Navy had seven carriers, of which only the *Lexington* and *Enterprise* were immediately operational in the Pacific. The *Saratoga* was on the West Coast; the *Wasp*, *Yorktown*, and *Ranger* were in the Atlantic; and the *Hornet* was shaking down in the Caribbean.

From Pearl Harbor to Coral Sea the *Wasp* and *Ranger* remained committed to the Atlantic. Operations of the remaining carriers conformed to the wholly defensive strategy in the Pacific. On 1 February, a series of carrier raids was launched to delay or divert the enemy's advance. The *Enterprise* and *Yorktown* participated in a combined air attack, surface bombardment, and re-

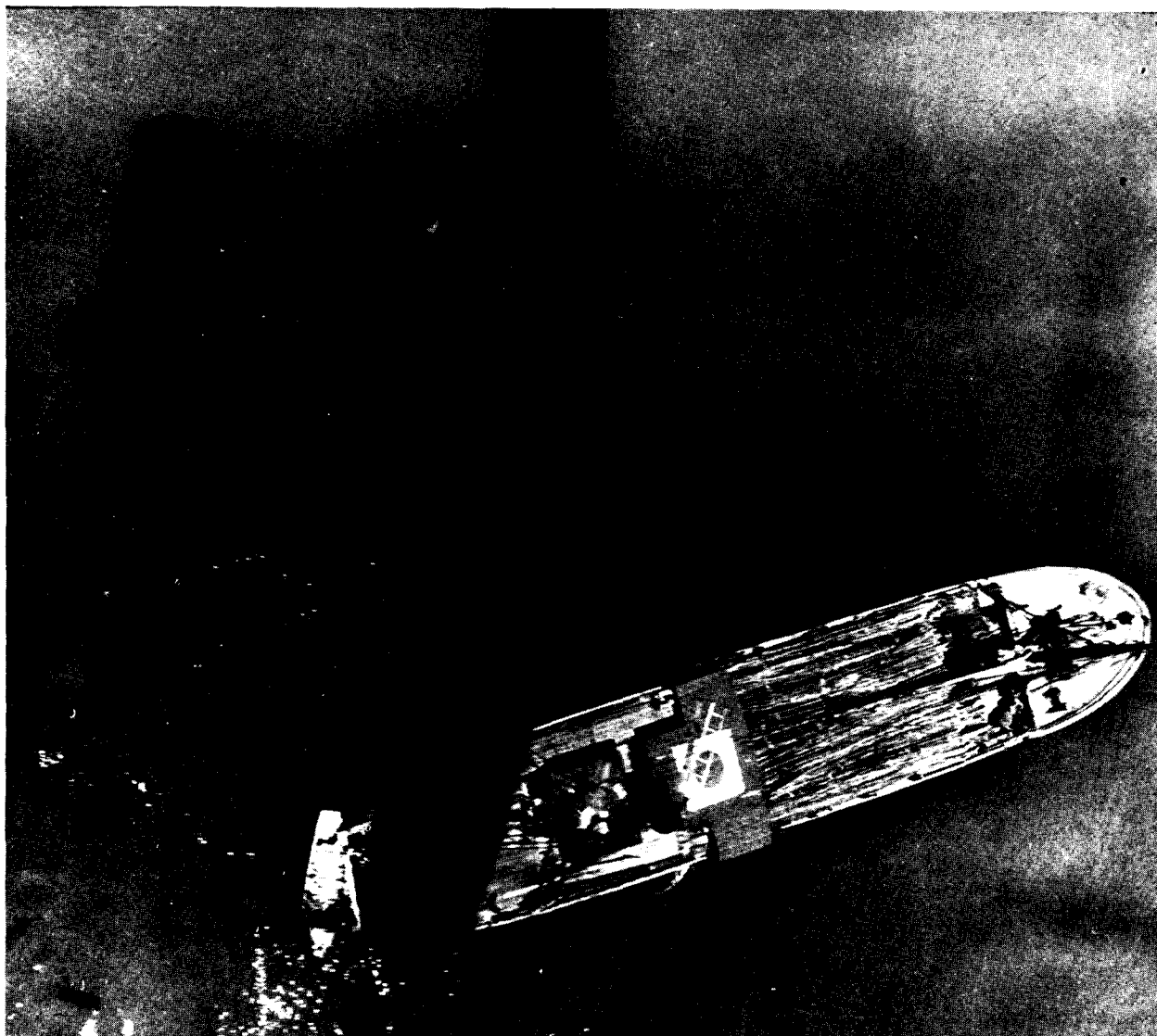
connaissance of the eastern Marshalls and northern Gilberts. A task group built around the *Lexington* was approaching Rabaul on 20 February when it was detected and forced to retire after successfully repulsing a Japanese bomber attack. Four days later the *Enterprise* and accompanying screen bombed and shelled Wake and then went on to launch strikes against Marcus. On 10 March the *Lexington* and *Yorktown* aircraft flew over the Owen Stanley Mountains to attack shipping at the eastern New Guinea ports of Lae and Salamaua where the Japanese had landed three days earlier. The Doolittle raid of 19 April on Tokyo was launched from the *Hornet* which, since it had Army bombers on deck, was supported by the *Enterprise*. Those early raids all met with a high degree of tactical success and demonstrated that carriers were not exclusively a Japanese weapon.

With the Battles of the Coral Sea and Midway, United States and Japanese carrier strength became nearly equal. At the same time the news that the Japanese advance was creeping down the Solomons and commencing the construction of an airfield on Guadalcanal made it advisable to undertake a limited offensive in the South Pacific. In view of the danger to supply lines to Australia and with the reassurance that the United States had 12 fast and 15 escort carriers on the ways, the Joint Chiefs of Staff determined to accept the risk, and orders were issued directing operations against the Japanese in the Solomon Islands. The first test of the Japanese perimeter came a year before the enemy expected it.

On 7 August 1942, the United States Marines landed on Guadalcanal, quickly overcame minor opposition, and captured a half-constructed airfield. The operation was covered initially by a task force of three carriers. Although the Jap-

anese were taken by surprise, their reaction was immediate and from 8 August through 15 November they attempted, by every means available, to retake the Guadalcanal airfield. United States forces remained on the defensive attempting to keep open the sea approaches and to hold and keep in operation the airstrip which had

been so easily taken on 7 August. During a series of duels between weakened carrier forces, numerous pitched air battles between land-based aircraft and several night surface actions, the issue remained in doubt until the Battle of Guadalcanal, 12-15 November. A Japanese attempt at limited reinforcement precipitated a



SHADOW OF POWER
A Coronado Menaces a Japanese Cargo Vessel

final night action on 30 November. The way was then clear for a land offensive which pushed back the poorly supplied Jap troops. In February 1943 some 10,000 survivors of the 30,000 troops which the Japanese had invested piecemeal in the campaign were evacuated.

United States forces began a slow advance up the Solomons chain leading toward Rabaul. As the Navy lost two carriers in the early part of the campaign, its first-line strength in the Pacific was reduced to two carriers, and this was a primary factor in explaining the slow progress of succeeding months. Guadalcanal air bases were expanded; the Russells were taken for an advanced fighter base; an amphibious campaign covered by planes from those bases took Munda and other points on New Georgia. From those airfields short amphibious advances took Vella Lavella and an island in the Treasury group on which further bases were built. A foothold at Torokina on Bougainville was obtained in November 1943. Only from here and from bases secured in similar short Southwest Pacific advances from New Guinea could land-based fighters finally reach the main Japanese base at Rabaul. Sixteen months elapsed from the date of the landing at Guadalcanal until the first South Pacific fighter planes flew over Rabaul less than 700 miles distant. Even then it was deemed desirable to take and develop further bases at Green Island and Emirau before the Rabaul area could be considered adequately covered; this consumed 3 months more.

The lessons and consequences of this long drawn-out campaign were numerous. It afforded an opportunity to perfect tactics by which the heavily armored United States fighter planes could master the brilliantly maneuverable but unarmored Japanese. It confirmed the need for close support of troops by aircraft and provided in numerous landings a school for the development of suitable techniques. It confirmed European experience as to the need for night fight-

ers and led to their inclusion in the first air echelon sent into captured bases. It provided opportunity for perfection of fighter direction and other techniques. It posed the question, only partially answered by heavy-bomber strikes, of an effective means of denying the enemy the use of the airstrips remaining in his possession in the northern Solomons and Bismarcks. It emphasized the importance of adequate search and reconnaissance including the use of land-based Navy aircraft, capable of penetrating enemy-held areas without escort, and of special photographic squadrons. Last, it saw the development of the Black Cats as all effective means of dealing with Japanese night shipping activities.

The air war was conducted principally by Marine and Navy shore-based planes of carrier types. Using largely dive and glide-bombing tactics, small planes proved most suited to this type of sea and island warfare in a theater where the supply problem was critical. Whether in terms of hits per gallon of gasoline, hits per pound of plane weight reflected in turn in time and effort of airfield construction, hits per dollar invested or flight crewmen risked, hits per hour flown, and in hits per ton dropped, the small, single-engine, low-altitude bomber with its crew of two or three and its ability to fly from short and narrow fields was the most effective weapon.

The campaign further demonstrated that the time required in the advance of a land based air force from one newly constructed air base to another placed a serious limitation on the ability of United States forces to capitalize on the destruction of an opposing Japanese air force. By the time the new position was fully developed and prepared to support a decisive air offensive, the Japanese had reorganized and reformed their units unhindered at the next base to the rear.

Whatever the lessons from the first sustained experience with United States power, the Japanese failed to profit from them. In the face of

rapid progress in radar search and fire control, night surface action once favorable to the inferior force and for which they had long trained was no better than action by day. But more important was what the Japanese lost: 2 carriers, 2 battleships, 6 cruisers, 39 destroyers, and some 3,000 aircraft and crews. The losses in heavy

ships were overshadowed by the attrition suffered in destroyers and other escort types which plagued them to the end of the war. Most serious of all was the loss of experienced air personnel, a loss which was never overcome. The Solomons campaign was a valuable laboratory to the side which could profit from experience.

The offensive against Japan depended upon United States forces supplemented by such units as its Allies could spare from commitments elsewhere. By the autumn of 1943 the United States was able to supply the Pacific theater with sufficient ships, planes, ground forces, and supporting equipment to undertake operations on a large scale.

Except for the Solomons and the Aleutians, where Attu and Kiska had been retaken, the Japanese still held the perimeter which they had staked out in 1942. The weakness in their strategic pattern was the separation of the industrial homeland from sources of raw material and the consequent dependence on water transportation not only to supply wide-flung military and naval units but also to maintain the Empire economy. Shipping and the supply routes presented an inviting objective. The second possibility was a bombing attack on the home industries which could be effectively conducted once strategic islands within range had been captured. Both these objectives could be attained if the United States won control of the sea in the western Pacific. This in turn required the defeat and, if possible, the destruction of the Japanese Navy and the capture by amphibious landings of those bases necessary to the operations of United States air and naval forces. From the Marianas it would be possible to bomb Japan and from the Philippines to sever the route to the Southern Resources Area.

Simultaneous advances were to be conducted by Southwest and Central Pacific forces. Based on Australia, the first was to proceed by a series of amphibious hops along the north coast of New Guinea to Morotai and thence to the Philippines. Except for three of the longer jumps, this campaign did not require carrier aviation and could

be conducted by the Army supported by land-based air and relatively light naval forces. The Central Pacific, however, presented the problems of much longer over-water operations starting from the Ellice Islands and proceeding from the Gilberts through the Marshalls and Marianas to the western Carolines from which a long jump could be made to the Philippines in collaboration with the Southwest Pacific forces. Because land-based air cover was impossible to maintain beyond 300 miles from base, carrier aviation necessarily played a major role. As it was expected that the Japanese Fleet would make its main resistance in this area, both carriers and heavy naval units were assigned to the Central Pacific. With the taking of the Philippines, the same forces could be withdrawn and used to move north and west from the Marianas toward the Bonins and Okinawa and finally to prepare an amphibious assault on the Japanese homeland.

The contribution of naval aviation to the Southwest Pacific advance was largely in reconnaissance and antishipping attacks. Marine air units were retained in the northern Solomons and the Admiralties to interdict bypassed enemy garrisons on Bougainville, New Britain, and New Ireland. In the Central Pacific the Navy had available both fast and escort carriers in increasing numbers, its land-based and tender-based squadrons, and Marine garrison air forces. Although the Army-Air Forces supplied heavy and medium bombardment groups as needed, the nature of the Central Pacific made the theater primarily a Navy responsibility. With the necessary equipment on hand and assured of a continuing supply of replacements and reinforcements, the United States prepared to launch its drives at the Japanese Empire.

The summer of 1943 saw the Marine and Army air units in the Solomons and the Fifth Army Air Force in New Guinea engaged in a death struggle with Japanese naval aviation based at Rabaul and Bougainville. Because it was expected that an advance on the Marshalls might be met with opposition of the same intensity and caliber the first steps were cautious. Airfields were constructed at Funafuti, Nanomea, and Nukufetau in the Ellice chain, and Baker Island was developed as a staging base for Army bombers based at Canton. Search and photographic reconnaissance by Navy squadrons and bombing by Army aircraft were initiated against the Gilberts and southern Marshalls. The fast-

carrer forces conducted strikes against Marcus in August, Tarawa and Makin in September, and Wake in October. These were in the nature of training and probing operations for the new *Essex*- and *Independence-class* carriers as they arrived in the Pacific. By November four large and five small carriers had been added to the existing force which comprised only the *Enterprise* and *Saratoga*, and a total of eight escort carrers had been assembled. It was now possible for the first major carrier-paced offensive to begin.

The air garrisons in the Gilberts, 100 miles to the north at Mille in the Marshalls, and 530 miles to the west at Nauru were overwhelmed



SEA POWER

U. S. Warships in the Admiralties

by carrier strikes on 19 and 20 November. These were carried out by the 11 fast carriers organized in 4 task groups, the largest carrier force yet assembled by any navy. On 20 November the marines landed on Tarawa, which fell after 2½ days of heavy fighting. The escort carriers and 1 fast-carrier group provided direct support, while other groups covered the approaches. Makin and Apamama were taken with ease and although the Japanese Navy made no effort to contest the landing by surface action, it did launch a series of troublesome and damaging night torpedo attacks by aircraft from Kwajalein. Despite daily bombings and daylight fighter patrols the planes staged through Mille in the evening.

With the Gilberts in friendly hands preparations were made for the assault on the Marshalls. Photographic reconnaissance by a carrier task force on 4 December 1943, confirmed by the pictures later brought back by Navy Liberators, showed that the enemy had fortified Maloelap, Wotje, and Mille in the outer ring of islands but had much less extensive installations on Kwajalein and Eniwetok farther to the west and none at all on Majuro, an atoll with sufficiently large anchorage for the fleet and land space for an airfield. Rather than assault the main Japanese defenses with the resultant heavy casualties as had occurred at Tarawa, Kwajalein, and Majuro became the first objectives in the Marshalls to be followed by landings on Eniwetok.

The operation commenced with an air bombardment by Army, Marine, and Navy units based in the Gilberts. Profiting from the example of the enemy at Pearl Harbor, the fast carriers approached from a direction in which Japanese searches were known to be weak. On 29 January 1944 approximately 700 aircraft struck Kwajalein, Maleolap, and Wotje and by evening there was not a Japanese plane operational east of Eniwetok. The latter was cleaned out the next day. Two landings were made on Kwa-

jalein Atoll, and by 4 February enemy resistance was overcome. In the meantime Majuro had been occupied without opposition. The loss of bases in the Marshalls caused the Japanese to withdraw the First Mobile Fleet from Truk, part to Singapore and the remainder to home waters,

Although it had not been planned to take Eniwetok until May, the speed with which Kwajalein Atoll had fallen was exploited by changing plans on the spot. Uncommitted reserves from that operation landed on Eniwetok on 17 February, and within 6 days the atoll was secure.

Truk was not only the reputed center of Japanese naval strength but was also the base from which air reinforcements could have been flown into the Marshalls. During the capture of Kwajalein and Majuro, night torpedo attacks like those experienced in the Gilberts had been prevented by keeping a combat air patrol over Eniwetok through which enemy planes would have had to stage. When an attack on the latter atoll was scheduled, the time seemed ripe for a raid against Truk itself. Although the nature and extent of the enemy installations had been a carefully guarded secret, Marine photo-Liberators from the Solomons had obtained a few pictures on 4 February which indicated that an air strike would be well within the capabilities of the fast carriers and the targets would be worth the risk. Achieving complete tactical surprise, a force of 5 large and 4 light carriers struck Truk on 16 and 17 February, destroying 26 merchant vessels, 6 warships, and 270 aircraft and inflicting damage on installations. One United States carrier was damaged in a night aerial-torpedo attack and, with 2 other carriers to provide cover, retired to Pearl Harbor.

Success at Truk led to a decision to turn north and investigate Japanese bases in the Marianas. Detected during the approach on 21 February, the six-carrier force fought its way without significant damage through a night-long series of attacks by land-based aircraft and carried out

the operation as scheduled. The Japanese First Air Fleet, already greatly reduced by actions in the Marshalls and at Truk, lost much of its remaining strength and the first photographs were obtained of installations and beaches in the Marianas.

The Truk and Marianas raids demonstrated the decisive striking and defensive power of the fast-carrier task force. Although tactical surprise was achieved frequently during the war, the Japanese in the Marianas were fully warned by their search planes about 18 hours in advance. The Japanese failure to stop the attack indicated that, concentrated in sufficient numbers and properly handled, carriers could operate against shore-based aircraft even without the element of surprise.

With the development of United States bases in the Marshalls, Palau and adjacent atolls became the only Japanese fleet anchorages in the Central Pacific remaining free from land-based air attack and reconnaissance. To prevent its use during Southwest Pacific operations at Hollandia, Palau was chosen as the next target for the fast carriers. Approaching from the southeast through the Admiralties, the carriers destroyed the Palau air garrison on 30 March and a wave of air reinforcements the following day. A feature of the attack was the first mining by carrier planes, which effectively closed the harbor for a month to 6 weeks. The enemy also lost 104,000 gross tons of war and merchant ships including 6 tankers of 47,000 tons, and 150 aircraft were destroyed. Because complete surprise had not been obtained, 4 war vessels and 15 to 20 merchantmen had escaped on 29 March.

After replenishment the fast-carrier task force went on to cover and support the landings of Southwest Pacific forces at Aitape and Hollandia on the north coast of New Guinea on 21 April 1944. These landings involved bypassing strong enemy positions at Hansa Bay and We-

wak in the longest hop yet made by Southwest Pacific forces. Although the Fifth Army Air Force in a series of brilliant operations had destroyed enemy air opposition in New Guinea, it was feared that the Japanese might bring up reinforcements and attack the amphibious force beyond the range at which land-based air could provide continuous cover. The presence of carriers insured carrying out the landings without interference, and because the enemy refused to risk further losses, the carrier planes had little to do.

Returning from Hollandia, the fast carriers struck a second time at Truk on 29 and 30 April. Since there were only a few small craft in the harbor, the attack was directed against shore installations and the remaining air strength. Japanese naval officers later testified that the two carrier strikes effectively destroyed Truk as an air and logistics base, a blow from which subsequent bombardment by Army aircraft from Bougainville and Eniwetok prevented all recovery.

Between 29 January and 30 April 1944, fast-carrier operations not only caused the enemy severe losses in ship and planes, but also provided information about Japanese installations in the Carolines, Palaus, and Marianas. From Eniwetok and other bases in the Marshalls and from South and Southwest Pacific airfields on Bougainville, Green, and Emirau, naval search planes could continue the collection of intelligence and carry on antishipping attacks. Marine garrison air forces effectively neutralized bypassed islands and Army bombers prevented further use of the great base at Truk and raided other installations.

In the meantime the carrier and amphibious forces prepared for landings in the Marianas. In staging planes from the home islands to the South Pacific, the enemy had a choice of going either through Formosa and the Philippines or through the Bonins and Marianas to the Palaus and Carolines. Shipping also proceeded along

much the same routes. The capture of the Marianas would sever one of the main lines between the Empire and the south, result in the acquisition of bases from which to bomb Japan, and assist southwest Pacific forces advancing along New Guinea toward the Philippines. As the commander in chief of the Japanese combined fleet, Admiral Toyada, declared, "The war is drawing close to the lines vital to our national defense."

Although aware of the departure of the first carriers from Majuro on 6 June, the Japanese did not know their objective until a fighter sweep eliminated their aircraft on the afternoon of 11 June. Tactical surprise was achieved by simultaneous operations in the Southwest Pacific area to which the force might have been proceeding and by naval patrol planes that shot down or drove off enemy search planes which might have discovered the carriers in transit. From the eleventh until the landings 4 days later, Guam, Tinian, and Saipan were held under constant attack, and on 13 June two fast-carrier task groups were sent north to disrupt the movement of enemy aircraft from the home islands through the Bonins. Carrier aircraft destroyed 120 Japanese planes on Iwo and Chichi Jima on 15 and 16 June.

Troops went ashore on Saipan as scheduled on 15 June but met unexpectedly heavy resistance which delayed the planned landings on Tinian and Guam from 18 June to 21 July. The escort carriers, which provided the bulk of the air support and defense against enemy land-based planes, maintained control of the air until 27 June, when 74 Army P-47's, flown ashore from escort carriers, which had brought them from Pearl Harbor, took over the task. Saipan was secure on 7 July.

The threat against a vital communications and supply artery brought the enemy fleet to action. On 14 June a submarine reported that large forces had sortied from Tawi Tawi in the

Sulu Archipelago. The Japanese Fleet was preparing to give battle. Misled concerning United States intentions by the timely landing of Southwest Pacific forces at Biak on 27 May, the Japanese expected a major landing in the Palaus or Moluccas. It was not until the amphibious force, assembled in the Admiralties, turned north toward the Marianas that the Japanese learned the objective and started their fleet northeast.

On receipt of the submarine report the two task groups attacking the Bonins were called south. Seaplanes operating from tenders in the open sea off Saipan and naval patrol planes from Southwest Pacific bases extended their searches to the outer limit of endurance. On the 15th, submarines reported large fleet units passing east through the Philippines by San Bernardino Strait.

With the Japanese Fleet approaching, a high-speed run to the west by the fast carriers was considered. The position of the landing forces, however, was precarious with much needed equipment still being unloaded from the transports. So long as there existed a possibility that undetected enemy units might be approaching from another quarter, the main elements of the United States Pacific Fleet were retained within striking range of Saipan. Once landing forces had been committed, they required defense against any possible interference from outside. The fast carriers, therefore, remained west of the island until Japanese intentions were definitely known.

At 0730 on 19 June combat air patrols reported increased air activity over Guam, an indication that the Japanese land-based airforce was bringing in planes from the Palaus to coordinate its activities with the approaching carriers. By 0950 radar screens began picking up large groups of enemy planes to the southwest. From the time the first United States planes made contact, air combat persisted

throughout the day until 1823, when a large group of enemy planes was intercepted while preparing to land at Guam. The fighter directors worked efficiently and only a few small, disorganized flights penetrated to the United States forces, scoring a bomb hit on the *South Dakota* and some near misses which caused negligible damage. In return, the enemy lost 385 planes in the air raid 17 on the ground.

The defeat of the enemy air force altered the situation so that the planes of the escort carriers were sufficient to protect the amphibious forces. The fast carriers moved west in pursuit of fleeing Japanese naval units. Although United States submarines had already sunk 2 enemy carriers, the main fighting strength of the Japanese Fleet remained. Late in the afternoon of 20 June a strike was launched and caught the enemy at extreme range. In the ensuing attack another carrier and 2 fleet oilers went down and 7 ships were left damaged. Even though about 100 planes were lost either in combat or through landing on the water when their fuel ran out, the United States units continued the pursuit during the night and the next day until it became evident that all chance of contact had been lost.

The Battle of the Philippine Sea did not result in the destruction of the enemy fleet, the bulk of which escaped to home waters. It did, however, mean the end of Japanese carrier aviation as an effective fighting force. It never recovered from the loss of trained air groups off Saipan.

The remainder of the Marianas campaign passed off without enemy interference. The fast carriers were rotated by groups for replenishment. Those which remained continued the neutralization of Iwo Jima and gave support to landings on Guam and Tinian. Even before the Marine fighter garrison had assumed control at Guam, the fast carriers went south to photograph and pound installations at Palau and Yap. With a final carrier raid and surface bombardment of

the Bonins the participation of the fast carriers ended. From 11 June through 5 August, United States carrier aircraft had shot down 915 enemy planes and destroyed another 306 on the ground. The inner Japanese perimeter had been broken and the primary line of communications with the south severed.

In the summer of 1944 the area separating Central and Southwest Pacific forces was growing smaller. Simultaneous landings at Palau and Morotai in September would bring them within 500 miles of one another and make possible a common advance into the Philippines. The plan for Palau also included the capture of Yap and Ulithi in the western Carolines which would provide safe anchorages for the fleet such as were not available in the Marianas.

Covering and diversionary operations by Central Pacific forces began on 31 August when a fast-carrier group hit the Bonin and Volcano Islands followed by further air strikes and cruiser and destroyer bombardment on 1 and 2 September. In all 54 Japanese aircraft were destroyed. The entire task force then raided Palau and Yap after which 3 task groups went on for a 6-day series of attacks on Mindanao in the Philippines. Because Japanese forces on Mindanao were unexpectedly weak, the planned attacks were cut short on 10 September and the carriers moved north to fuel and prepare for raids on the Visayans in the central Philippines.

Two days of strikes on 12 and 13 September proved much more profitable. Although Japanese air attacks were sporadic and ineffective, considerable opposition was experienced over airfields, and the final score showed over 300 enemy planes destroyed, and 13 large merchant ships, 20 smaller ones, and 35 sampans or barges sunk. On conclusion of these strikes, 1 carrier group went south to cover the landings on Morotai and 1 east to Palau, while the third replenished preparatory to attacks on Luzon.

Landings were made by the marines on 15

September on Peleliu Island and by the Army on 17 September on Angaur, with direct air support furnished by escort carriers augmented by fast-carrier groups. By 24 September captured airstrips were in use by shore-based Marine aircraft and a heavy-bomber runway was operational by 16 October. Carriers were withdrawn on 1 October. The only enemy air opposition had been harmless, night attacks by a single float **plane**. Opposition to Southwest Pacific landings at Morotai was light.

From 21 to 24 September the fast-carrier task force returned to the Philippines. Airfields on Luzon and the harbor of Manila were attacked for the first time in almost 3 years of Japanese occupation. After 2 days with excellent results the carriers returned once more to the Visayans. During the month of September, carrier operations in the Philippines destroyed over 800 enemy aircraft and sank over 150 vessels without damage to United States ships and with relatively minor losses in planes. The assault on a land mass defended by hundreds of aircraft dispersed on scores of fields demonstrated on an unprecedented scale the ability of carriers to gain and maintain control of the air and was basic to any plan for invasion.

Because the successes of the fast-carrier strikes and intelligence information indicated the weakness of Japanese forces in the Visayans, it was decided to move against them as rapidly as possible. The plan for the capture of Yap was dropped, and landings in the Leyte-Samar area were scheduled for 20 October 1944 by forces under command of General of the Army MacArthur. The Seventh Fleet, which operated under General MacArthur, was augmented by units from the Pacific theater including amphibious elements, 18 escort carriers, and land- and tender-based patrol planes. The fast-carrier task forces were retained under Pacific Fleet command for covering and supporting the Central Pacific areas and also were assigned mis-

sions in full support of the Leyte operations.

Preliminary to the landings, air operations against the Philippines were stepped up. Naval patrol-plane searches from the Southwest Pacific were extended to cover the southern and central Philippines and coordinated searches were made by the Fourteenth Army Air Force based in China. Throughout October the carriers attacked the Ryukyus, Formosa, and the Philippines, destroying another 1,000 aircraft. In the most intense air reaction of the war to date, the Japanese sent 600 sorties against the task force attacking Formosa, but the effectiveness of carrier fighter-plane and anti-aircraft defense limited the damage to 2 cruisers which were towed back to base.

Directly supported by aircraft from three divisions of six escort carriers each, the landings commenced with the capture of minor outposts in lower Leyte Gulf on 17 and 18 October. On 20 October the main landings were made on the beaches of upper Leyte Gulf. Although initial ground opposition was relatively light, the enemy committed his entire fleet.

The Japanese converged upon Leyte Gulf from three directions. A southern force, which transited the Sulu Sea, was met and decisively defeated in a night surface engagement in Surigao Strait. Enemy carriers approaching from the north were destroyed by the fast carriers off Cape Engano. Although attacked by air on 24 October as it crossed the Sibuyan Sea, a third enemy force succeeded in passing through San Bernardino Strait and surprised an escort-carrier unit off Samar. Despite superiority in armament and numbers this force was driven off and retired by the route it had come under constant air attack. The failure of the Japanese to carry off a daring maneuver may be attributed to skillful handling of the older battleships and to the efficiency of United States radars that turned the engagement at Surigao into a disaster and also to the enemy's inability

to coordinate land-based air with the movements of his fleet. As a result, the Japanese lost 4 carriers, 3 battleships, 10 cruisers, 9 Destroyers, a submarine, and some 370 aircraft compared with the United States losses of a light carrier, 2 escort carriers, 2 destroyers, a destroyer escort, and 99 planes.

With the Battle for Leyte Gulf control of the sea passed completely into the hands of the United States. The Japanese Navy ceased to exist as an effective fighting force. Although at Coral Sea, Midway, and the Philippine Sea contact had been between air components of the respective fleets, the Battle for Leyte Gulf, one of the great naval engagements of history, was a combined air-surface action, which demonstrated the integration and flexibility of the United States naval forces. It was the combination of various agents that brought victory as the following tabulation of enemy losses will show: 13 war vessels were sunk by carrier aircraft alone, 8 by naval surface ships alone, 2 by submarines alone; a cruiser, crippled by surface action, was later sunk by carrier aircraft; a second such cripple sank after repeated heavy attacks by Army B-24s; a carrier, mortally damaged by carrier air attack, was sunk by surface action; and a cruiser damaged by carrier aircraft was sunk by a submarine.

United States battle damage and aircraft losses had forced one of the three escort-carrier units to retire, and a second was badly hurt by suicide attacks. This reduction in air strength at the objective area made it necessary to call in the fast carriers for close support. For the remainder of the month the fast carriers flew fighter sweeps over the Visayans and Luzon. On 27 October, with only one airfield in operation, the Army's Far East Air Forces assumed responsibility for air defense and support of troops in the Leyte-Samar area, and within a few days the remaining carriers withdrew. Because the Japanese were making strenuous

efforts to increase their Philippine air strength and on 1 November made strong suicide attacks which sank one destroyer and damaged three others in Leyte Gulf, the Southwest Pacific command immediately requested further assistance from the carrier forces. A long-planned carrier attack on the Empire was abandoned and throughout November the fast carriers continued to strike at Japanese aircraft and shipping in the central Philippines and on Luzon. Over 700 aircraft and 134,000 tons of shipping were destroyed in these attacks.

Although bad weather severely hampered airfield construction, by early December, Army and Marine shore-based squadrons had taken over control of the air around Leyte. With the ground campaign progressing satisfactorily, Southwest Pacific forces prepared to resume their advance by landing on Mindoro Island. Since the invasion fleet would have to move through confined waters within the Philippine Archipelago, where it would be peculiarly vulnerable to enemy air attack, direct coverage was furnished from escort carriers of the Seventh Fleet, which beat off suicide attacks and restricted losses to two LST's sunk and a cruiser and destroyer damaged. To prevent enemy air operations at the source three fast-carrier task groups maintained continuous air patrols over Japanese fields on Luzon. Often referred to as the Navy's rolling blanket, this new technique accounted for 298 enemy planes in three days, three-fourths of them on the ground. A further 45 Japanese aircraft were shot down by the combat patrols of the escort carriers and another 55 were either destroyed by ships' gunfire or expended themselves in suicide dives.

With Mindoro in the hands of United States troops and with the end of organized resistance at Leyte on 20 December, the way was open to commence operations against the important Luzon area, the center of Japanese power in the islands. Army aircraft began a series of strikes

on the great complex of airfields around Manila and completed the disorganization of Japanese air forces which had been well advanced by over three months of carrier-plane attacks. Already 1,500 enemy planes had been destroyed on the ground in the Philippines and during the three-month period carrier aircraft had accounted for 3,800 Japanese planes in the air and on the ground in the Philippines-Formosa-Ryukus area .

The climax of the Philippine campaign was the invasion of Lingayen Gulf in western Luzon. The military objectives of the operation were the seizure of the central Luzon plain and the Manila area and the denial to the enemy of the northern entrance to the South China Sea. The reinforced Seventh Fleet was to transport, protect, and land the invasion forces by a route passing west of Luzon through the inland waters of the Philippines. Direct air support was to be provided by escort carriers while the Army Air Forces neutralized Japanese air bases to the south and the fast carriers took care of those in Formosa, the Ryukus, northern Luzon.

Army heavy bombers began raiding Luzon airfields on 22 December. Navy search planes from Leyte and Mindoro, coordinated with long-range aircraft from China, extended their patrols of the sea approaches to cover all the Philippines and the South China Sea. On 3 January, as mine-sweeping, bombardment, and escort-carrier units started their northward advance through the Sulu Sea, the fast carriers initiated 2 days of strikes against Formosa and the Ryukyus. Despite Japanese efforts at dispersal and camouflage, over 100 aircraft were destroyed, the majority on the ground. Designed to prevent reinforcement of Japanese air power on Luzon, this effort also reduced the number of planes on Formosa which were available for direct attacks on United States forces in Lingayen Gulf. On 4 January 1945, the hoarded remnants of the Philippine air garrison

began suicide attacks on the advancing ships, sinking an escort carrier. On the following day Kamikazes caused damage to another escort carrier, 2 cruisers, and a destroyer. To relieve the escort carriers already fully occupied with defense of the amphibious fleet, the Southwest Pacific command requested that the fast carriers operate south of their originally designated area so as to cover the chain of bases centered around Clark field near Manila. Repeated strikes on 6 and 7 January destroyed over 110 enemy planes and combined with the sweep of land-based planes and the activities of the escort carriers, reduced enemy sorties from about 130 on the sixth to less than half that number on the seventh.

Some aircraft, however, escaped the vigilance of the attacking forces. Since every Japanese plane, except a handful reserved for the evacuation of staff officers, was designated for a suicide mission, the invasion forces were exposed to serious danger. Although Japanese orders directed that Kamikazes concentrate on the transports, actually the combatant ships in Lingayen Gulf received the heaviest damage. The situation appeared so serious that the fast carriers, which had planned to attack Formosa on 7 January, were retained to continue their raids on Luzon. Kamikazes continued to appear in twos and threes for a week or more but they were merely the remnants of the enemy air forces in the Philippines. On 8 January, the Japanese naval air commander had left for Singapore and his staff for Formosa, while the commanding general of the Fourth Air Army retired, without his army, to the hills of Luzon.

The troops went ashore on 9 January. The conquest of the Luzon plain turned out to be easier than expected, and without air support the enemy could put up effective resistance only in mountain areas. When on 17 January the Army Air Forces with which Marine squadrons were operating assumed responsibility for



AMPHIBIOUS ASSAULT
Iwo Jima, 19 February 1945

air support, the escort carriers withdrew. Although the Japanese continued to hold out in parts of the Philippines until the end of the war, the principal naval advantages of the request were gained by mid-January. United States forces not only controlled the sea but had severed the last route to the Southern Resources Area. Between 10 and 19 January the fast carriers were in the South China Sea, and American planes destroyed 57 ships along the coast of Asia, ranging as far south as Camranh

Bay in Indo-China. Such small vessels as the Japanese tried to slip through after January were effectively checked by the collaboration of submarines and naval land-based patrol planes.

The Philippines campaign revealed the poor state of the Japanese air force. Although production of planes had been increased in 1943 and 1944 so that more aircraft were available than ever before and even though the quality of the planes improved, the ratio of losses in combat mounted higher and higher. All United

States aviators agreed on the cause. The Japanese had failed to replace the superb pilots who rode so high in the first year of the war. The enemy's training program had broken down. With adequate numbers of aircraft and poorly trained pilots the Japanese resorted in desperation to Kamikaze, suicide tactics; they turned their aircraft into guided missiles and flew them onto the decks of United States ships. It was an effective, dangerous, but not decisive, maneuver. The percentage of hits did not exceed that achieved by American carrier flyers using conventional bombing methods.

After the conquest of the Marianas in June 1944, Central Pacific forces had turned south to meet Southwest Pacific forces in the Philippines. In February 1945, they were ready again to move north and west in operations preliminary to the invasion of Japan itself. Iwo Jima was selected as the next objective in order to secure a base from which Army fighters could escort B-29 strikes on the Empire and also to stop damaging raids from Iwo against the crowded airfields on Saipan. Preliminary bombings of Iwo and the minor air base at Chichi Jima were conducted by shore-based aircraft from the Marianas. Reinforced by B-29 reconnaissance flights, naval shore-based and tender-based patrol planes extended the air search to the coast of Japan itself. Covering operations for the invasion were begun by the fast carriers on 16 and 17 February when the first carrier raids were made on the Tokyo area of the Japanese home islands. On those two days and again on the 25th strong air opposition was encountered despite bad weather. During these raids, 420 Japanese planes were shot down, 228 were destroyed on the ground, and a limited number of sorties were directed against strategic targets such as aircraft-engine plants and airplane factories.

The pattern of attack at Iwo followed that of other amphibious operations. Direct air sup-

port and defense were furnished by escort carriers with the fast carriers preventing the enemy from bringing up reinforcements. The Marines on shore, however, encountered the most vicious and determined defense of the Pacific war. The Japanese had taken advantage of the natural terrain to build a complete underground defense system much of which defied the most intense air and surface bombardment. In many parts of the island the marines had to dig out and kill the enemy individually. From 19 February to 16 March bitter fighting continued until the Japanese garrison was virtually eliminated.

If the price for Iwo Jima was high, the results were also great. On 8 March, naval patrol planes began to use the island for searches that covered the coast of Japan as far as Tokyo. Army fighter planes from Iwo escorted the B-29's of the Twentieth Air Force on their devastating raids against Japanese industries, and the big bombers used the island as an emergency-landing field. Between March 1945 and the close of the war over 2,400 B-29's put in at Iwo with an incalculable saving in planes and lives. The existence of an emergency field made it possible to reduce the amount of gas carried for reasons of safety and to increase the bomb load. Finally, from Iwo Jima air-sea rescue planes could cover most of the B-29 route from the Marianas to Japan.

The reconquest of the Philippine's had permitted the United States to sever the connection with the Southern Resources Area. The Japanese could obtain only a trickle of supplies from the mainland by way of the East China Sea and the Straits of Tsushima. Before an assault on the home islands could be launched, more fleet anchorages, airfields, and staging areas for troops were required. All of these objectives could be satisfied by the occupation of Okinawa in the Ryukyus. Accordingly, the Joint Chiefs of Staff directed that Central Pacific forces undertake the operation.

The assault on Okinawa was the largest amphibious operation of the Pacific war. The joint expeditionary force included 1,213 ships, 564 support aircraft based on escort carriers, and 451,866 Army and Marine ground troops. Also available for air support as well as to prevent enemy interference and reinforcement were a fast-carrier force with 82 ships and 919 planes and a British carrier force with 22 ships and 244 planes. For interdiction and neutralization raids against enemy air bases there were the Army's Twentieth and Far East Air Forces.

Preassault operations were initiated by fast-carrier attacks on Kyushu, Shikoku, and western Honshu on 18 and 19 March. Beginning on 23 March, the fast carriers operated continuously for 2½ months in the Okinawa area, providing direct air support and cover for the amphibious forces. These were the longest sustained carrier operations of the war.

Islands in the Kerama Retto, 15 miles to the west of Okinawa, were seized on 26 March in order to provide a protected anchorage and a base for logistic support. From tenders seaplane searches extended far into the Yellow Sea and to the Straits of Tsushima between Korea and Japan. Day and night antisubmarine patrols were flown by patrol and carrier planes completely around the southern Ryukyus where the surface ships were operating. Search aircraft, acting in coordination with submarines, watched the exits from the Inland Sea.

At 0830 on 1 April 1945, the amphibious assault on Okinawa itself began. Landings were made over the western beaches against unexpectedly light opposition, and by noon the two airfields at Yontan and Kadena had been captured. As operations ashore progressed, Japanese resistance increased. On 19 April heavily defended positions to the south were encountered and a long drawn-out battle began.

The expected air reaction was slow to materialize and for the first few days was relatively

light. Starting on 6 April, the Japanese air forces struck with a fury never before encountered. The scale of effort in suicide missions was the outstanding and most spectacular aspect of the Okinawa operation. During the period from 6 April to 22 June, 10 major, organized Kamikaze attacks were carried out. The relatively short distance from Japanese air bases in Kyushu and Formosa permitted employment by the enemy of planes of all types and pilots of every degree of proficiency. In 896 enemy air raids approximately 4,000 planes were destroyed in combat of which 1,900 were Kamikazes. Damage to United States forces amounted to 28 ships sunk by air attack of which 26 were by Kamikaze planes, and another 225 damaged, of which 164 were by Kamikazes.

The Japanese Navy made a last, despairing effort. At 1520, 6 April, a force consisting of the battleship *Yamato*, the light cruiser *Yahagi* and eight destroyers sortied from Tokuyama on the Inland Sea with the object of attacking the invasion fleet off Okinawa at daylight on the morning of 8 April. This force was sighted by United States submarines while proceeding south through Bungo Channel during the evening of 6 April. Contact was regained the next morning by naval patrol planes and by air search groups from the fast-carrier force. Commencing at about 1240 a series of coordinated attacks by carrier fighters, dive-bomber, and torpedo planes resulted in the sinking of the *Yamato*, the *Yahagi*, and four destroyers. Suffering varying degrees of damage the remaining destroyers retired to Saseho.

Heavy air attacks on the amphibious and covering forces continued during April and May, after which they declined rapidly. During this period valuable support was rendered by the Twenty-first Bomber Command and the Far East Air Forces in attacks on air fields in Kyushu and Formosa. In April approximately 40 per-

cent of the effective sorties of the Twenty-first Bomber Command were on such missions. On 7 April the first of the land-based Marine aircraft attached to the Tactical Air Force arrived on Okinawa. Consisting originally of Marine aircraft to which were later added Army fighters, this force operated jointly for over 2 months with the escort-carrier planes and ultimately relieved the carriers of responsibility for air defense and direct support of ground troops. Units of Fleet Air Wing One, including both seaplanes and landplanes, were based in the Kerama Retto and at Yontan airfield on Okinawa and conducted search and antisubmarine operations and antishipping strikes in the East China Sea and Korea areas. A British carrier force neutralized Japanese air bases in Sakishima Gunto and Formosa which were a constant threat from the southwest. This force was present from 26 March to 20 April and again from 3 to 25 May, and although relatively small, it provided valuable and necessary assistance.

Ashore the operations proceeded slowly. By 20 April all organized Japanese opposition in the northern two-thirds of the island had ceased. On 19 April the ground forces launched a large-scale offensive in the south, but slow progress was made against stubborn resistance. Japanese defense positions were well planned. The rugged terrain with many natural caves and elaborate underground installations presented difficult obstacles. Direct air support was furnished by both fast and escort carriers and by land-based Marine planes. Naval gunfire was provided throughout the campaign. On 21 June all organized resistance on Okinawa ceased and the last escort carriers departed after a stay of 88 days in the area.

From 1 July to 15 August, when the Japanese accepted Allied terms, the final actions of the war took place. From Okinawa, Iwo Jima, and the Philippines naval search planes scoured the waters and sank whatever enemy shipping they

encountered. B-29's contributed to the strangulation of Japan by extensive mine laying in the Inland Sea and the Straits of Shimonoseki, while Privateers of Fleet Air Wing One carried out the same type of operation along the coasts of Korea. Submarines penetrated the Japan Sea, the last link with the mainland outside the reach of United States air power. Army and Marine planes from Okinawa launched a series of raids on installations in Kyushu that were to begin the softening-up for the first landings on the home islands. As commerce dropped to a mere trickle that was of necessity directed to secondary ports from which rail distribution was almost impossible, the Twentieth Air Force in the Marianas continued with the methodical annihilation of Japanese industrial centers, and fast-carrier task forces of the British and American Navies conducted a series of raids to destroy the remnants of the Japanese Fleet and attacked strategic points in northern Honshu and Hokkaido that were beyond the area of B-29 operations.

Because of a desperate fuel situation Japanese ships were found at their dock or anchored in sheltered inlets. The enemy air forces still possessed about 10,000 planes, of which one-half were combat types. Together with a supply of fuel and semitrained pilots all aircraft were being hoarded to use in suicide attacks against an invasion force. Since the enemy refused combat, until a landing had been begun, United States aircraft roamed at will over Japan. In a series of 9 raids between 10 July and 15 August, the fast carriers destroyed over 1,200 aircraft, 90 percent of them on the ground, damaged most of what was left of the Japanese Navy, and destroyed the Aomori-Hokodate railroad ferry system that connected Honshu and Hokkaido Islands. On occasion the battleships and cruisers of the carrier task force moved in close enough to bombard industrial plants on shore.

The unremitting military pressure, in which

Navy, Marine, Army, and British air units all played their appointed roles, underlined an argument going on in Japan itself. The invasion of Okinawa had brought a change of cabinet, and the new prime minister, Admiral Suzuki, was feeling his way toward peace through a difficult domestic situation. It was a case of overruling the military and naval fanatics who had long dominated Japanese policy and precipitated the war in the first place. They desired to continue the struggle to the bitter end on the excuse that some compromise peace might be attained. Otherwise they would drag the country to ruin with themselves. Between 6 and 10 August, two atomic bombs were dropped and Russia entered the war on the side of the Allies. Whether these events determined the Japanese to immediate acceptance of the Potsdam Declaration will probably never be known; they certainly provided a powerful punch line to an already winning argument.

On the morning of 15 August the fast carriers launched their aircraft for raids on the Tokyo area. The first strike had already gone in and the second was approaching the target when word of the Japanese surrender arrived. In a last demonstration of the excellent control maintained over air-borne planes, the second strike was recalled. During the day combat patrols were kept flying. Either out of curiosity or piloted by hotheads who refused to accept the emperor's orders, a few Japanese aircraft approached too close and were shot down "in a friendly fashion," as Admiral Halsey termed it.

The war was over.

In the advance across the Central Pacific the carrier task force with its extreme flexibility and mobility had been the dominant factor. It established the conditions under which long-range amphibious advances were possible. It never failed to gain command of the air at the required time and place, successively overwhelming the air garrisons not only of the Japanese perimeter but of the major fortresses of Formosa and the Philippines, and it maintained command of the air until shore-based air forces could be established. This remained true even when the enemy in desperation converted the remnants of his air force into guided missiles. In a naval war conducted across vast stretches of ocean, it destroyed the Japanese carrier air force at Midway and in the Marianas, and the surface fleet in the battle for Leyte Gulf. In an amphibious war where it was necessary to storm the beaches against a well-emplaced and fanatically tenacious enemy, it excelled in the direct support of troops. In a war whose pace was at all times governed by what was logistically possible, the carrier task force was an economical weapon independent of the investments in time, personnel, and priceless shipping space required for construction of airfields and facilities soon to be left far behind the advancing front. Its mobility gave to the attacker the advantages of continuous initiative and surprise. No weapon is equally good at all times or in all places, but for the Pacific war the carrier task force was ideal.

VII TACTICAL EFFECTIVENESS OF NAVAL AVIATION

A prerequisite to control of the sea was control of the air above it. In the first days of the war, the Japanese prevented the British from interfering with the movement of troops to Malaya by a successful aerial attack on the *Prince of Wales* and the *Repulse*. To drive the enemy from the air in vital areas was the first mission of naval aviation. With the development of night tactics this became a 24-hour job which required specially equipped night planes as well as conventional day fighters. For patrol planes it meant the ability to penetrate enemy-held areas alone, to possess the firepower necessary to drive off interceptors, and to return to base with vital information.

When the Catalina proved to have insufficient speed and armament to defend itself, the Navy obtained Liberators for use in forward areas. Even this type did not have enough guns and required other modifications to change it from a high-level bomber into a patrol plane. From experiments that amounted to altering 50 percent of the Liberator's internal arrangements, the Navy developed the Privateer. In 1944 and 1945, planes of these 2 types flew 15,000 patrols and destroyed 504 of the 937 Japanese aircraft encountered, against a loss of 18. During the same period, Mariner and Coronado flying boats on similar missions shot down 24 enemy planes and lost 3.

In 1943, Japanese night torpedo attack indicated a need for night fighters, but neither the Army nor Navy had suitable radar-equipped planes available. Royal Air Force experience favored the development of specially designed twin-engine, two-seater aircraft. Since the Navy could neither wait for the completion of the new planes nor could it hope to operate them from carriers without further design changes, it

equipped a number of its standard Hellcats and Corsairs with the necessary instruments and developed special training for night pilots. Before the Army's Black Widow reached the Pacific theater the Navy had night fighters on all large carriers and at land bases in forward areas. Fighter directors worked out a technique by which interceptions were made as far as 80 miles from base. With a loss to themselves of 3 aircraft, Hellcats alone shot down 163 enemy planes in night combat.

Important as were these special aspects of air activities, the enemy lost the major portion of his air forces in conventional daylight operations. Although, owing to the destruction of Japanese records, exact figures will never be obtainable, naval aviation accounted for three-fifths or almost 15,000 of the total enemy planes destroyed. Of these, the most reliable record credits 9,000 as having been shot down and the remainder as having been knocked out on the ground. In aerial combat the Navy lost only 897 aircraft for an advantage of 10 to 1.

Even during the period of heavy losses in 1941-42, naval aircraft destroyed 830 enemy planes while suffering 265 air combat losses for a favorable ratio of 3 to 1. In 1944 when naval aviation cracked the enemy air defenses of Rabaul and carried the offensive to the Marshalls, Carolines, Marianas, and Bonins, and to the extensive chains of enemy air bases in the Philippines and Formosa, the ratio rose to 15 to 1; 4,021 Jap planes shot down against 261 air combat losses. In 1945 when the naval offensive concentrated on the Ryukus and Japan, the ratio rose further to 22 to 1; 3,161 Japanese planes shot out of the air against 146 losses suffered at the hands of enemy pilots.

The above figures, include the air engagements

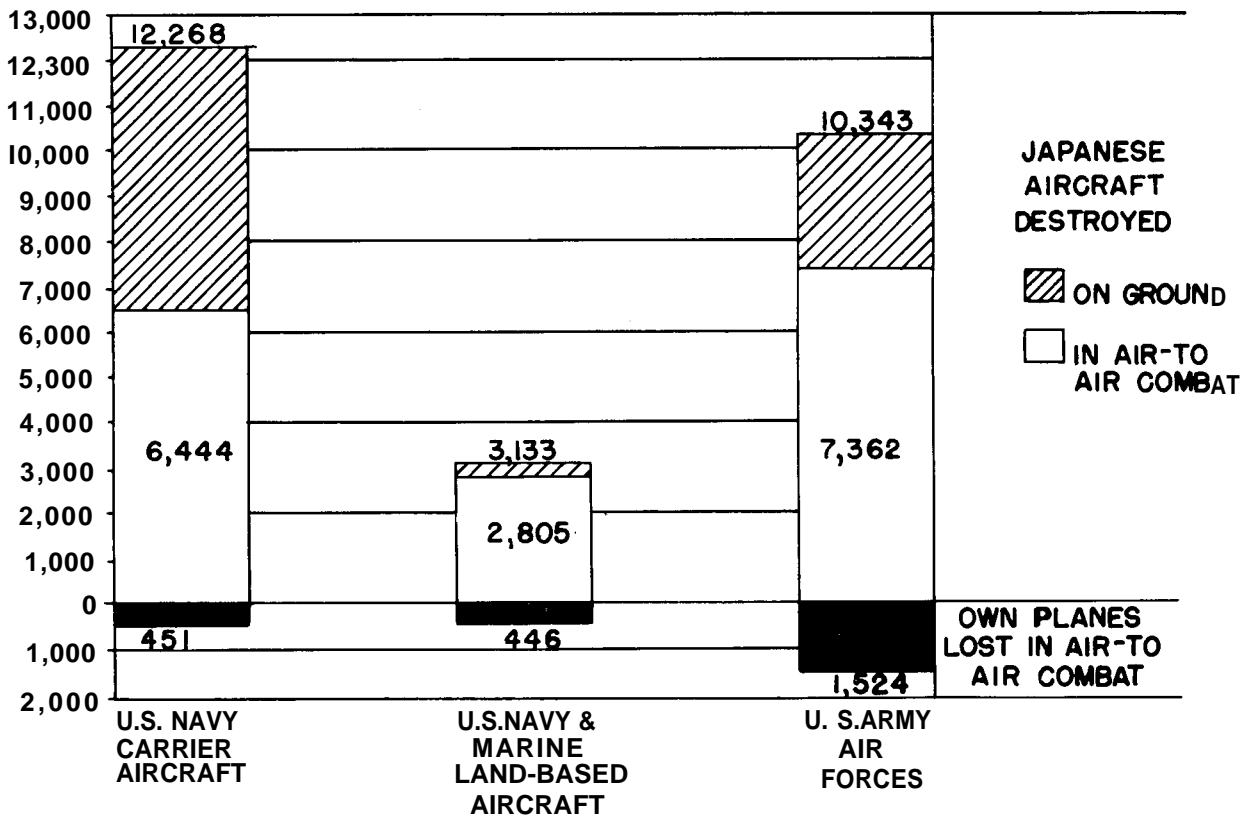
of all types of naval aircraft. Fighter planes naturally enjoyed a superior record and destroyed 13 Japanese planes in the air for each 1 lost in combat. During the last 12 months of the war, the Hellcat, mainstay of the carrier forces, knocked down 3,518 Jap planes against a loss of 160; the Corsair, used by both Navy and Marine pilots, 1,042 against 49; the Wildcat, used on escort carriers, 377 against 9 losses. These ratios were 22 to 1, 21 to 1, and 42 to 1, respectively.

Control of the air was also reflected in the ability of a bombing effort to reach the enemy and the corresponding ability to break up and prevent an enemy attack from reaching its objective. During 1944 and 1945, Navy and Marine dive-bombing and torpedo planes made 102,000 sorties against the Japanese, engaged

in combat on 742 occasions, and lost only 18 planes to enemy fighters. Although many of these flights occurred in areas where the enemy's air force had already been annihilated, the remainder indicated the effectiveness of the cover furnished by Navy fighters. Even in 1942 when the Japanese air force was at its peak, it customarily lost 20 to 40 percent of its aircraft in any mission encountered by Navy planes. Although complete figures are not available for both land and carrier-based aircraft, the latter destroyed 70 percent of the enemy bombers and 50 percent of the fighters intercepted. No air force could stand such losses over an extended period of time without becoming in fact, if not in name, a suicide force. The Kamikaze merely acknowledged an existing situation.

Aerial combat was essentially a defensive

COMPARATIVE U. S. & JAPANESE AIRCRAFT LOSSES



Comparative Aircraft Losses.--Japanese loss are based on the best available United States Army and Navy figures. Although it is impossible, to check these figures from enemy sources, they are believed to be approximately correct. Japanese aircraft destroyed by British Empire and Netherlands Air Forces are not included.

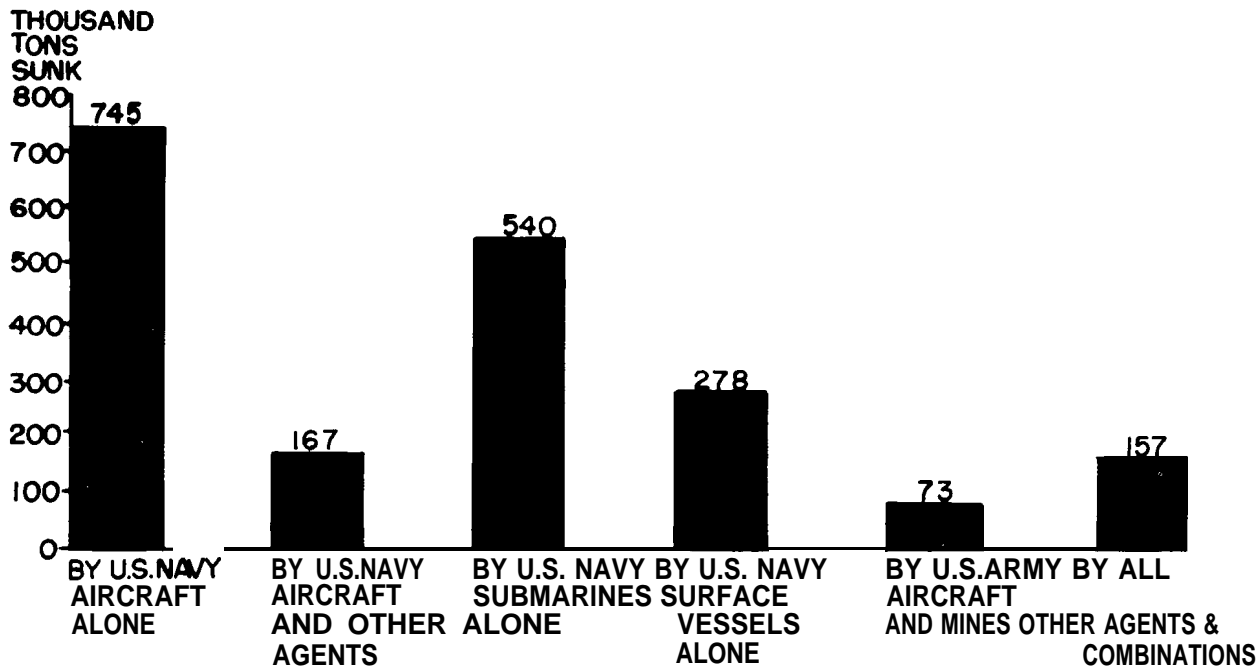
function designed to protect the fighter's own air-borne or surface forces from direct attack. If freed from this duty, the fighter plane could perform operations of an offensive nature. Of 500,000 sorties flown by naval fighter planes in the Pacific war, only 12,000, or 2½ percent, resulted in aerial combat; the remainder was largely for other purposes.

More than able to overcome air-borne opposition, naval aviation pressed its attack against airfields and grounded planes. Because during amphibious operations vast numbers of ships in a restricted landing area were especially vulnerable to bombing, the fast carriers first tried to clear the air of enemy planes and then went on to destroy parked aircraft and to render fields inoperable, thus stopping hostile air activity at the source. Approximately one-third of the sorties by carrier aircraft were for this purpose and in some campaigns the number reached two-

thirds. Although at no time was it possible to dispense with combat air patrols only about 28 percent of the enemy aircraft destroyed were shot down in the defense of United States forces as against 32 percent in the air over enemy ships and installations and 40 percent on the ground.

In overcoming the Japanese in the air, carrier planes destroyed 18 enemy to each of their own that was lost, while naval and Marine land-based aircraft enjoyed an advantage of 8 to 1. The disparity resulted not from a difference in plane types, which were the same, but from the ability to concentrate carriers and send them into the heart of a Japanese-held area. Although before the war it was frequently stated that the added weight and other design factors necessary in carrier planes made it impossible to operate them against shore-based aircraft, this turned out not to be true. Carriers were mobile units that, when assembled in sufficient numbers, could

JAPANESE WARSHIP TONNAGE SUNK, WORLD WAR II



Warship Tonnage Sunk. --The predominance of United States naval forces, particularly aircraft, in the destruction of the Japanese Fleet is clearly illustrated above. United States Navy units alone accounted for 85 percent of all sinkings and participated with other forces in an additional 5 percent. Naval aircraft alone accounted for 38 percent and participated in an additional 8 percent.

overwhelm an enemy's airforce in any area that the United States desired to penetrate. Development of radar and fighter-direction technique insured only a minimum of planes being used for defense and relieved the remainder for offensive missions against either shore installations or hostile fleet movements. With control of the air overhead and with adequate air support, the United States Fleet could move freely about the sea and land troops and equipment wherever the strategic plan demanded.

Command of the sea also required the destruction of Japanese warships which might threaten our ships using Pacific waters. It was further necessary to deprive Japan of its merchant marine both to prevent its use to reinforce and supply enemy bases and to cripple the entire Japanese economy, which was dependent on shipping for the bulk of its oil, iron ore, cooking coal, rubber, aluminum and other nonferrous metals, and for much of its food.

Naval aircraft were highly effective against shipping targets. Dive bombers were developed by the Navy as a means of controlling maximum accuracy with minimum hazard to planes in attacks on heavily armed warships. The torpedo plane was designed to launch the most lethal weapon yet devised for shipping attack. To these initial tactics were added three additional means of attacking ships: masthead bombing, pioneered in the Pacific by the Fifth Air Force, rocket attack, and strafing.

Armed with these weapons, naval aircraft sank 745,000 tons of Japanese warships and cooperated with other agents in sinking an additional 167,000 tons. Included in the vessels sunk by naval aircraft, either alone or with other agents, were 6 out of Japan's 12 battleships, 12 of 20 carriers, 18 of 40 cruisers. Of all sinkings in the class of destroyer or larger, naval and Marine aircraft accounted for 48 percent and for about 42 percent of combatant tonnage of all types.

Naval aircraft were also responsible for damaging a large number of major enemy warships which then required extended periods of repair. This damage frequently had as important an effect on the course of the war as the sinkings. Hits on units of the Japanese carrier force in the Battle of the Coral Sea were an important factor in the abandonment of plans for invading Port Moresby. Similar damage in the Battle of the Eastern Solomons caused the withdrawal of Japanese naval forces, giving our sea and land forces in the Solomons a needed breathing spell and opportunity for reinforcement. Damage to Japanese carriers by carrier attacks in 1943 resulted in the permanent withdrawal of heavy warships from Rabaul and removed the threat of naval interference with the occupation of Bougainville. After the latter actions the Japanese refused again to risk heavy warships within range of naval aircraft, except with massed carrier support as in the Battle of the Philippine Sea, or on an admittedly last-ditch suicide mission as in the Battle for Leyte Gulf and the last sortie of the *Yamato*.

Important in naval air action against enemy warships was the ability to inflict damage with a minimum expenditure of effort. Only about 160 bombers and escorting fighters, carrying about 80 tons of bombs and torpedoes, made the attacks which sank 1 Japanese carrier and damaged another at the Coral Sea. In the attacks on the second day of the Battle of Midway, which resulted in the sinking of 4 carriers and proved to be the major turning point of the Pacific war, the hits on enemy carriers were inflicted by about 80 dive bombers. The naval air contribution to the crucial Battle of Guadalcanal amounted to less than 350 attack sorties and less than 160 tons of bombs and torpedoes. A battleship, a cruiser, and 11 troop transports were credited sunk in whole or in part by these air attacks, and other vessels were damaged. In the battle for Leyte Gulf two elements of the

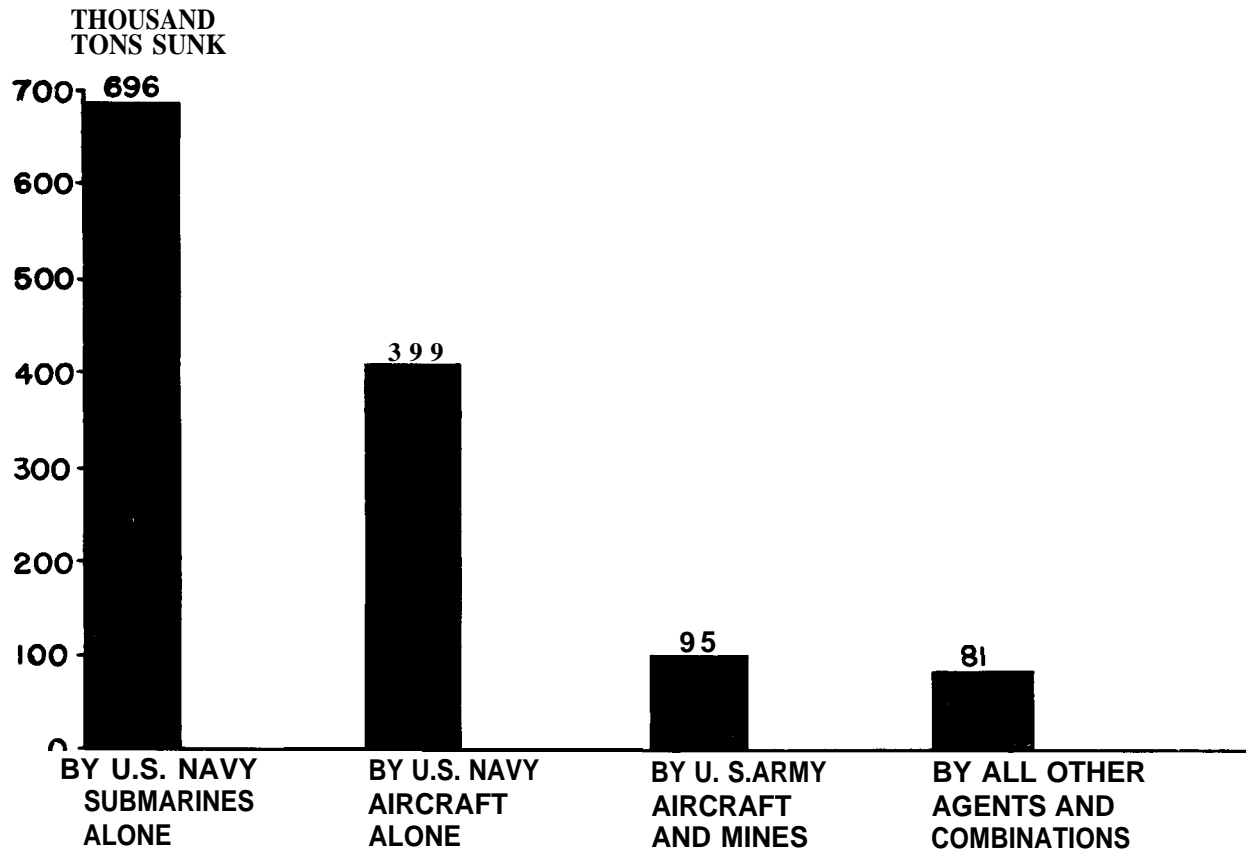
3-pronged attack were routed with a total expenditure of only 750 tons of bombs.

Naval aircraft unaided sank over 1,500,000 tons of Japanese merchant vessels during the war; in cooperation with other forces they assisted in sinking another 200,000 tons. These figures included only vessels of 500 tons or over but not the hundreds of small barges, sampans, luggers, and other vessels sunk by naval aircraft, whose total has never been compiled. About 50 percent, 800,000 tons, went down in the 4 months of the Philippines campaign from mid-September 1944 to mid-January 1945; 200,000 tons in the Truk, Marianas, and Rabaul raids of February 1944; and 100,000 more in March 1944 at Palau and elsewhere. The ton-

nage destroyed by naval planes exceeds that of any other agent except submarines which accounted for over half the total.

Complete data on losses of smaller vessels are almost impossible to obtain. It is believed that submarines played a smaller and Army and Navy aircraft and aerial mines a larger part in sinking these vessels. Carrier fighters devoted an enormous volume of effort to strafing and rocket attack on these vulnerable targets. Naval patrol bombers whose daily searches covered the entire western Pacific made hundreds of individual masthead-bombing and strafing attacks on isolated small ships. Army bombers and fighters were effective against these vessels along the coasts of New Guinea and the Bismarck Sea, the

JAPANESE TANKER TONNAGE SUNK, WORLD WAR II



Japanese Tanker Losses.—Only submarines and naval aircraft were persistently able to reach the inner zone shipping lanes where most Japanese tankers were routed. The chart shows the result: 84 percent of tanker sinkings were accomplished by these two forces. The resultant losses deprived the Japanese military machine of most of its fuel, and both operations and training had to be restricted.

East Indies, the Philippines, and Formosa. In the last months of the war mines laid by B-29's further crippled the remnants of this junior merchant fleet, by then confined largely to the inland waters of Japan, and harassed even there by both carrier and naval patrol planes.

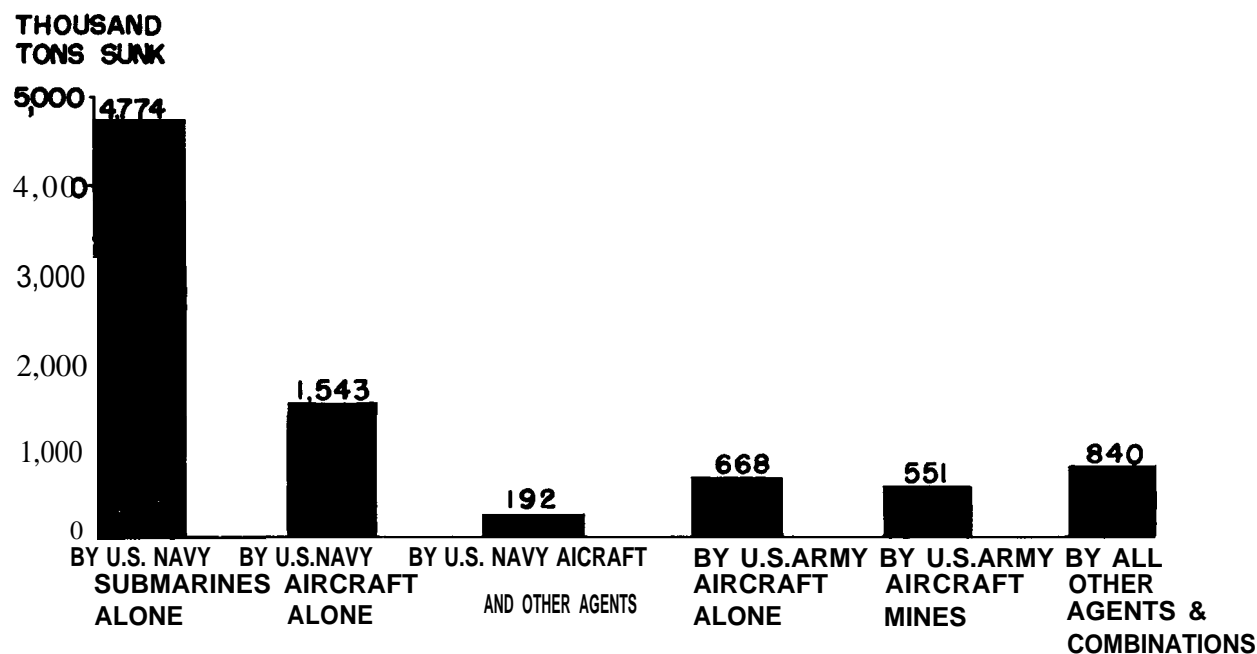
Only 9 naval planes and only about 4 tons of bombs or torpedoes were required, on the average, to sink each 1,000 tons of Japanese war or merchant shipping. In executing its decisive campaigns against the enemy fleet and merchant marine, naval aviation expended only 14 percent of its attack effort and only about 4 percent of its combat sorties.

Naval aircraft operated against enemy ground forces in all parts of the Pacific. Much of this effort was devoted to attacks whose main purpose was the attrition of enemy units either in advance of an invasion or on bypassed islands to prevent

the Japanese from harassing communications. Strikes were also made against specific beach-head defenses and adjacent supply facilities in preparation for a landing. Finally, planes afforded direct close support to ground troops. Although the proportion in each of the three categories is not known, naval aircraft directed 54 percent of their total attack effort to enemy troops, weapons, equipment, defense installations, and supply facilities. This figure is exclusive of sorties to neutralize airfields or attacks on Japanese industrial and transportation facilities.

The effectiveness of air support was measured not by the damage inflicted on installations but by the rapidity with which marines and soldiers advanced against the enemy. The variety of targets in close-support missions was very great and was dictated by the need of the troops, the

**TONNAGE OF JAPANESE MERCHANT VESSELS SUNK, WORLD WAR II
(VESSELS OF 500 TONS AND OVER)**



Japanese Merchant Vessels Sunk.---Submarines alone accounted for 54 percent of sinkings; naval aircraft alone, 18 percent. Navy units participated in 77 percent of all sinkings and were the sole agents in 76 percent. The principal elements represented in the last bar of the chart are losses to British Empire and Netherlands forces and marine casualties.

suitability of the target for airplane attack, and the availability of aircraft and other weapons such as naval gunfire and shore-based artillery. Enemy gun positions on the reverse side of a hill could be put out of operation only by aircraft. Planes frequently discovered their own targets behind Japanese lines and, as in the case of supplies or reinforcements, prevented their reaching the front lines. Frequently aircraft were called upon to keep the enemy down as friendly troops moved up. Such activities cannot be represented statistically. Although in ground combat the achievement of victory rested with the foot soldier, naval aviation provided him with invaluable assistance, facilitated his advance, and by its accurate methods of attack saved thousands of American lives.

The foregoing discussion has set forth naval aviation's part in the Pacific war. It demonstrates how effectively the Navy balanced the potentialities of air weapons against their limitations, developed them, and used them with other weapons to implement the strategic plan. Yet it is pertinent briefly to isolate naval aviation from the naval structure as a whole to consider its efficiency as an air force.

One of the most pervasive phenomena of the war was the popular tendency to evaluate the effectiveness of air attack in terms of bomb tonnage. This was readily understandable in view of our national predilection for great size and quantitative measures and the ease of comparison which a tonnage figure provides. From the standpoint of military analysis bomb tonnage is to some extent a measure of effort but only occasionally a good measure of effectiveness. It was most significant in attacks on large urban centers made under favorable weather conditions so that most bombs could not help but hit the area. Yet even in the attacks on Japanese cities, there was wide variation in the area laid waste per ton of bombs depending on the type of bombs used and on the concentration of their fall. As the

size of the target decreased, or when weather and other factors affected accuracy, the full tonnage dropped remained a cost of the attack, but the effect on the enemy depended on what proportion of the bombs hit the target. For example the Strategic Bombing Survey reported that of 30,000 tons of bombs dropped in high-altitude attacks on 3 large German oil and chemical plants with a total area of $3\frac{1}{2}$ square miles, only 1 bomb in 8 hit within the plant fences and only 1 of 30 inflicted physical damage to manufacturing facilities.

Probably the largest Japanese targets customarily bombed by naval aircraft were airfields. The average large runway had an area of about 50 acres, considerably smaller than one of the oil plants mentioned above. The largest type of enemy ship attacked by naval planes, a large aircraft carrier, had a deck area of about 2 acres. Against a submarine, the lethal area in which a bomb had to hit was about a quarter acre and on a beachhead a gun position presented an area of only one two-hundredth of an acre. The tonnage of bombs dropped in attacks against such targets was of very little significance but the question often arose whether the target could be efficiently bombed at all. The statistical chance against hitting a 25-foot diameter gun revetment was 10,000 to 1 in high-altitude bombing, 600 to 1 in low-altitude glide bombing, 300 to 1 in the most accurate dive bombing, and about 100 to 1 in masthead bombing. The development of the high explosive rocket reduced the chance to 21 to 1; and, if it was desired to put the gun temporarily out of action while troops advanced or friendly bombers were carrying out an attack, this could be accomplished by a fighter plane with a few hundred rounds of ammunition.

Except for patrol planes, naval aviation operated from carriers or from small land fields in advanced areas, both of which required small aircraft with limited bomb capacity. As an integral part of the naval forces, it had as targets primarily

naval objectives--ships, parked aircraft, shore installations and close support of amphibious troops. Because the types of plane and the nature of the targets put a premium on accuracy and effectiveness of each bomb dropped, naval aviation did not engage in high-altitude, pattern bombing. Three methods of bomb attacks were commonly used: glide bombing at altitudes from 1,000 to 4,000 feet; dive bombing at the same altitudes but with an angle of 65° to 90°; and minimum-altitude, or masthead bombing, from 50 to 300 feet. Especially against war vessels aerial torpedoes were used at close range and low altitude. With the introduction of the high-explosive rocket in 1944, naval aviation acquired a weapon more suitable than bombs against such targets as small shipping and ground installations. An index of its importance was the use of

over 100,000 rockets in the Okinawa campaign. Finally, naval planes employed machine guns and light cannon against many small targets.

In measuring the tactical effectiveness of an air force it was not the volume of effort but attainment of objectives and the cost of results that counted. Each type of target and operation had to be considered separately; there was no common standard. To destroy half of Tokyo required 14,000 tons of bombs. Less than one-twentieth of this tonnage won the battle for Leyte Gulf; a few dozen dive bombers won the Battle of Midway. The comparative importance of these achievements is not found in any measure of sorties or bomb tonnage. They are in fact, not comparable at all, except as each was a vital contribution to victory achieved by skilled application of appropriate weapons.

VIII LESSONS LEARNED

The lessons of any naval war are of great importance to the United States. The lessons of the war against Japan are unique. Unlike the great conflicts of the eighteenth century and the First World War, where blockade and relatively passive control of sea lanes provided limited, although decisive, naval objectives. Japanese expansion and the United States victory were campaigns fought across the sea.

World War II also witnessed the full development of aviation. In view of the complete lack of factual evidence, many of the opinions expressed between the two World Wars on the role of air in naval operations were based largely on theory and to a considerable degree were ultimately proved false. Bombing of anchored and undefended battleships off the Virginia Capes after the last war led to statements that navies were obsolete and that no ship could operate within range of land-based aircraft. Although certain advocates of independent air power questioned both the possibility and usefulness of close support of troops, such support was proved not only possible but indispensable. The accuracy of high-level, precision bombing was vastly overestimated, as witness both the ineffectiveness of this means of attack against shipping and the improved efficiency of B-29 attacks after the adoption of medium-altitude, area bombing. A considerable body of opinion in both the Army and the Navy held that the airplane would quickly master the submarine. While this was ultimately accomplished, it came about rather late in the war after immense effort in research and design of new equipment and in the development of techniques for cooperation of planes and surface ships. Certain improvements in U-boat design and equipment, which appeared too late to become operational on a wide scale, made it ex-

tremely doubtful that Allied superiority would have long prevailed.

Those who questioned the importance of the airplane were equally far from the mark. The disappointment of officers who planned for fleet engagements after the fashion of Trafalgar and Jutland was doubtless as great as that of theorists who had confidently dismissed the battleship as a modern weapon, only to find it profoundly useful and singularly invulnerable in support of amphibious landings. The conclusion is that while times do change, revolutions are seldom as complete as the revolutionaries hope.

The efforts of the various nations between the wars to solve the problems of the employment of aircraft in naval warfare were instructive. The debilitating effects of Britain's separate air force on the British Navy are well known. The effectiveness of the lumbering Swordfish torpedo-plane was a high tribute to the gallantry of the pilots but hardly complimentary to the organizational system which produced it. Counting on their geography, the Italians established a land-based air force with which they thought to control the Mediterranean. Constantly outfought by British carrier aircraft, the greatest victory of the Italian Air Force was scored against its own navy which it once put to ignominious flight. The Japanese developed aviation as part of their fleet, and the operations of their carrier striking force from Pearl Harbor to Ceylon set the pattern of the Pacific war, but they failed to solve the defensive problem and this failure, with their limited recuperative abilities, nullified their whole war plan. The outbreak of war found United States aviation, both military and naval, woefully deficient in types and quantities of aircraft. Doubly fortunate in geography and in-



STRIKE ON TOKYO

Planes from Carrier Task Force Pass Mount Fujiyama, February 1945

dustrial power the country was able to go forward with the building of great forces incorporating the early lessons of the war and the most recent technology, thus achieving an unexpectedly early victory. As it may not again be possible to extemporize, the importance of correct evaluation of the experience cannot be overestimated.

The experiences of warfare, however, are never conclusive. They cannot be controlled like experiments in a laboratory but must be taken as they occur. Two examples from the recent conflict may be cited to show the dangers of facile generalization from insufficient evidence. In the past it had been taken for granted that aircraft carriers could not operate for extended periods within range of a large number of enemy air bases, yet from September 1944 until the end of the war this was done and in every instance the shore bases had the worst of it. It would be unwise to deduce from this experience too rigid theories for the future because against an enemy, equal plane for plane and pilot for pilot, it would have been much more difficult and costly, although at what point such operations would become unprofitable it is impossible to determine. Likewise the operational capabilities of B-29's with full bomb loads against heavily defended targets were somewhat limited. Although islands within 1,300 miles of Tokyo had been secured, it was necessary to pay a great price for Iwo Jima, 600 miles nearer the objective, in order that the bomber bases might be free from attack and that the bombers might have fighter protection and an emergency landing field.

The impact of technology on modern warfare is such as to render generalization and prediction doubly dangerous. Although the carrier task force was the outstanding fighting unit in the advance across the Pacific, if the developments in radar and fighter direction had not occurred when they did, the event would have

been far different. On the other side of the picture, had the Germans developed the proximity fuse for antiaircraft fire, the important effect of the heavy bomber in Europe, achieved as it was at great cost in men and effort, might have been drastically reduced.

The United States possessed no single weapon sufficiently effective in itself to defeat Japan. All the tools of modern war were used in the advance across the Pacific. The integrated employment of all forces each possessing its specialized weapons and equipment was essential to accomplish the ultimate aim. Each assault clearly demonstrated that we had no single means of destroying the enemy or securing the objective. The extent to which man could protect himself and absorb punishment, particularly from air attack, was a striking feature of World War II and revealed limitations in the capabilities of modern weapons.

The fact is that there exists no single science of war. There are many sciences with which war is concerned, but war itself is a practical art and skill. It is impossible ever wholly to anticipate war's requirements as the experiences of the Germans and the Japanese revealed. Any exclusive adoption of a single weapon or type of weapon immediately limits freedom of action and greatly simplifies the enemy's problem of defense. War is a phenomenon of immense complexity whose problems are solved pragmatically by hard experience and clear thinking. There is danger that investigation of a single aspect of one war may give rise to an unbalanced interpretation. Limitations are as significant as accomplishments.

Certain features of the war in the Pacific, however, are of such importance that they must be considered in any planning for the future:

1. Control of the air was prerequisite to control of the sea.
2. Control of the sea permitted the concentration of carrier air power to control the air, and

the construction of bases necessary for continued local control of the air.

3. Local control of the sea permitted the landing, support, and supply of amphibious forces on hostile shores.

4. General control of the sea was decisive against an enemy dependent on ocean commerce for vital supplies.

5. Control of the sea, including the landing of military forces on a hostile shore, was properly a naval function achieved by air, surface, and submarine forces acting in concert.

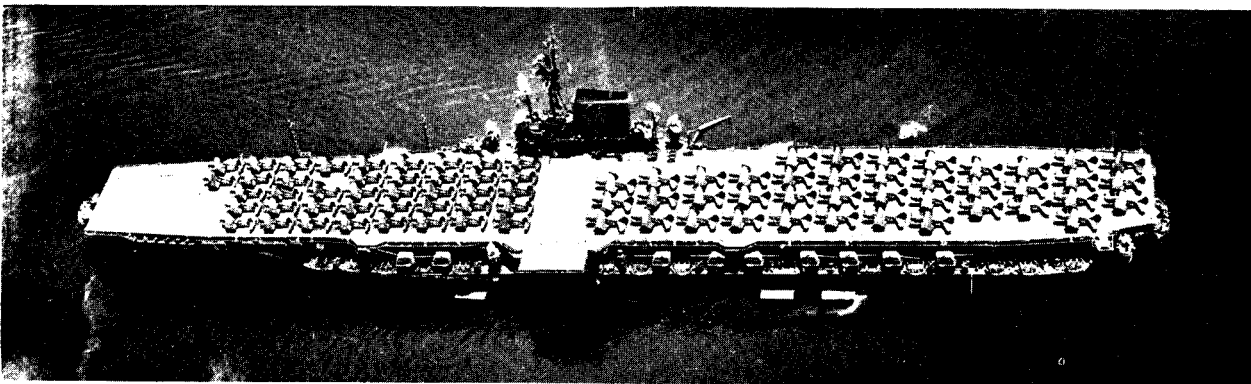
6. Naval aviation was an integral part of the naval forces and, as such, possessed the especially designed planes and equipment and employed the special tactics necessary to fulfill its role.

7. With control of the sea gained and maintained by the Navy, it was possible for land forces to control large-scale offensive operations and for strategic bombing to destroy enemy's industrial potential at will.

Technology is never static, it produces changes in the methods and tactics of warfare, but it does not alter basic concepts of strategy. For centuries control of the sea has permitted a belligerent to remove the field of operations from his own shores and to fight on the territory of an enemy. Since the United States achieved status as a great power in the last quarter of the

nineteenth century, it has been three times engaged in war. On each occasion it has been able to carry the conflict to the enemy because it possessed control of the sea. Behind a shield of sea power, the country has employed its great resources and industrial machine to build the forces for victory. Whether the growing range of bombing aircraft and the greatly increased destructiveness of explosives has made immunity from air attack impossible in the future is arguable. However, the amount of explosive carried will continue to vary inversely with the distance a plane must travel. Each added mile of range increases the opportunity for interception before the attacking aircraft reaches its objective. Although air raids may level cities, they do not lay waste an entire countryside as large-scale land operations do. So long as war remains a possibility, control of the sea will be vital to the national defense.

When the Japanese entered the conflict, they had a plan for a war of limited objectives. They seized a perimeter but soon found that it was insufficient for proper defense. In Europe the Germans conquered large amounts of territory but failed to put either England or Russia out of the conflict, and so long as those belligerents remained in the field Hitler could not force a peace. Experience proves that in the modern world there is no such thing as a war of limited



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objectives; there is only total war which ends with the exhaustion and defeat of one of the contestants. Such defeat can best be accomplished by an attack on the enemy's homeland, the source of his ability to wage war. Against Germany a direct land campaign was required; the Japanese recognized the inevitability of defeat as the strategic air attack was reaching high gear and as the invasion forces were assembling. In offensive air operations the closer the base to the objective the more effective and the less costly will the task be. For the United States this means the establishment of bases supplied by ships, and for the free movement of ships control of the sea is mandatory. Control of the sea will also remain vital to the offense.

Submarines and aircraft, within the limits imposed by range, penetrated enemy-held areas without support. Neither of them could capture and hold territory or supply a beachhead. When the Japanese lost their carriers at Midway the invasion fleet turned back without attempting to land. Control of the air was prerequisite to control of the sea. When United States forces moved across the Central Pacific, they encountered a string of strong, mutually supporting Japanese air bases which were frequently referred to as so many "unsinkable aircraft carriers." With control of the sea it was possible to concentrate enough "sinkable carriers" to overwhelm and isolate the area under attack and to reduce the Japanese bases to so many unsinkable hulks. After strategic islands had been captured, the freedom of United States ships to sail the ocean made it possible to construct installations and to keep the occupying forces continually supplied with men, equipment, and aircraft, which in turn contributed to control the air in the vicinity. Control of the sea was vital to control of the air.

Spanning oceans with loads of atomic explosives may become technologically possible but will not alter the basic fact that each added mile

of range will increase the likelihood of interception and decrease the bomb load of the attacker. As the naval task force found in combating guided missiles in the form of Kamikazes, early warning increases the chance of breaking up a raid. For that reason alone, bases which can only be supplied and held as long as control of the sea is maintained will remain important. In the second place, the belligerent possessing bases closest to an enemy will have the advantages of being able to launch a more concentrated attack with fewer aircraft. Since the United States is not connected by land with any great power, the necessary bases must be away from its shores; i. e., in an area where possession can be maintained only by sea communications. Last, control of the sea makes possible fighting the war on an enemy's territory with all the destruction that such a campaign implies. In the War of 1812, superior sea power allowed the enemy to burn Washington. In two great wars of the twentieth century the United States protected by the Navy was safe from devastation.

Except for strategic bombing, in which the Navy did not engage aviation does not function independently. It exists as one of the elements necessary for control of the land or control of the sea and operates with other forces having the same end in view, and the techniques for control of land and sea are not the same. The experience of other nations shows, and the lessons of the war confirm, that modern warfare is highly specialized and each phase requires its particular aircraft, equipment, and tactics, for the use of which special training is necessary. In the United States this has resulted in the creation of separate military and naval air components, capable when the situation demands of operating in support of one another, but each concentrating on the development of planes, equipment, and tactics best suited to its normal sphere of action. In naval warfare the necessity for complete integration of aviation with the other naval

forces was completely demonstrated in the conflict with Japan. Because naval aircraft used the same air, because on occasion they took off from the same bases, did not mean that they duplicated the work of the Army Air Forces.

The mission in the case of each was different, The Navy must retain every component necessary to its effectiveness, and must further develop the unity of purpose, training, and command that brought victory in the Pacific war.