

UNITED STATES
NAVAL AVIATION,
1919-1941



Naval Aviation and the Navy in the 1920s

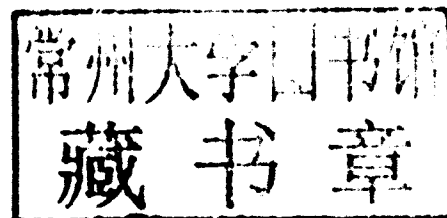
U.S. NAVY

NAVY DEPARTMENT
WASHINGTON, D.C.

United States Naval Aviation, 1919–1941

*Aircraft, Airships and Ships
Between the Wars*

E. R. JOHNSON



McFarland & Company, Inc., Publishers
Jefferson, North Carolina, and London

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LIBRARY OF CONGRESS CATALOGUING-IN-PUBLICATION DATA

Johnson, E. R., 1948—
United States naval aviation, 1919–1941 :
aircraft, airships and ships between the wars /
E. R. Johnson.
p. cm.
Includes bibliographical references and index.

ISBN 978-0-7864-4550-9

softcover : 50# alkaline paper ∞

1. United States. Navy—Aviation—History—20th century.
 2. Airplanes, Military—United States—History—20th century.
 3. Military airships—United States—History—20th century.
 4. Aeronautics, Military—United States—History—20th century.
- I. Title.

VG93.J627 2011 359.9'4097309042—dc22 2011006978

BRITISH LIBRARY CATALOGUING DATA ARE AVAILABLE

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Front cover: *from top* Rigid Airship USS Macon ZRS-5 in 1935;
Martin T4M-1 attached to VT-2B of the Saratoga Air Group in 1931;
Vought OS2U-1 sited on a Type P-6 catapult in 1940 (Lloyd S. Jones)

Manufactured in the United States of America

*McFarland & Company, Inc., Publishers
Box 611, Jefferson, North Carolina 28640
www.mcfarlandpub.com*

United States Naval
Aviation, 1919–1941

ALSO BY E.R. JOHNSON
AND FROM MCFARLAND

*American Flying Boats and Amphibious Aircraft:
An Illustrated History* (2010)

American Attack Aircraft Since 1926 (2008)

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Preface

By June 1942, within six months of Japan's devastating attack on Pearl Harbor, the U.S. Navy had checked the Japanese military advance in the Pacific to the extent that the United States could return to its original war plan of defeating Germany first. That the Navy was able to accomplish this with six fleet aircraft carriers—two of which were based in the Atlantic at the time—and little more than 1,000 combat aircraft was not a miracle or simply a matter of luck but the culmination of more than 20 years of determined preparation. This book explains and illustrates, in terms of individual aircraft, airship, and ship development, the process of trial and error that ultimately enabled naval aviation to succeed in those critical, early months of the war. The book is introduced by a historical summary listing the major influences that shaped the course of naval aviation during the period.

For organizational purposes, the book is divided into three main parts. Part I covers heavier-than-air development in chronological order, subdivided by attack aircraft, fighter aircraft, observation and scout aircraft, patrol aircraft, and trainer, transport, and utility aircraft. Part II covers lighter-than-air development in chronological order, subdivided by rigid airships (dirigibles) and non-rigid airships (blimps). Part III covers aviation-related ship development in chronological order, subdivided by aircraft carriers, seaplane and airship tenders, and seaplane-equipped warships. With the exception of seaplane-equipped warships, each subdivision is preceded by a procurement synopsis to summarize and interrelate the chronology of events. Supplementing the main parts are four appendices: foreign aircraft and airships in chronological order; racing and experimental aircraft in chronological order; aircraft, airship, ship and aviation unit designations, nomenclature, and abbreviations; and status of naval aviation in December 1941. A glossary of aviation terms follows.

Introduction: Influences That Shaped U.S. Naval Aviation, 1919–1941

“Naval aviation cannot take the offensive from the shore; it must go to sea on the back of the fleet.... The fleet and naval aviation are one and inseparable.”

—Rear Admiral William A. Moffett, first chief of the
Naval Bureau of Aeronautics, 1921–1933.

World War I

At the time the United States entered World War I in April 1917, Naval Aviation, both within the U.S. Navy and the U.S. Marine Corps, was little more than a vestigial organization, then consisting of 54 aircraft and 48 pilots. Nineteen months later, in November 1918, it had grown to a force of 2,107 aircraft and 15 airships, with 6,716 officers and 30,693 enlisted personnel in Navy units, and 282 officers and 2,180 enlisted personnel in Marine units. Even after the inevitable postwar downsizing of the fleet, Naval Aviation managed to emerge from the process as an important force in being, which, by 1920, still maintained a strength of about 850 aircraft and 30 airships in Navy units, with another 88 aircraft allocated to the Marines. Though Naval Aviation would not regain and surpass its 1918 force levels for another 23 years, World War I had nevertheless left behind a strong foundation upon which a postwar aviation establishment could be built.

Naval Treaties of 1922, 1930, and 1936

The disarmament of Germany after World War I left Great Britain with the largest navy in the world, the United States a close second, Japan third, France fourth, and Italy fifth. In order to avoid a repeat of the unrestrained naval arms race that had taken place both before and throughout the war, these five nations met in Washington, D.C., in late 1921 to negotiate a treaty placing limits on existing and future naval armaments. The Washington Naval Treaty, signed by the five participants in February 1922 and ratified by the U.S. government in June 1923, established an allowable ratio (expressed in thousands of tons displacement) between Great Britain, the United States, Japan, France, and Italy of 5:5:3:1:1 with regard to “capital ships,” which included battleships and battlecruisers.

Of great future significance to Naval Aviation, a similar

ratio extended to construction of aircraft carriers: Britain and the U.S., 135,000 tons each; Japan, 81,000 tons; and France and Italy, 60,000 tons each. Although the offensive capability of carriers was largely untested at the time of the treaty, Britain already had two with a third nearing completion, and the U.S. and Japan each had one. Faced with controlling the largest ocean areas (the Atlantic and the Pacific in the case of Britain and the U.S.), these three nations originally viewed carriers as a means to broaden fleet reconnaissance and spot for the big guns of capital ships, with secondary emphasis on the strike role, and perhaps as important, all three had battleships or battlecruisers under construction, otherwise illegal under the treaty, which could be completed as carriers (i.e., Britain—*Eagle*, *Courageous*, and *Glorious*; U.S.—*Lexington* and *Saratoga*; and Japan—*Akagi* and *Kaga*). Although reconnaissance would remain a vital carrier function, the U.S. and Japan, to a much greater extent than Britain, afterward used their new carriers to evolve multi-mission capabilities such as anti-carrier tactics, attacks on shore bases, and support of amphibious assaults.

Of related significance, the Washington Treaty, though limiting new cruiser construction to a maximum displacement of 10,000 tons and gun armament of 8 inches, placed no restriction on tonnage, thereby triggering a cruiser construction “race” between the five participating powers. Continuing negotiations through the 1920s led to adoption of the London Naval Treaty of 1930, which made a distinction between gun armament of “heavy” cruisers (up to 8 inches) and “light” cruisers (up to 6.1 inches) and set limits on both the tonnage and number of ships allowed: Britain, 339,000 tons/15 heavy cruisers; U.S., 323,500 tons/18 heavy cruisers; and Japan, 208,850 tons/12 heavy cruisers. Between 1929 and 1939, applying this formula, the U.S. Navy placed 27 new “treaty” cruisers in commission—18 heavy, 9 light—each of which was equipped to handle two or more floatplane scouts. Added to this were the 19 remaining battle-

ships (16 after 1930), 10 pre-treaty light cruisers, and two gunboats, so that by 1939 the fleet possessed 55 warships operating approximately 170 floatplanes between them.

The final treaty, the Second London Treaty of 1936, made no important changes except for an “escalator clause,” invoked after Japan refused to sign the treaty, that allowed the armament of two planned U.S. battleships (i.e., BB-55 and -56) to be increased to 16 inches. These were the first Navy battleships designed from the outset to accommodate floatplanes. After 1936, Navy shipbuilding programs relative to battleships, cruisers, and carriers were timed to place new vessels in service beyond the expiration of all treaty restrictions in 1942; however, the start of war in Europe in September 1939 effectively ended the treaty system altogether. Nonetheless, the treaties had irrevocably moved the U.S. and Japan onto a path in which major sea engagements fought a few years hence would be decided, not by converging lines of battleships, but by aircraft launched from fleets out of sight of one another.

Fleet Tactics

Naval Aviation, while not displacing the primacy of the battle line, still evolved into a key component of fleet battle tactics during the period between the wars. Fleet tactics as a whole, including the specific role to be played by aircraft within the Battle and Scouting Fleets, were largely formulated and practiced over a period of 17 years (1923–1940) through a series of 21 different Fleet Problems. Even from the very start, aircraft were seen as a means of extending the fleet’s striking power, adding over-the-horizon reconnaissance and attack capabilities that had not previously existed. During Fleet Problem I in 1923, before *Langley* possessed an operational air group, battleships were used to simulate aircraft carriers, and their floatplanes functioned as fictitious air groups.

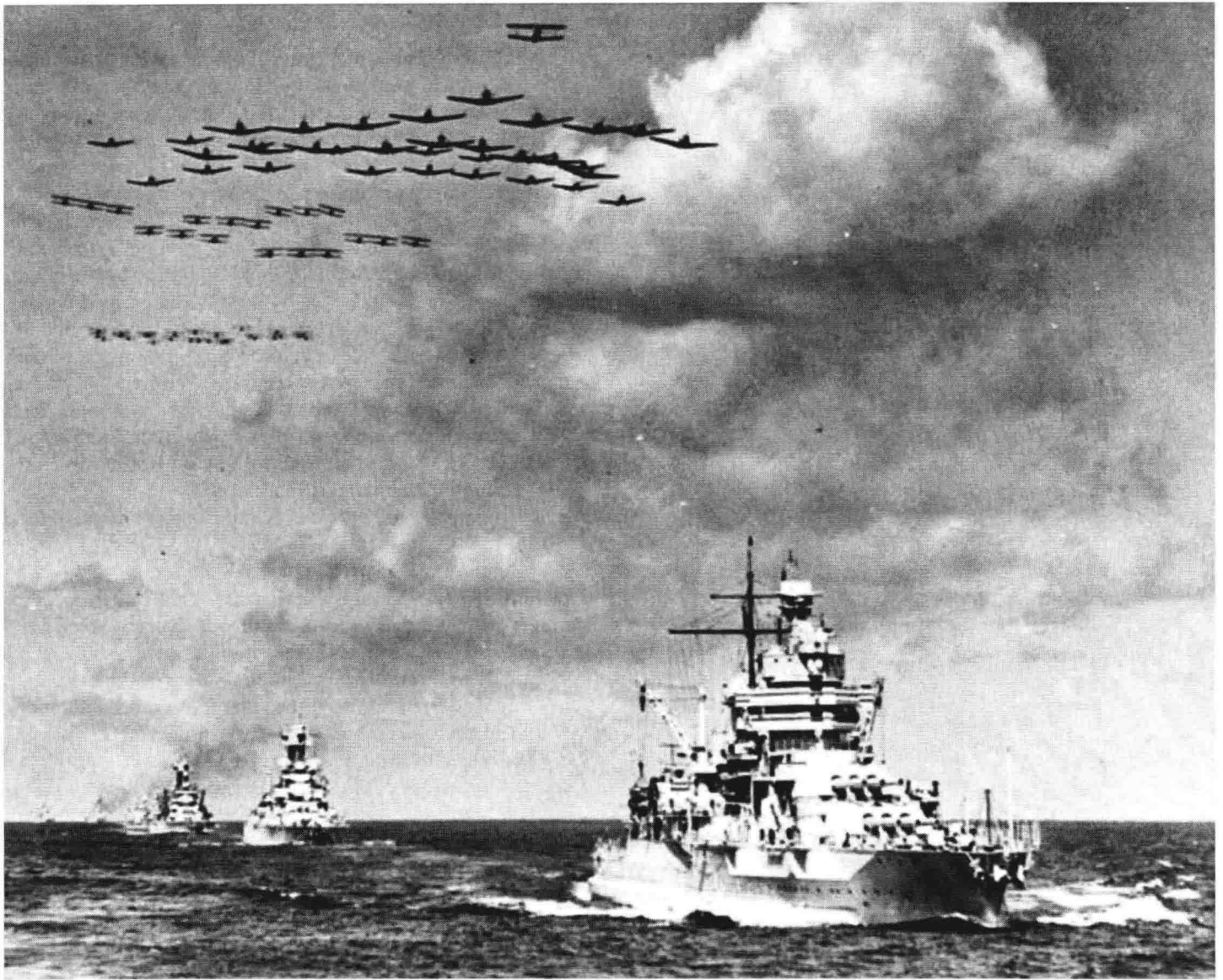
The potential shown by *Langley*’s still incomplete air group during Fleet Problem V in 1925 helped speed the completion of fleet carriers *Lexington* and *Saratoga*. Although “sunk” afterward, *Saratoga*, in Fleet Problem IX of 1929, convincingly demonstrated how a detached carrier could circumvent an enemy fleet to attack shore installations (i.e., the Panama Canal in this case). The next year, in Fleet Problem X, the tactical advantage abruptly shifted between opposing fleets when *Saratoga* and *Langley* were both “disabled” by a surprise attack launched from *Lexington*. In mock air attacks against the Battle Fleet at anchorage in Pearl Harbor, carried out in Fleet Problem XIII in 1932 and again in Fleet Problem XIX in 1938, the Battle Line was “eliminated” as an effective fighting force on both occasions. Ironically, virtually the same tactics would be copied by the Imperial Japanese Navy in December 1941.

One of the earliest influences on tactics was the advent of aerial gun spotting for battleships. By using aircraft to pinpoint targets, accuracy beyond 18,000 yards increased by a factor of 200 percent. Initially, from 1919 to 1922, surplus World War I landplane fighters had been launched from turret platforms on

one-way flights, but catapult developments during 1922 enabled a switch to recoverable floatplanes, with 18 battleships having been fitted with one or more catapults by 1925. Battleships likewise carried the first shipboard aircraft intended primarily for fleet air defense—float-equipped single-seat fighters—from 1925 until 1928, when the concept was overtaken by carrier-based wheeled fighters once *Lexington* and *Saratoga* joined the Battle Fleet. The ability of cruisers to carry floatplanes, starting in 1924, brought about an equally dramatic change in tactics, in so far as these ships could now use aircraft to scout large areas of ocean without distancing themselves from the main body of the fleet. However, related efforts to incorporate aircraft-carrying, rigid airships (i.e., *Akron* and *Macon*) into the fleet as long-range scouts ended in disaster, with the entire program being abandoned in mid-1935.

By far, however, the biggest change in fleet tactics was wrought by the introduction of aircraft carriers, especially as *Lexington* and *Saratoga* began participating in 1929. At first, torpedo attack was seen as a carrier’s primary anti-ship tactic, with the objective of hindering the enemy’s battle line until our own battleships could maneuver into optimal position (i.e., crossing the “T” in line astern formation) to administer the coup de grâce. But starting in 1930, this tactic began giving way to an anti-carrier doctrine: simply stated, before the opposing battle lines were in a position to maneuver, the carrier force would use its aircraft to seize control of the air first by sinking or disabling the enemy’s carrier force. Lacking air cover, the enemy fleet would be at a serious disadvantage as our battleships moved into position—crossed the T—to inflict a killing blow from maximum range. Moreover, if carriers were the primary targets, a low and slow-moving torpedo attack would be unnecessary; instead, the thin carrier decks could easily be taken out of action by dive-bombing attacks. Equally important, carriers gave the fleet the ability to launch surprise attacks on shore installations or to provide air cover and close air support during amphibious assaults, and a fleet equipped with two or more carriers could perform these missions independently and simultaneously. Central to the carrier doctrine was emphasis on “aggressive offensive action,” which meant finding the enemy force first and launching an air strike just as soon as it came within range.

An essential building block in the implementation of the Navy’s carrier doctrine was coordination of flight deck operations. As early as 1925 deck crews aboard *Langley* departed from a “clear-deck” landing procedure, which allowed no more than six aircraft in the air at any time, in favor of a “deck park,” where recovered aircraft were immediately moved up to the bow so incoming aircraft could land right behind them. Other innovations included erecting a traverse crash barrier between the deck park and planes landing-on, plus specialized teams of flight deck personnel identified by variously colored jerseys. By 1927, despite limited deck space, *Langley* was able to keep 22 aircraft in the air at any given time, and when *Lexington* and *Saratoga* began operating, this number increased to 83. Another Navy policy that strengthened anti-carrier tactics (vis-à-vis the



Battle formation as seen in 1939. Three battleships in the van with the *Enterprise* (CV-6) Air Group overhead.

Japanese) was early emphasis on the scouting function, giving air groups a higher ratio of scouts and bombers versus fighters and torpedo planes, and this policy eventually evolved into development of one type of aircraft—the scout-bomber—to perform both roles. Still, from a tactical perspective, the torpedo remained the only aerial weapon capable of inflicting serious damage on heavily armored ships, so with the *Yorktown* class and the planned *Essex* and *Independence* classes after it, this concern led to a restoration of one torpedo squadron (VT) to future air group complements. Henceforth and until the middle of World War II, a U.S. Navy carrier air group typically consisted of four squadrons of 22 aircraft each, a VF, a VS, a VB, and a VT, plus a five or six-plane utility unit. Comparatively, a Japanese carrier air group of the same period consisted of four squadrons of 65 aircraft, one fighter, one dive-bomber, and two torpedo, with no units dedicated to scouting.

Another decisive advantage of U.S. Navy carrier doctrine (versus the Japanese) lay in the independent authority of carrier captains and air group commanders (CAGs) to make tactical decisions on the spot, as the situation demanded. When the Pacific Battle Line ceased to exist as an effective fighting force on December 7, 1941, the Navy already possessed carrier tactics of sufficient flexibility that they could be readily adapted to the naval forces remaining. Following the Pearl Harbor attack, since they were no longer tied to support of the battle line, U.S. Navy carriers were given the added capability to maneuver independently and thus respond to rapidly changing tactical conditions much faster than their Japanese counterparts. Though outnumbered and outgunned by the Japanese fleet, superior tactics employed by U.S. Navy carriers during the early months of the war made a critical and decisive difference between victory and defeat.

Figure 1: Typical Cruising Formation

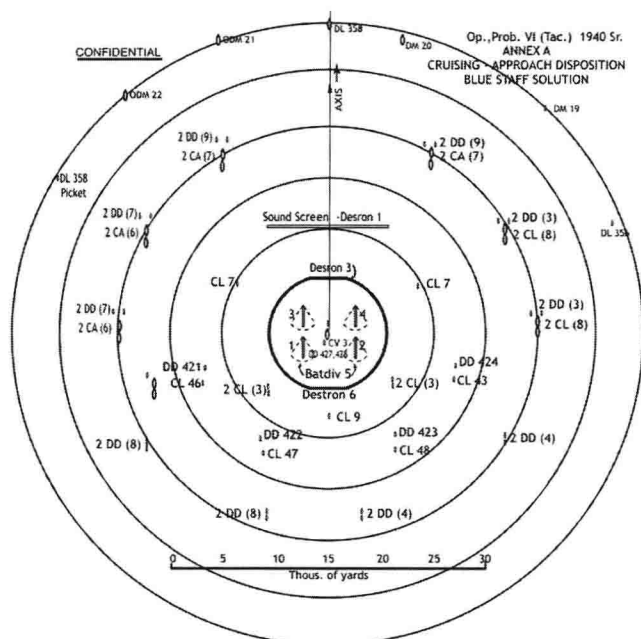
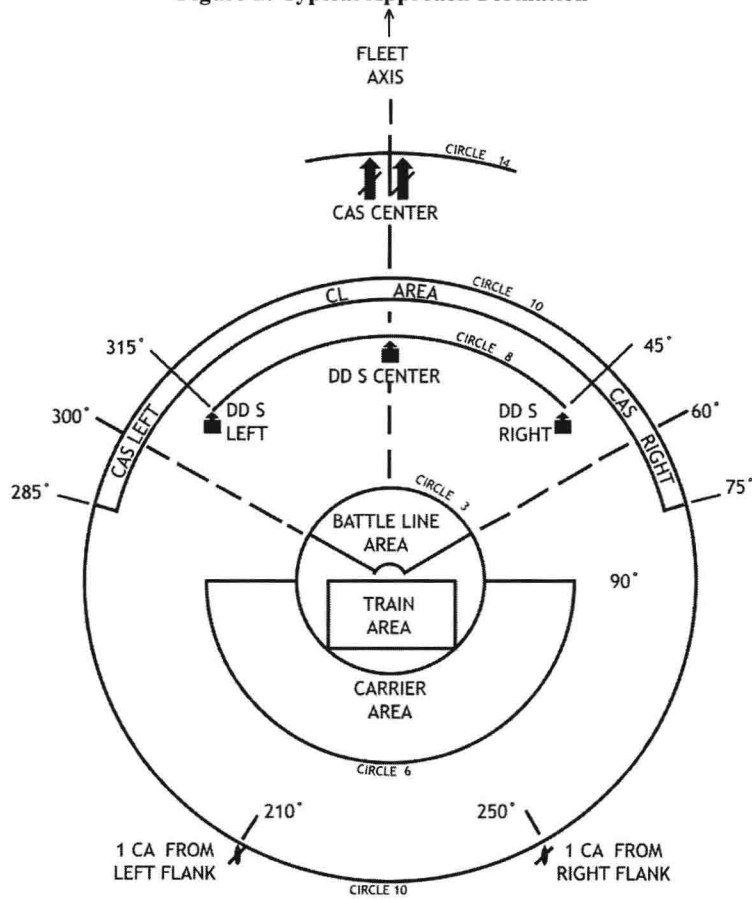


Figure 2: Typical Approach Formation



Battle fleet diagram from the late 1930s.

U.S. Government Support

Presidential and congressional support of Naval Aviation and the Navy in general can be said to have been uniformly unenthusiastic until 1932, when Franklin Delano Roosevelt became president and Democratic majorities swept both houses of the U.S. Congress. Roosevelt, a former assistant secretary of the Navy during World War I, not only championed a strong Navy but also believed Naval Aviation should play a bigger role within it. The Vinson-Trammell Expansion Act of 1934 authorized (not as yet funded) the Navy to build up its fleet to levels authorized by the Washington and London Treaties and of great importance to Naval Aviation, permitted new operational aircraft to be ordered in proportion to the number of aircraft carriers, battleships, and cruisers that would be built. In 1936, Congress funded construction of *Yorktown*, *Enterprise*, and *Wasp*, along with six new cruisers, followed in 1937 by two battleships, and in 1938 by *Hornet*, *Curtiss* (AV-4), and *Barnegat* and *Biscayne* (AVP-10 and -11), effectively tripling the size of Naval Aviation before the end of the decade.

But the most far-reaching legislation came with passage of the Two-Ocean Naval Expansion Act of 1940. Among other things, the act called for construction of 18 new *Essex* class aircraft carriers, seven battleships, plus the thousands upon thousands of aircraft needed to equip them. Some experts have characterized this act as tantamount to a declaration of war against Japan, to-wit: in order to have any practical strategic advantage, Japan would be compelled to attack American forces and possessions in the Pacific before the ships and aircraft authorized under the Act could begin entering service in 1942 and 1943.

Naval Leadership

It goes without saying that none of the foregoing factors—ships, aircraft, tactics, procedures, or government—would have shifted the advantage in the absence of effective leadership. During the period between the wars, as Naval Aviation grew in stature, a number of senior Navy officers were placed in major leadership positions. Most of these men came into their jobs with virtually no practical aviation experience, but together, with great imagination, they forged Naval Aviation into a potent fighting force.

Rear Admiral William A. Moffett. Considered by many to be the "architect of Naval Aviation," Moffett, at age 52, joined the aviation establishment after a brilliant career serving aboard cruisers and battleships. He had been awarded the Medal of Honor in 1914 for his actions in the invasion of Vera Cruz, Mexico, while commanding the cruiser *Chester*. As the first chief of the newly formed U.S. Naval Bureau of Aeronautics (BuAer) in 1921, Moffett became a leading advocate of the belief that aircraft and airships should be integral to the fleet itself, giving strong emphasis to their ability to operate directly with or from ships in an offensive role. Under his guidance, BuAer became a nucleus of aviation ideas and

a focal point for development of new aircraft and airships. In this role, Moffett also oversaw pilot and aircrew training programs, construction of new air bases, and development of catapults and carrier-arresting equipment. He was one of the 60 people lost when the airship *Akron* crashed at sea in 1933.

Vice Admiral Joseph M. Reeves. Regarded at the time as the Navy's foremost expert on battleship gunnery, 53-year-old Capt. Reeves assumed the post of Commander, Aircraft Squadron, Battle Fleet in 1925, using *Langley* as his flagship. He is credited with developing the deck park and many of the innovative deck routines that became standardized in carrier operations. Reeves also laid the groundwork for the "Carrier Warfare Model," which determined the tactical role carriers would play within the Battle Fleet. Later, as a Vice Admiral, Reeves was designated Commander-in-Chief, U.S. Fleet, from 1934 to 1936. He died in 1948.

Fleet Admiral Ernest J. King. A submarine officer at the time, Capt. King transferred to Naval Aviation in 1926 at the behest of RADM Moffett and became Naval Aviator No. 3368 in 1927 at age 49. He commanded the seaplane tender *Wright* until 1929 and assumed command of *Lexington* in 1930. Following the unexpected death of Moffett, he became the second chief of BuAer in 1933, being promoted to rear admiral soon afterward. In 1940, as a vice admiral, King was appointed Commander-in-Chief, Atlantic Fleet, then in January 1942, became Chief of Naval Operations (CNO). During his wartime tenure as CNO, he was promoted to fleet admiral. He died in 1956.

Fleet Admiral William F. Halsey. Halsey spent most of his early naval career in torpedo boats and destroyers. In 1934, at age 52, he reported to NAS Pensacola for pilot training and was subsequently designated a Naval Aviator. In 1935, after winning his wings, he assumed command of *Saratoga*. Reaching flag rank in 1938, Halsey took command of Carrier Division One and Carrier Division Two, and in 1940 became Commander Aircraft Battle Force with the rank of vice admiral. Perhaps more than any other high-ranking officer, Halsey exemplified the concept of "aggressive offensive action." As a full admiral during World War II, he commanded South Pacific Forces from late 1942, and in 1944, became Commander-in-Chief, Third Fleet. Halsey was promoted to fleet admiral after the war ended and died in 1959.

Admiral John S. McCain, Sr. After serving mainly on battleships, McCain became a Naval Aviator in 1936 at age 51. From 1937 to 1939, while commanding *Ranger*, he made major contributions to development of aircraft carrier tactics in later Fleet Problems. In early World War II, after being promoted to rear admiral, he served as Commander of Air Forces for the Western Sea Frontier in the South Pacific, then from late 1942 to 1944, acted as chief of BuAer. McCain returned to the Pacific in 1944 as a vice admiral in command of the Fast Carrier Task Force that supported various amphibious operations during 1945. He died in September 1945 and received a posthumous promotion to full admiral. Admiral McCain was the grandfather of Senator John S. McCain, III.

Admiral Marc A. Mitscher. Naval Aviator No. 33, Mitscher

served aboard battleships for several years before undertaking flight training in 1916. As pilot of NC-1, he participated in the first transatlantic flight attempt in 1919. During the 1920s Mitscher was instrumental in developing early flight operations from *Langley* and *Saratoga* and in the 1930s, played an active role in the formulation of tactics and carrier doctrine. He became the first captain of *Hornet* in late 1941 and was in command during the Doolittle raid in April 1942 and the Battle of Midway in June. As a rear admiral, Mitscher became Commander Air, Solomon Islands during 1942 and 1943, then after promotion to vice admiral, commanded Task Force 58 in 1944 and 1945. After the war, in 1946, he attained full admiral and was named Commander-in-Chief, Atlantic Fleet. He died in 1947.

General Roy S. Geiger. Known as the "father of Marine Aviation," Geiger joined the Marines in 1907 and received his wings as a Naval Aviator in 1917. After serving with the First Aviation Force in France during World War I and holding various Marine Aviation command positions through the 1920s, he became Officer-in-Charge, Marine Corps Aviation in 1930. After rising to the rank of Colonel in 1935, Geiger was appointed as Commanding Officer, Aircraft One, Fleet Marine Force. In mid-1941, he was promoted to brigadier general when his command was reorganized as the 1st Marine Air Wing. After the 1st MAW arrived at Guadalcanal in 1942, Geiger was given combined command of all Navy, Army Air Force, and Marine air operations in the area and subsequently promoted to major general. He became director of Marine Aviation in 1943 but returned to the Pacific later that year to command the I Amphibious Corps. In mid-1945, as a lieutenant general, he was appointed Commanding General of the Fleet Marine Force, Pacific. He died in 1947 and was posthumously promoted to four-star general.

Emergence of Marine Corps Aviation

Following World War I, the aviation arm of the Marine Corps almost ended before it got off to a good start. When the 2,462-man strong First Aviation Force disbanded in 1919, Marine aviation suddenly found itself with no permanent status within the peacetime Naval Aviation establishment. Given this tenuous state of affairs, Marine officials, most notably its Director of Aviation, Major Alfred A. Cunningham, began actively lobbying the U.S. Congress to mandate a permanent post-war Marine aviation branch. In 1920, due in part to these efforts, Congress established a peacetime Marine manpower level at a 20 percent ratio (i.e., 26,380 officers and men) of the Navy, which included 1,020 personnel allocated to aviation operations as well as establishing permanent Marine air stations (MCAS) at Quantico, Parris Island, and San Diego.

From this point forward, Marine Aviation was entirely reformed in terms of both organization and mission. During World War I, the First Aviation Force had operated without any organic connection to Marine ground forces; however, under the 1920 plan, it was reorganized into four groups of squadrons or detachments having the prime mission of supporting Marine

operations on the ground. Marine Aviation did not actually become an official part of the Naval Aviation establishment until early 1925, from which point procurement of virtually all Marine aircraft, with minor exceptions, was tied to the BuAer system and likewise, prospective Marine pilots were trained pursuant to the Student Naval Aviator curriculum at NAS Pensacola. By the late 1920s, Marine fighter and observation squadrons had been reequipped with carrier-capable aircraft and routinely underwent carrier qualification as an operational training requirement, and from 1932 to 1934, two Marine squadrons were detached for permanent duty aboard *Lexington* and *Saratoga*.

In 1927 Marine Aviation reorganized itself into the East Coast Expeditionary Force (Quantico) and West Coast Expeditionary Force (San Diego), with squadrons detached to support ground operations in China, Haiti, and Nicaragua. During this timeframe Marine Aviation is generally credited with having developed the first combat-tested dive-bombing techniques while providing close air support to ground forces during the Nicaraguan campaign. Commencing with the establishment of the Fleet Marine Force (FMF) in 1933, Marine Aviation, with an inventory of 92 aircraft at the time, was reclassified between FMF Aircraft One on the West Coast (three squadrons) and FMF Aircraft Two on the East Coast (four squadrons), and this scheme of organization, with its emphasis on support of amphibious and ground operations, remained in force into the World War II-era and afterward. From 1930, in addition to regular frontline squadrons, Marine Aviation's pool of pilots and trained personnel was augmented by establishment of reserve units, having grown to 10 squadrons by 1940, and the reserve pilot training system (Navy and Marine both) received another boost in 1935 with the passage of the Naval Aviation Cadet Program. During 1941, Marine Aviation grew to a strength of 6,467 officers and men with 659 rated pilots, but the process of bringing new units to operational readiness went much slower, so that as of December 6, 1941, frontline operational strength consisted of just 227 combat aircraft in two air wings with five frontline squadrons each. In the four years that followed (1942–1945), these numbers increased to an incredible 116,648 officers and men with 10,049 pilots, organized into five air wings, 31 air groups, and 103 squadrons.

Emergence of Coast Guard Aviation

The U.S. Coast Guard came into being in 1915 as a result of a merger of the Revenue Cutter Service (armed maritime

law enforcement) and Life-Saving Service (assistance to ships in distress). From its initial organization, the Coast Guard functioned as an agency of the U.S. Treasury Department until November 1941, from which point operational control was vested in the Navy Department. In 1916 and 1917, with the objective of establishing an aviation group within the Coast Guard, a number of its officers underwent pilot training at NAS Pensacola, but as events transpired, they were subsequently assigned to serve in various Navy aviation units for the duration of World War I. The first actual Coast Guard Aviation operations commenced in 1920 when six Curtiss flying boats on loan from the Navy were used to evaluate the practicality of aerial search and rescue missions from a base established at Morehead City, North Carolina; however, operations ceased in 1921 due to lack of funding. In 1926, after five years of inactivity, Coast Guard Aviation finally received funding to acquire five single-engine seaplanes to be operated from new bases established at Gloucester, Massachusetts, and Cape May, New Jersey, for the purpose of assisting Coast Guard vessels in the detection and apprehension of Prohibition Act violators (i.e., liquor smugglers).

But the most significant expansion of Coast Guard Aviation came in the early and mid-1930s as search and rescue capabilities were added to augment its law enforcement duties. Between 1931 and 1935, over 40 aircraft were added to the Coast Guard air fleet, including 19 twin-engine seaplanes (i.e., Douglas RDs and General Aviation PJs) billed as “flying life boats” and 15 single-engine amphibians (i.e., Grumman JFs) that could be used for either law enforcement or rescue missions. Coast Guard Aviation continued to grow through the late 1930s, establishing new operating bases on both coasts, and by late 1941, when it officially came under the Navy Department, numbered 90 pilots and 56 aircraft divided between 10 bases. Although the Coast Guard adopted the naval designation system for its aircraft, it appears that procurement was made through the Treasury Department rather than BuAer until 1941. The exact numbers of aircraft serving with the Coast Guard during World War II is not reported anywhere, but some references suggest that up to 300 aircraft, most under Navy bureau numbers but some under AAF serials, were allocated to Coast Guard units between 1942 and 1945. Coast Guard aircraft flew armed antisubmarine patrols off both coasts and the Gulf of Mexico during the wartime period, but search and rescue operations, including ships sunk or in distress and downed aircraft, remained their prime mission. Control of the Coast Guard reverted back to the Treasury Department in 1946.

PART I

Heavier-Than-Air Development

ATTACK AIRCRAFT

Synopsis of Attack Aircraft Procurement

The first decade following World War I marked a dramatic shift in emphasis by Naval Aviation from shore-based aerial attack toward aircraft launched from carriers operating within the Battle Fleet. As the United States' first carrier, USS *Langley* (CV-1), joined the fleet in 1922, the Navy possessed no made-for-purpose carrier aircraft and had yet to develop any practical criteria upon which new aircraft requirements could be issued, and even after the first true fleet carriers, *Lexington* and *Saratoga* (CV-2 and -3), entered service in late 1927, budgetary constraints obliged the newly established carrier air groups to make due with a variegated mix of aircraft, many of which had been adapted from obsolescent floatplane and landplane designs. Thus, from its inception in 1921, one of the U.S. Naval Bureau of Aeronautics' (BuAer) principal aims in procuring new aircraft—for obvious logistical and financial reasons—was to combine as many functions as practical into one airframe-engine combination. What the new carrier air groups needed were more fighters to improve air superiority around the Battle Fleet and more dedicated attack aircraft to extend the reach of the fleet's offensive striking power.

During the mid and late 1920s, the aerial torpedo was viewed as Naval Aviation's principal anti-ship weapon, so that early procurement efforts were focused mainly on carrier-based torpedo planes like the Martin T3M and T4M. At the same time, to preserve some shore-based torpedo and bombing capability, BuAer commenced development of the twin-engine Naval Aircraft Factory TN/Douglas T2D; however, after Air Corps criticism, the Navy was officially restricted from maintaining land-based bombardment operations, and these aircraft were subsequently reconfigured as floatplanes for patrol duties. As Naval Aviation moved into the decade of 1930s, rapid progress made in dive-bombing tactics influenced a shift toward procurement of purpose-built bomber and bomber-fighter types like the Martin BM, Great Lakes BG, and Curtiss BFC/BF2C to such extent that the Navy's fourth carrier, USS *Ranger* (CV-

4), was launched in 1933 with no provision for torpedo stowage.

By 1935, however, further refinements of tactics led BuAer to narrow the field to two basic attack classifications: two-seat scout-bombers (SB) combining the functions of scouting and dive-bombing into one airplane and three-seat torpedo bombers (TB) capable of either launching torpedoes or making level bombing runs. Renewed interest in torpedo-carrying aircraft had been spurred by the prospect of developing new aircraft types for the larger *Yorktown* class carriers planned. Carrier air groups, from this point, typically comprised four squadrons of 15 to 22 aircraft, consisting of one fighter unit (VF), two scout-bomber units (normally one VS and one VB), and one torpedo-bomber unit (VT), and this would form the basic air group pattern for fleet carriers until the middle of World War II. This rule-of-thumb did not apply, at least initially, to the two fleet carriers built without provision for torpedo stowage, *Ranger* (CV-4) and *Wasp* (CV-7), which both carried an extra VS unit instead of a VT.

While BuAer made considerable progress in establishing the functional criteria for carrier-based attack aircraft, it was decidedly slow in taking advantage of certain advances seen in the aeronautical state-of-the-art during the 1930s. Chief among its concerns was the higher operating speeds and unforgiving stall characteristics exhibited by newer all-metal monoplane designs, with the result that all of the fleet's operational attack aircraft were biplanes until the first monoplane types began entering service in late 1937. This conservative approach to innovation was nowhere more apparent than in 1934 and 1935 when simultaneous requirements were issued for new monoplane and biplane torpedo and scout-bombers as a hedge against the possibility that the monoplane types might fail to work out. However, as events transpired, new monoplanes like the Douglas TBD and Vought SB2U measurably out-performed the biplanes while still demonstrating acceptable approach speeds and wave-off characteristics. Although the first monoplane scout and torpedo-bombers began reaching fleet squadrons in late 1937, the re-equipping process was lethargic and did not keep pace with the formation of new air groups necessitated by new carriers

coming into commission (i.e., *Yorktown* in 1937, *Enterprise* in 1938, *Wasp* in 1940, and *Hornet* in 1941).

The outbreak of war in Europe in 1939, coupled with serious concerns over Japan's intentions in the Pacific, induced U.S. policy-makers to lay plans for an unprecedented expansion of Naval Aviation. In 1940 the U.S. Congress authorized a massive carrier construction program, encompassing not only a new class of fleet carriers but providing for light carriers (CVLs) and escort carriers (CVEs) as well. To equip the emergent carrier force, BuAer pressed aircraft companies hard to develop new types of attack aircraft (i.e., Brewster SB2A, Curtiss SB2C, Grumman TBF, and Vought TBU) and simultane-

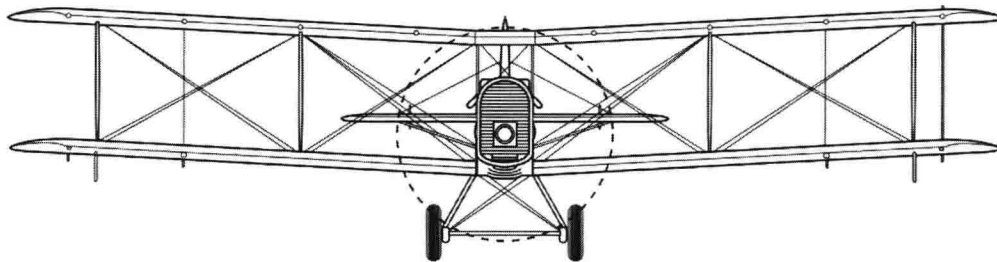
ously announced plans to order them in unheard of quantities. But the effect was far from instantaneous, so that by December 1941 the Navy's inventory of dedicated attack aircraft stood at only 809 torpedo and scout-bombers. During the course of World War II this figure grew exponentially, rising to 10,038 attack aircraft on hand by the middle of 1945.

Airco DH-4B/4M (O2B)—1918

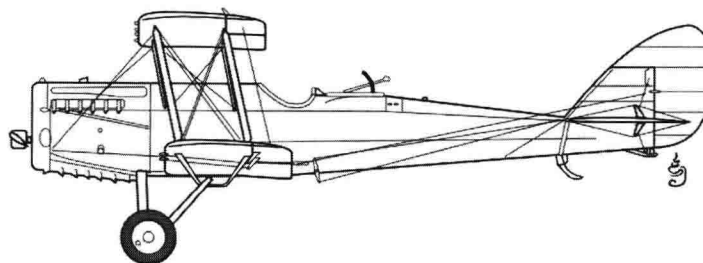
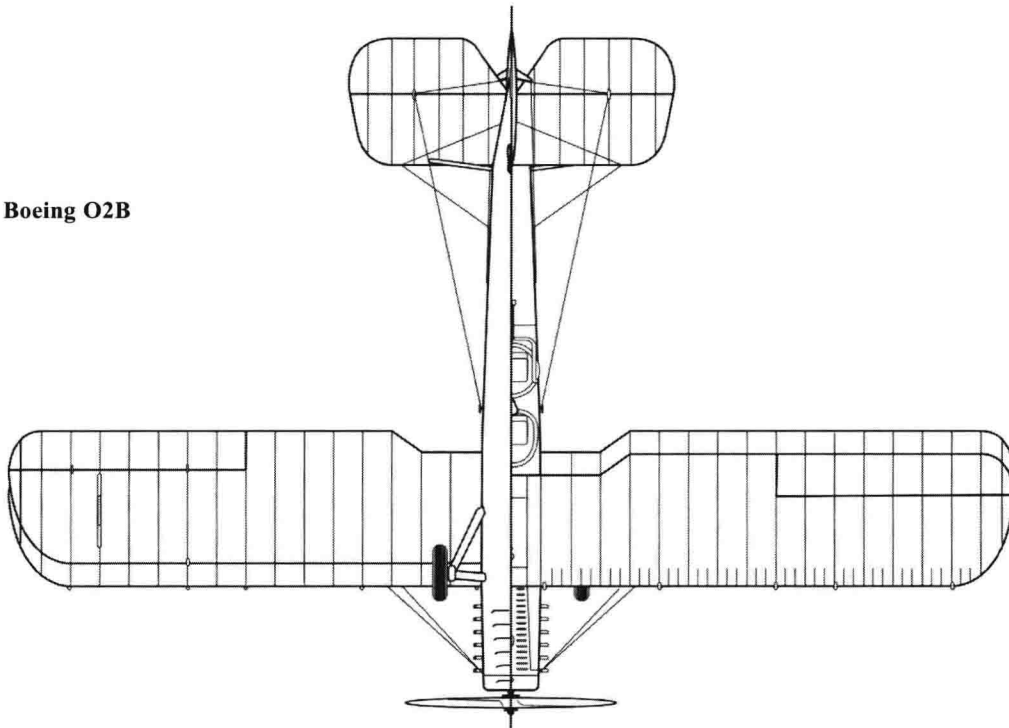
TECHNICAL SPECIFICATIONS (DH-4B)

Type: Two-place observation, bomber, and general purpose.

Manufacturer: Dayton-Wright Co., Dayton, Ohio; Standard Aircraft



Boeing O2B



Corp., Patterson, New Jersey; Fisher Body Div. of General Motors, Cleveland, Ohio; Boeing Airplane Co., Seattle, Washington; and Naval Aircraft Factory, Philadelphia, Pennsylvania.

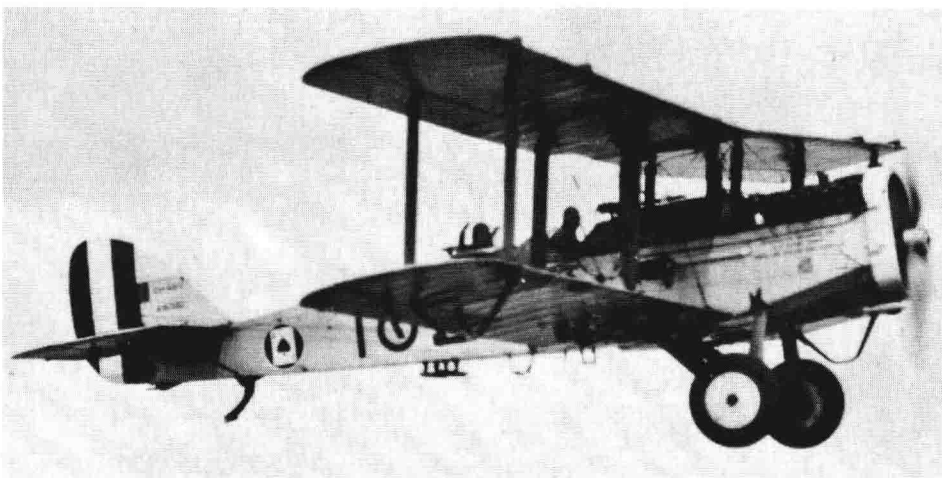
Total produced: 222 (USN/USMC)

Powerplant: One 400-hp (various auto mfrs.) Liberty 12-cylinder water-cooled inline engine driving a two-bladed fixed-pitch wooden propeller.

Armament: Two fixed forward-firing .30-cal. machine guns, two flexible .30-cal. machine guns in rear cockpit, and up to 322 lbs. of bombs carried on wing racks.

Performance: Max. speed 123 mph at s.l.; ceiling 14,000 ft.; combat range 550 mi.

Weights: 2,939 lbs. empty, 4,595 lbs. loaded. Dimensions: Span 42 ft. 5½ in., length 29 ft. 11 in., wing area 440 sq. ft.



This Marine DH-4B-1 was attached to VO-8M out of San Diego in 1927, one of 80 DH-4Bs rebuilt from War Department stocks by the Naval Aircraft Factory during the early 1920s. Replaced by OC-1s in 1928.

Based on Geoffrey de Havilland's British design for Airco, a total of 4,846 DH-4s powered by American-designed and made Liberty engines were license-built in the U.S. during 1918 and 1919. From 1919 to 1923, to improve crash protection and crew communication, 1,538 DH-4s were completed or converted to DH-4B standard, which entailed moving the main fuel tank forward and the cockpit aft, repositioning the landing gear, and skinning the entire fuselage with plywood. In the interval, the Navy received 92 DH-4Bs from the War Department, including 50 DH-4B-1s with increased fuel capacity, plus another 80 rebuilt by the Naval Aircraft Factory. Starting in 1923 as an Army program, 147 DH-4s were remanufactured by Boeing as the DH-4M with new welded, steel tube fuselages, and

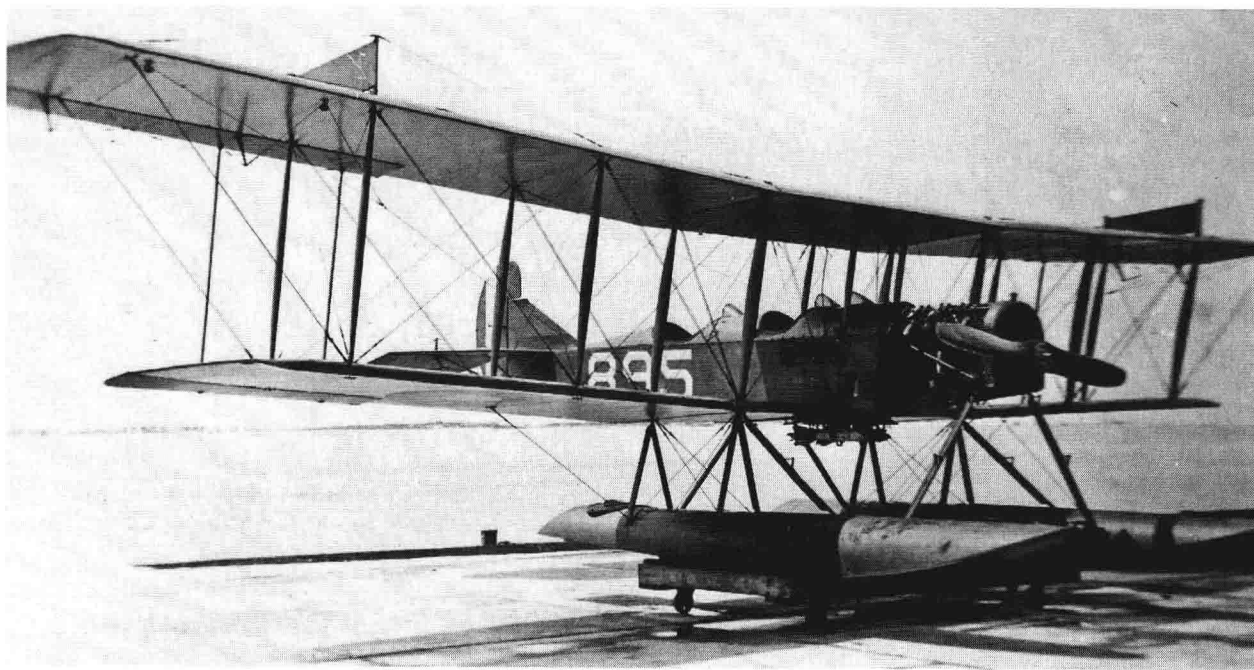
30 were delivered to the Marine Corps in 1925 under the new designation O2B-1. DH-4Bs and O2Bs serving with Marine Expeditionary Forces in Nicaragua during 1927 were credited with developing the first combat-tested dive-bombing techniques. The Navy operated DH-4Bs until 1927, while the last O2Bs remained in Marine service until 1929.

Curtiss R-6L—1919

TECHNICAL SPECIFICATIONS (R-6L)

Type: Two-place observation and torpedo floatplane.

Manufacturer: Curtiss Aeroplane Co., Buffalo, New York.



An R-6L seen on beaching dolly about 1920. Retrofitting of a 400-hp Liberty engine gave it the ability to take off with a 1,063-pound aerial torpedo. Two squadrons were maintained until 1922.