The U.S. Aircraft Carrier

From Flattop to Dominant Strike Force • Part I

adapted excerpts from the book Aircraft Carriers *by Norman Polmar, Potomac Books, Inc., Washington, D.C.*

Ed. Note: *One of the Tailhook Association themes for 2016 is "The Role of Carrier Aviation — Past, Present and Future." In support of this theme there will be a series of articles in the next few issues of* The Hook *that account for some historical and mission perspectives.*

The first detailed proposals for an aircraft carrier are believed to have been published in 1909, the same year that the U.S. Army purchased the world's first flying machine for military service.

Fragile and underpowered aircraft of the day were not ready to operate from the moving deck of a ship at sea. The U.S. Navy was first in flying off and landing aircraft on a ship; however the Royal Navy (RN) initiated the actual development of aircraft carriers as a distinct type of ship.

Early Interest in Naval Aviation, Carrier Aviation

In August 1909 the Navy Department directed the U.S. naval attaché in Paris, CDR Frederick L. Chapin, to attend an aviation meet in Rheims, France. The men and flying machines impressed Chapin. He submitted a proposal that the U.S. Navy modify one of the new, 16,000-ton battleships of the *Connecticut* (BB-18)-class to launch a Wright airplane; he also recommended the construction of auxiliary ships with flight decks for aircraft operation. His report, which also discussed the possibility of aircraft making night attacks against warships, was duly filed in the Navy Department, apparently without generating interest.

Glenn Curtiss aroused the U.S. Navy's interest in aviation. In 1908 the 30-year-old Curtiss designed, built and flew his own airplane. He won nationwide publicity in May 1910 when he flew 143 miles from Albany to New York City in two hours, 50 minutes to capture the New York *World's* newspaper $10,000 prize. Somewhat prematurely, the *World* claimed, "The battles of the future will be fought in the air! The aeroplane will decide the destiny of nations."

The newspaper promptly set up a "bombing range" on Lake Keuka near Hammondsport, New York, arranging floats to simulate a 500-by-90-ft. outline of a battleship. Curtiss flew over and dropped eight-in. lengths of one and a half-in.-diameter lead pipe on the "battleship." RADM William W. Kimball, one of the observers, declared, "There are defects for war

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Glenn H. Curtiss

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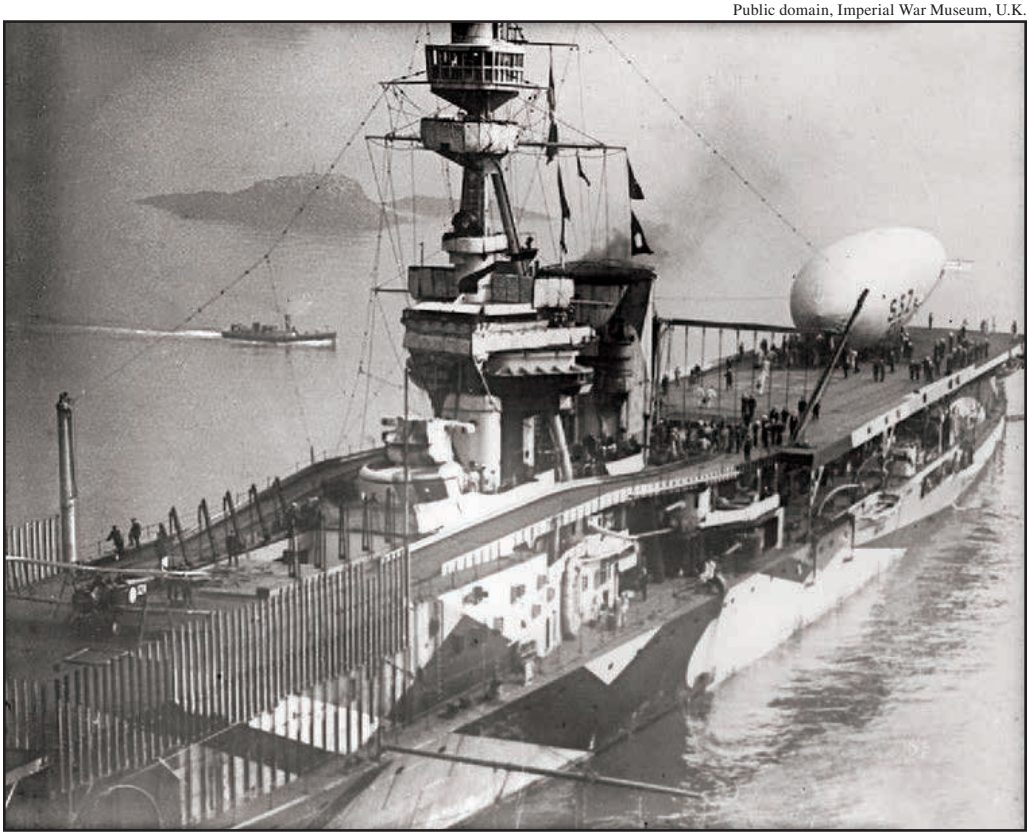

purposes such as lack of ability to operate in average weather at sea, signaling its approach by noise of motor and propellers, impossibility of controlling its height and speed to predict approximate bombing ranges and difficulty of hitting from a height great enough to give a chance of getting within effective range."

The press interpreted the results differently: The *World* told of "an aeroplane costing a few thousand but able to destroy the battleship costing many millions." The New York *Times* acknowledged a new "menace to the armored fleets of war." The aircraft versus battleship controversy was raging before the Navy had its first aircraft. At the time the U.S. Army had only one Wright flying machine.

Early British Design and Production

The RN's interest in aviation began as early as 1911 when the service considered the possibilities of using the airplane and airships for tactical scouting at sea and sent four officers to train as pilots. In January 1912 the RN made its first flight from a warship using an experimental takeoff rig that was later improved and used on other warships. During 1913 naval maneuvers, HMS *Hermes* became the first British airplane-capable warship when it was temporarily outfitted as a seaplane tender support ship with canvas hangars and a flying-off platform.

The first ship to be designated an "aircraft carrier" was HMS *Furious*. Shortly after the start of World War I, ADM Sir John Fisher, the First Sea Lord, ordered the construction of three large light cruisers — *Glorious, Courageous and Furious*. Begun in 1915, they were to be fast, lightly armored and heavily gunned. Their draft was to be kept to an absolute minimum for operations in the relatively shallow Baltic Sea.

Completed in late 1916, *Glorious* and the *Courageous* each mounted a main battery of four 15-in. guns in twin turrets and 14 torpedo tubes of 21-in. diameter (more torpedo tubes than any other ship of the day). Construction of the similar *Furious* had been delayed to arm her with a pair of 18-in. guns in single turrets — the largest guns mounted in a warship until two Japanese battleships appeared with 18.1-in. guns in WW II. On 17 March 1917, the Admiralty issued orders for *Furious* to be completed as a "partial" aircraft carrier at the expense of one of her 18-in. guns. In place of the forward 18-in. turret, a hangar was built on the forecastle of *Furious* with its roof forming a slanted flight deck, 228 feet long and 50 feet wide, ample for aircraft takeoffs. Behind her flying-off deck *Furious* retained the bridge structure, masts and funnel of a battle cruiser.

The hermaphrodite *Furious* joined the British Fleet in July 1917. Forward she was an aircraft carrier, aft a battle cruiser.

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Opposite page: *USS* Langley *(CV-1) at NAS San Diego pier, 17 Dec '19.*

Above, right: *British aircraft carrier HMS* Furious *following its initial conversion and in dazzle paint scheme, with naval airship* Sea Scout Zero *on the after flight deck, c. 1918.*

Right: *With an early catapult, a Sopwith* Pup *being readied for takeoff from the forward flight deck of HMS* Furious*, c. 1918–'19.* • Furious *with Sopwith* Camel *on forward flight deck, c. 1918. • A Sopwith* Pup *being brough up from the forward hangar on* Furious*, c. 1918.*

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Overall she was 786 feet long, displaced 19,100 tons and had an 18-boiler turbine propulsion plant that moved her at 31.5 knots. Her 18-in. gun was the most powerful weapon afloat; maximum range was more than 20 miles and fired shells weighing 3,320 pounds.

As originally completed *Furious* carried an "air group" of four seaplanes and six wheeled aircraft. A hydraulic-operated lift transported them between the hangar and flight deck. Since *Furious* had only a flying-off deck, after takeoff the planes had to fly to nearby shore bases or come down at sea.

After less than a month's operations with the new aircraft carrier, Squadron Commander E.H. Dunning, the ship's senior flying officer, resolved to solve the problem of landing on the ship. On 2 August, Dunning approached the stern of *Furious* in a Sopwith *Pup*. The ship was steaming into a 21-knot wind at a speed of 26 knots, putting a 47-knot wind over the flight deck. This was approximately the landing speed of the fighter so that the plane would almost hover over the flight deck.

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Edwin H. Dunning

Dunning flew up along the starboard side of the ship, and when abreast her bridge, he sideslipped to port and cut off his engine as he came over the flight deck. As the plane settled several men grabbed straps attached to the plane and brought it to a stop. Dunning had made the world's first landing of an aircraft on a warship underway.

On 7 August 1917 *Furious* again went to sea for landing experiments. Dunning made the first approach. This time there was more wind over the flight deck and after the plane settled toward the deck, waiting crewmen grabbed it. The craft was blown back against the combing of the elevator hatch and was damaged. Dunning was uninjured and immediately climbed into another *Pup*. He flew off and came around for another landing. As the plane came over the deck Dunning waved the crew away. He was not satisfied with the approach and wanted to come around again. But as he opened his throttle the engine stalled. Men raced to grab the straps, but they were too late. The *Pup* was blown over the side into the sea. It took 20 minutes for *Furious* to slow, turn and hoist out a boat. The smashed *Pup* remained afloat because of an air bag in its tail. Dunning, apparently knocked unconscious in the crash, drowned.

After Dunning's fatal accident the landing experiments were halted and *Furious* briefly joined her near sister ships *Courageous* and *Glorious* in the North Sea for operations against the Germans. In November 1917 *Furious* entered the yard for installation of a landing-on deck. Behind the ship's funnel was installed a landing deck 287 feet long and 70 feet wide. Under this deck, as under the forward flying-off deck, a hangar was provided that could accommodate 10 aircraft with an elevator to lift and lower them. Thus modified, the ship carried a total of 12 Sopwith *Pups* and eight Short seaplanes.

The aircraft "equipment" in *Furious* included trackways around the ship's funnel and bridge to connect the two flight decks. After a plane landed aft, it could be placed on a wheeled trolley and brought forward to the flying-off deck. A sandbag arresting gear (similar to the system used by Eugene Ely in the United States) was installed to engage a hook under the aircraft. In addition, aircraft were slowed by small V-shaped hooks on their wheel axles that engaged

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Above: *Squadron Commander E.H. Dunning made the first landing on a ship underway, 2 Aug '17 on* Furious*. Five days later he attempted two more landings; the first was successful but the second failed and Dunning was killed when his Sopwith* Pup *tumbled over the side after his approach was too high and the engine stalled on an attempted go-around.*

Left: *A Parnall* Panther *two-seater reconnaissance biplane lands on* Furious*. Parallel rows of wires acted as guides to the undercarriage, while collapsible barricades helped to slow the aircraft. The hydrovane ahead of the wheels assisted "landings in the drink."*

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fore-and-aft wires. Together those devices would, hopefully, halt an aircraft before it reached a barrier of manila hawsers stretched across the forward end of the landing-on deck.

This form of arresting gear worked reasonably well when tested ashore. However, it was never satisfactory on carriers, although it was retained for a number of years. When it was finally abandoned in 1925 there was no replacement system, and for a number of years British carriers had to rely solely on a strong head wind and slow landing speed to halt aircraft.

In March 1918 *Furious* emerged from the yard as an aircraft carrier at both ends and a monstrosity amidships; as an aircraft carrier she was unsuitable. The hot boiler gases that poured from her centerline funnel affected the density of air over her stern. With the bridge structure cutting off the air streams over the landing deck and creating eddies, the exhaust gases made landing a most difficult event. Almost every attempt ended in an accident of some severity. Even CDR Rutland, now senior flying officer in *Furious*, went over the side while making a landing, narrowly escaping with his life. For a while the aircraft were fitted with twin skids in lieu of wheels, but these were no improvement; being rigid and unsprung, they would not yield on impact as did tires, and tended to break on touching down on the hard wooden deck of *Furious*. In short order Naval Aviators decided that aircraft could not land on *Furious,* and the ship became operational as a "takeoff-only" carrier.

In 1916 the British government purchased the unfinished Italian liner *Conte Rosso* for conversion to an aircraft carrier with a flight deck running her entire length, uninterrupted by superstructure or funnels. The liner was laid down at the William Beardmore yard in Glasgow, England, but work on her halted when the war began. Work resumed to complete her as a carrier.

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Eugene B. Ely

Renamed *Argus*, she was launched in late 1917 and completed with a flight deck 550 feet long and 68 feet wide on a hull of 14,450 tons, which was 565 feet overall in length. To provide a clear flight deck, her chart house was installed on an elevator that lowered during flight operations, and exhaust gases were led aft through trunks and expelled over her stern.

The flat appearance of *Argus* created her nickname "flatiron." She could make 20.75 knots for short periods, adequate to get her 20 aircraft into the air. There were two elevators amidships to move planes between the hangar and flight decks. Normally the elevators fitted flush with the flight deck. However in early flight operations, one elevator would be left a few inches below the flight-deck level to "trap" landing aircraft and prevent them from running forward and over the bow.

The trap worked too well. Of 500 landings in that mode, 40 ended in crashes and 90 seriously damaged aircraft. The lowered-elevator scheme was abandoned.

Eagle, a battleship purchased from Chile named *Almirante Cochrane* and converted by the British, began trials in 1920. Significantly, she introduced the "island" structure to aircraft carrier design with her bridge, mast and funnels incorporated into a streamlined superstructure on the starboard side of the flight deck.

Argus, *Eagle* and *Hermes* (the world's first ship begun as an aircraft carrier) were the first generation of true aircraft carriers. Although completed too late for WW I, they were valuable experimental and training ships.

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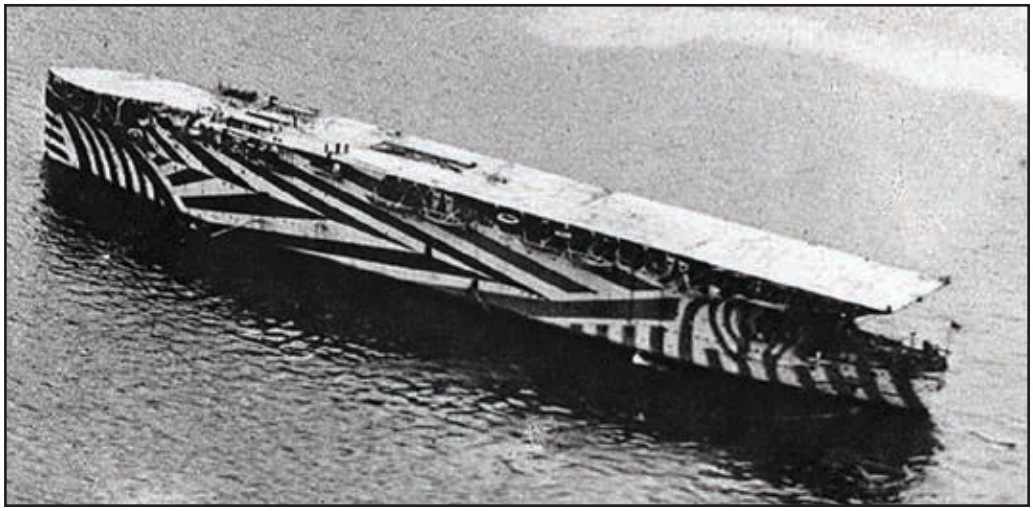
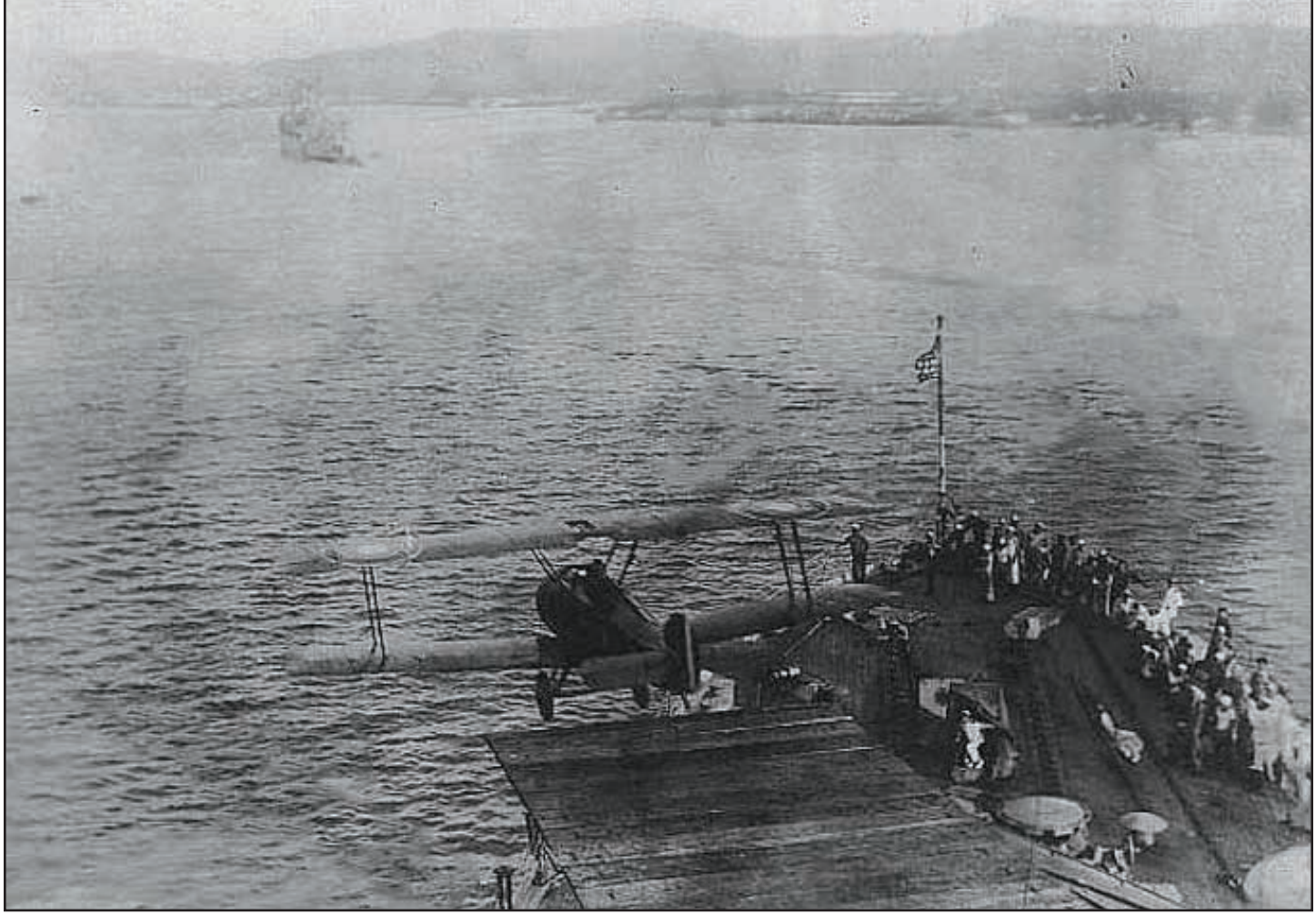


Above: *HMS* Eagle *underway, first aircraft carrier with the island on the starboard side of the ship, c. 1930s. It was sunk by German U-boat U-73, 11 Aug '42.*

Right: Argus*, nicknamed "Flatiron," c. 1917, a British aircraft carrier that served in the Royal Navy from 1918 to 1944. She was converted from an ocean liner that was under construction when WW I began.*



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First flight of an airplane off an American battleship USS Texas (BB-35) *from the take-off platform in a Sopwith* Camel *by LCDR E.O. McDonnell, 10 Mar '19.*

When WW I ended, the RN was unquestionably the world leader in carrier aviation. In the last year of the war a political event destroyed this lead and prevented the RN from ever having it again. In response to German airship strikes on England and Gotha bomber daylight strikes on London, the Lloyd George government passed a law authorizing a new Air Ministry to control all aspects of aviation in warfare and to form the Army's Royal Flying Corps and RN Air Service. On April Fools' Day 1918, the Royal Air Force (RAF) became the world's first autonomous air service.

With the Air Ministry and the RAF in complete control of aviation personnel and aircraft in the fleet, the RN's carrier force suffered grievously in the 1920s and 1930s. The lead in carrier aviation soon passed to the United States and Japan.

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Edward O. McDonnell

Observations Between the Wars

The U.S. Navy observed British carrier development with interest during WW I. When the United States entered the conflict 6 April 1917, its naval air arm had only 54 aircraft. When the war ended 19 months later the Navy's flying force had 2,107 aircraft. But there were no carrier operations by any of these planes because there were no carriers.

In the absence of an aircraft carrier, an effort was made to operate fighter-type aircraft with the fleet through the use of gun turret platforms. Platforms had been built over two of the 14-in. gun turrets of the U.S. battleship USS *Texas* (BB-35) while the ship was in England, November 1918. An aircraft could spot the fall of shot farther and more accurately than could men on the mast of a warship, an important factor in the era of big-gun warships.

The first takeoffs from *Texas* were not made until fleet maneuvers in the Caribbean the following spring. Two Sopwith *Camels* and a Sopwith *1 1/2 Strutter* were assigned to the ship. LCDR Edward O. McDonnell made the first flight in a *Camel,* 9 March 1919, while the ship was at anchor at Guantanamo Bay, Cuba. A similar platform was erected on the battleship *Mississippi* (BB-41) that operated a Hanriot HD-1. Three flights were made from each ship during the maneuvers. After taking off the planes landed ashore.

Six additional U.S. battleships were fitted with turret platforms. Takeoffs were made by British-built *Camels* and S.E.5As, French-built Nieuport 28s, and American-built Hanriot HD-1s and Vought VE-7s. All of the aircraft were fighters, with the VE-7 being derived from a trainer produced for the Army in 1917–'18.

The last U.S. Navy flights from battleship gun turrets were recorded in August 1920 when the Navy ended its experimentation with that form of shipboard aviation.

Instead the Navy decided to rely on seaplanes. Seaplanes could be serviced by modified destroyers, patrol craft and a minelayer, which became the first U.S. ships specifically assigned to full-time aviation duties. They were not seaplane carriers and were not even completely adequate as tenders. Rather, they were accommodation ships for aircraft crew and mechanics — and had limited maintenance facilities and stowage for spare parts and equipment.

In 1919 an unfinished merchant ship was acquired by the Navy and converted to a full-fledged seaplane tender. This was *Wright* (AV-1), which joined the fleet in December 1921. The U.S. Navy had yet to develop a ship to carry and launch seaplanes as did Great Britain, Japan and other nations.

The United States took a major step toward obtaining an aircraft carrier in the summer of 1919 when Congress passed the annual Naval Appropriations Act, which provided up to $500,000 for the conversion of a collier to an aircraft carrier for temporary fleet operations and experiments.

Jupiter (AC-3) was selected for conversion. The seven-year-old coal carrier was no stranger to "firsts." When commissioned in 1913 *Jupiter* was the Navy's first large ship with electric propulsion, and in 1914 she had been the first ship to pass through the Panama Canal.

In March 1920 *Jupiter* entered the Norfolk Navy Yard for conversion. All of her coal handling gear was removed and a flight deck 534 feet long and 64 feet wide was installed. The girder-supported flight deck was installed over the holds and over the ship's bridge. Traveling cranes were provided beneath the flight deck to hoist aircraft from the ship's holds and to transfer them forward and aft along the main (open) deck; a single elevator was installed to lift aircraft to the flight deck. Two jib cranes were fitted to the main deck to handle seaplanes over the side. Two 145-ft. catapults were mounted forward (removed in 1930).

Initially a short smokestack was installed on each side of the ship, each connected to the other so that exhaust gases could be discharged from either side, depending on the wind direction. (The ship was later given a fixed funnel on her port side and still later two port-side funnels that hinged outward during flight operations.) The ship retained her original electric-drive propulsion system and as a carrier was rated at an "estimated" speed of 15 knots. In reality she was a knot or two slower, making this first carrier too slow to keep up with battleships, which had a maximum speed of 21 knots.

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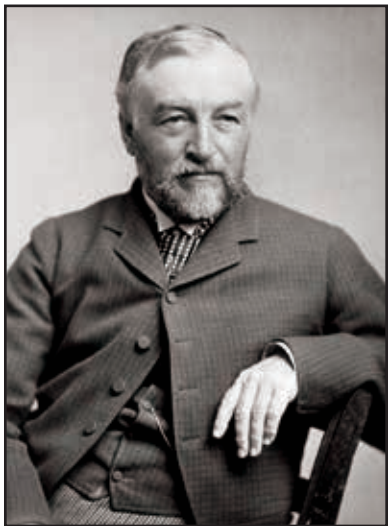

Samuel P. Langley

First Generation Aircraft Carriers

The U.S. Navy commissioned the converted collier *Jupiter* as the aircraft carrier *Langley* (CV-1) — aircraft carrier No. l, in the classification scheme for U.S. naval ships, 20 March 1922. Her new name honored astronomer and physicist Samuel Pierpoint Langley who experimented with flying machines as early as 1898. While *Langley* was being converted at the Norfolk Navy Yard, LCDR Godfrey de Courcelles Chevalier led a team of Navy pilots in flight training to operate from *Langley*. They practiced touch-and-go landings on a 100-foot wood platform built over a coal barge. At the same time at NAS San Diego on North Island, California, Navy pilots began training on an 836-ft. wood flight deck — somewhat longer than *Langley's* deck.

Langley's conversion was completed in September 1922. On 17 October while anchored in the York River, eastern Virginia, LCDR Virgil C. Griffin made the first takeoff from her deck, flying a Vought VE-7SF biplane. *Langley* aviator Jackson Tate recalled, "This was not so simple as it sounds. Planes had no brakes. In order to allow a plane to turn up to full power and start its deck run, it was necessary to develop a device consisting of a bomb release attached to a wire about five feet long. The bomb release was hooked to a ring on the landing gear and the end of the wire to a hold-down fitting on the deck. A cord led from the bomb-release trigger to an operator on the deck, who released the plane on signal."

Nine days later, 26 October, while *Langley* was steaming at 12.5 knots, Chevalier made the first landing on her deck with an Aeromarine 39-B biplane. As the plane settled down on the deck, its wooden propeller broke, but there was no crash. At the time *Langley's* arresting gear, much like the RN original design, consisted of wires running fore and aft, suspended about 10 inches above the deck and covering the after 200 feet of the flight deck. Comb-like devices on the planes' landing gear slowed them as they glided along the wires, which converged as they ran forward. While not entirely successful, this system of fore-and-aft wires was used on U.S. aircraft carriers until 1929.

Langley was also fitted with a flush-deck catapult forward — for launching heavy aircraft or lighter ones when there was no wind over her deck. On 18 November 1922 CDR Kenneth Whiting, piloting a PT seaplane, made the first catapult launch while *Langley* was anchored in the York River. *Langley* operated for two years in an experimental role, testing aircraft and carrier equipment, training pilots and developing operating techniques. There were accidents of varying severity during this period, but

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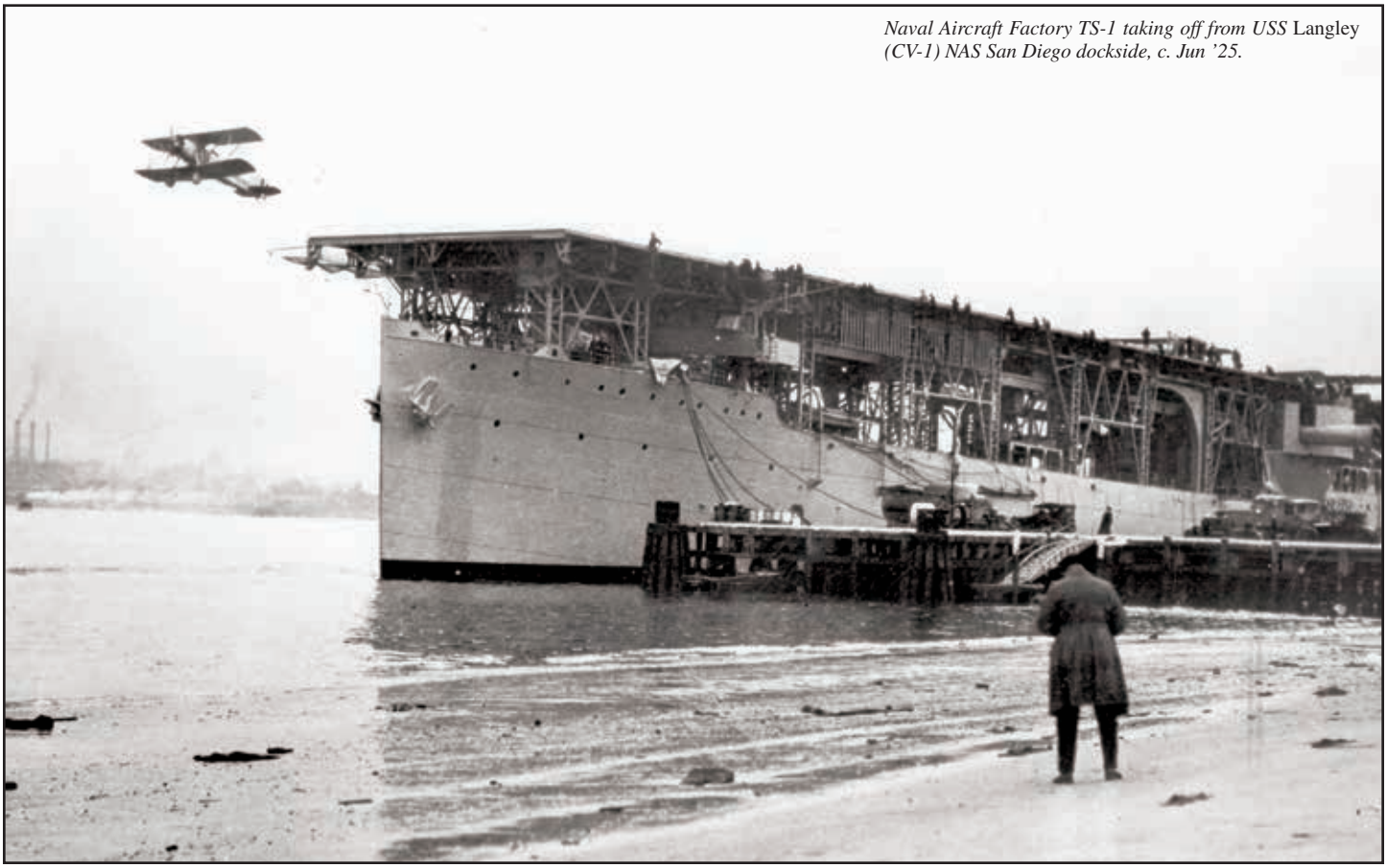

Naval Aircraft Factory TS-1 taking off from USS Langley *(CV-1) NAS San Diego dockside, c. Jun '25.*

National Archives

Three ships' insignia, from left: Langley, Lexington *and* Saratoga.

Left: *LCDR Godfrey de C. Chevalier landing an Aeromarine 39-B on USS* Langley *(CV-1), 26 Oct' 22.*

Opposite, top: *USS* Saratoga *(CV-3) in the foreground with her sister ship* Lexington *(CV-2) in the background off Diamondhead, at Waikiki Beach, Hawaii, 2 Feb '33.*

Opposite, bottom right: *Original* Langley *pilots. In the back row, second from right, stands Alfred Melville Pride. In the back row, center, Godfrey Chevalier (wearing glasses).*

no fatalities aboard the ship. On 29 November 1924, *Langley* joined the *Battle Fleet* at San Diego, ending her role as a purely experimental ship.

Navy Fighter Squadron (VF)-2 began flying from *Langley* in January 1925 for carrier qualifications, the first squadron to be assigned to a U.S. carrier. The squadron flew VE-7S fighters, rotating aircraft to the ship *Langley* also was assigned her own liaison and training aircraft.

In March she took part in her first exercise, *Fleet Problem V* off the West Coast. The nine VE-7S fighters of VF-2 aboard *Langley* had little influence on the outcome of the exercise, but her participation demonstrated the feasibility of operating a carrier with the fleet. As a result, the Commander-in-Chief, *U.S. Fleet*, ADM Robert E. Coontz, recommended accelerating the completion of the U.S. Navy's next two carriers, *Lexington* (CV-2) and *Saratoga* (CV-3).

Up to that time *Langley* normally carried only one 12-plane squadron that could be accommodated in her hangar deck, plus a few planes assigned to the ship. In October 1925, CAPT Joseph M. (Bull) Reeves, newly appointed as commander *Aircraft Squadrons, Battle Fleet*, came aboard *Langley*.

Reeves wanted to increase the number of planes embarked in the ship and to shift focus of operation from experimentation to tactical employment, and gain experience in operating large numbers of aircraft from a single flight deck.

During the next two years, Reeves and his aviators and flight-deck crew improved carrier operations — takeoff intervals were reduced to 15 seconds and landing intervals were reduced to one and a half minutes. Squadrons received aircraft improvements, or in some cases, new aircraft. Flight-deck personnel were better trained and organized, enabling smoother flight-deck operations.

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ADM Robert E. Coontz

In January 1928, *Langley* entered the Mare Island Navy Yard, Vallejo, California for an overhaul and, at the recommendation of Reeves, the flight deck was lengthened by 23 feet. When the carrier returned to sea, Naval Aviation Observer Reeves, recently promoted to rear admiral, ordered 36 aircraft to be placed on the flight deck.

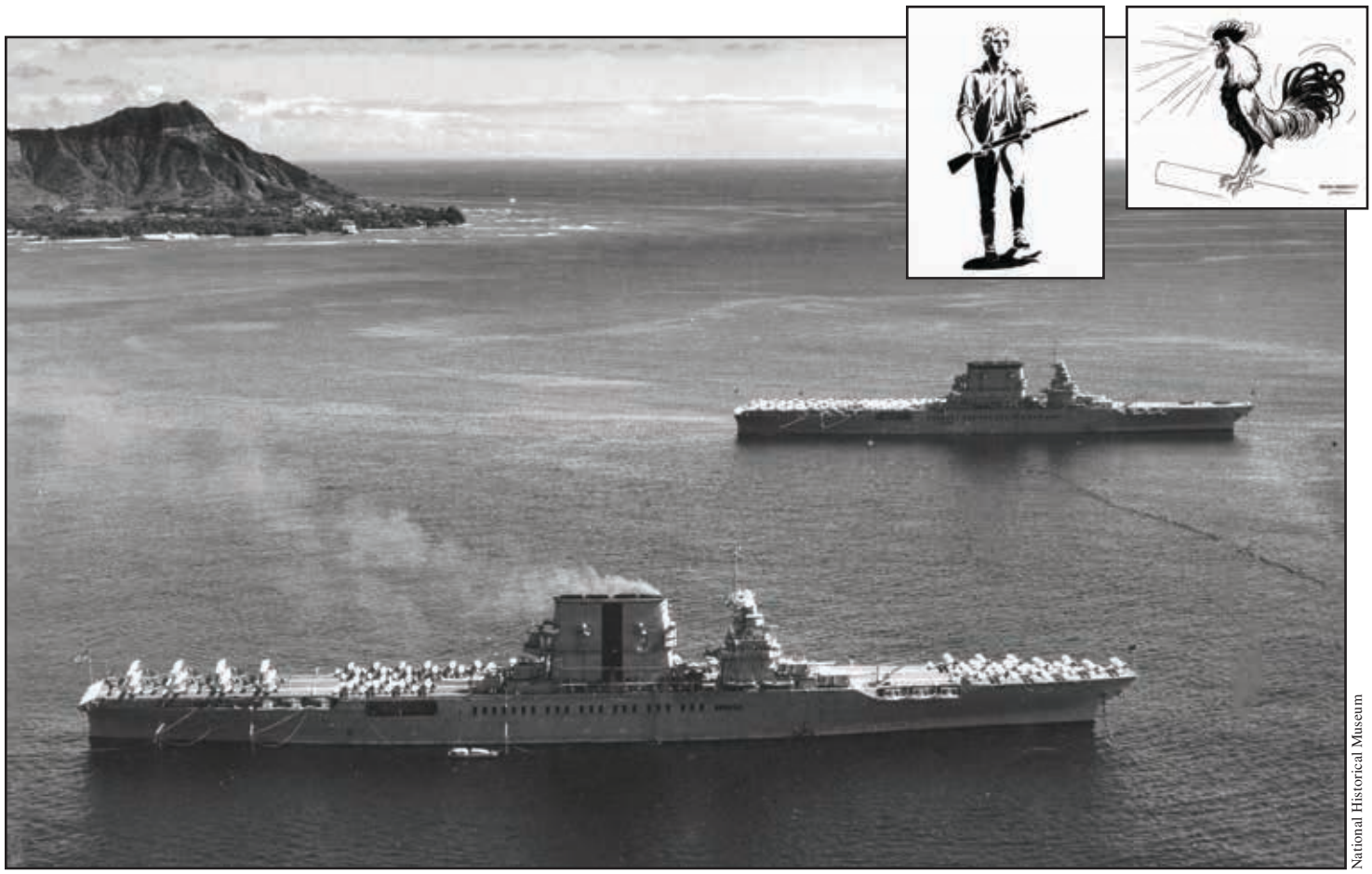
Not all aviators aboard including Commanding Officer CAPT John Towers supported Reeves' effort to embark 36 aircraft. The concern was that the increased loadout would result in more aircraft mishaps or aircrew death that could put the carrier business at risk. Reeves stood pat on his decision.

During operations off Hawaii in April 1928 *(Fleet Problem VIII) Langley* operated its 36 aircraft successfully. The ship's new Boeing F2B-1 fighters were highly maneuverable and easily outfought the Army's fighters. Also during the next two months, *Langley* and her aircraft participated in drills and exercises testing the ability of the Army and Navy to defend the islands. Operations included a simulated attack on 17 May in which 35 aircraft were launched at daybreak in just seven minutes — one plane every 12 seconds! The simulated bombing and strafing runs took the Army defenders by surprise. The successful operation validated Reeves decision to embark 36 aircraft and tactically employ them.

Second Generation Carriers

At the Washington Naval Conference of 1921–'22, politicians with relatively little assistance from naval authorities, decided to a large extent the course of carrier aviation for the next two decades. The aircraft carriers that went to sea between 1917 and the mid-1920s were the first generation. Most were converted cruisers, merchant ships and auxiliaries, with only the British *Hermes* and Japanese *Hosho* of this period being specifically laid down as aircraft carriers.

Just before the United States entry into WW I, Congress authorized the construction of six large battle cruisers. These were originally to be 35,300-ton, 874-ft. warships, each mounting ten 14-in. guns. Massive turbo-electric machinery — with exhaust gases carried away by seven funnels — were to drive the ships at 35 knots. In the early stages of construction the ships were redesigned to have a displacement of 43,500 tons and mount eight 16-in. guns with a resulting loss of two knots. None of the six was begun before hostilities ceased and none had been launched when construction was halted on 8 February 1922, in accordance with the Washington treaty limitations. The treaty allowed two capital ships to be converted to aircraft carriers. On 1 July 1922, Congress authorized the completion of the battle cruisers *Lexington* (33 percent complete) and *Saratoga* (35 percent) as aircraft carriers. Their unfinished sister ships *Constellation*, *Constitution*, *Ranger* and *United States* were scrapped on the building ways. Before the arms limitations were accepted, the Navy had contemplated construction of a 35,000-ton aircraft carrier and much of that design work went into the new ships. As the *Lex* and *Sara* took shape it became evident that they would be the largest and most powerful warships afloat. Their hulls retained the sleek lines of battle cruisers. Each ship measured 888 feet overall in length — a dimension not equaled in warship construction until WW II. Ostensibly, each carrier had a standard displacement of 33,000 tons. In reality each displaced some 3,000 tons more. The Navy Department claimed the additional tonnage was allowed under a provision of the Washington treaty that did not count weight added for certain defense systems against air and submarine attack. The only ship to displace more than these carriers between the wars was the



National Historical Museum

British battle cruiser *Hood* (42,l00 tons), which was 27 feet shorter than the big carriers.

The carriers had turbo-electric machinery designed to produce 180,000 horsepower — six times that of a contemporary battleship. This type of propulsion, tested in the collier *Jupiter*, offered several operational advantages over the geared turbines in other major warships, although it was larger, heavier and more expensive than an equivalent geared turbine plant. Still, turboelectric drive permitted more compartmentalization (for damage control) and was — in theory — more resistant to damage. In practice turbo-electric drive would be highly vulnerable to electrical short circuits from battle damage.

Lexington and *Saratoga* were the world's largest warships built with electric propulsion during the 20th century. The carriers' design speed was 33.25 knots. Both ships would exceed those figures, with *Lexington* once maintaining a speed of 34.5 knots for one hour while developing 210,000 horsepower; *Saratoga* set a big-ship speed record of 34.99 knots. So powerful were these ships that when electric power failed in the city of Tacoma, Washington in the winter of 1929–1930, *Lexington* tied up at the port and for 30 days produced electricity for the area. During the emergency *Lexington* supplied more than four million kilowatt hours of electricity.

At first it was proposed to leave the flight decks of *Lexington* and *Saratoga* unobstructed by superstructures, but after wind tests with ship models, it was decided to have their control stations, funnels and guns combined into massive island structures on the starboard side of the flight decks. These structures stretched almost one-third the length of each ship and included a massive

National Air and Space Museum

RADM William A. Moffett

National Air and Space Museum

CDR Albert Dunning collection

funnel to carry away exhaust gases from the ship's 16 boilers, venting the gases high above the flight deck where they would not interfere with landing operations.

Under the terms of the Washington treaty, guns up to 8-in. caliber were allowed in aircraft carriers. When *Lexington* and *Saratoga* were being redesigned the proposal was made to mount the largest weapons allowed plus a sizable battery of anti-aircraft guns. The Bureau of Aeronautics (BuAer) under RADM William A. Moffett decried the idea, stating, "The necessary defense of an airplane carrier against aircraft should be the aircraft carried on the carrier. It should therefore not be necessary to install anti-aircraft guns on board an airplane carrier." The BuAer also advocated 6-in. guns as the carriers' main gun battery. The Navy's General Board overruled the Bureau, noting, "The carrier may be able under many conditions to defend itself with some success with its own aircraft. The primary mission, however, of those aircraft is not the defense of their carrier, so it may well happen that they will not be available for defense when most are needed for that purpose. Aircraft will, of course, be useless as defensive weapons at night and under certain conditions of weather."

When completed *Lexington* and *Saratoga* each had a main battery of eight 8-in. guns arranged in twin turrets, two forward and two aft of the island structure. The guns had a range of 28,000 yards. Each carrier also had a dozen 5-in. anti-aircraft guns in galleries along the edge of her flight deck plus several machine guns.

The main batteries of the carriers would be their bombers. At *Lexington's* launching Moffett prophesied, "This great carrier … represents a powerful instrument on the offensive. I am convinced that a bombing attack launched from such carriers, from an unknown point, at an unknown instant, with an unknown objective, cannot be warded off by defensive aircraft based on shore." Significantly, Moffett generally favored smaller aircraft carriers; he noted that two 16,500-ton carriers could have been built in place of each of the battle cruiser conversions and, together, been able to carry the same number of aircraft.

The large carriers had two centerline elevators to connect the flight deck and hangar deck. The latter was fully enclosed as the ships' hull lines being carried up to the flight deck, although there were significant side openings in the hangar deck. That full enclosure of the hangar decks reduced their hangar capacities.

Saratoga, built by New York Shipbuilding in Camden, N.J., had to be completed by the American Brown Boveri Electric Company; still, she was the first to be commissioned, 16 November 1927. A month later, 14 December, *Lexington*, built by the Fore River Shipbuilding in Quincy, Mass., ran up her commission pennant. After provisioning and shakedown cruises, *Sara* and *Lex* passed through the Panama Canal in mid-February and late March 1928, respectively, reporting to the *Pacific Fleet*. Initially each was assigned 83 aircraft: 36 fighters in two squadrons, 32 bombers in two squadrons, a 12-plane scouting squadron and three utility planes. Although the squadrons were collectively referred to as the *Lexington Air Group* and *Saratoga Air Group*, there were no air group commanders; rather the squadrons were commanded by the carrier commanding officer, with the senior squadron commander aloft taking charge of a given formation.

Reeves was dissatisfied with the number of aircraft embarked on aircraft carriers. Soon after the two ships came under his command, he set to work to increase their capacity. Gradually more planes were put aboard until flight operations were impacted by having too many fighters and bombers on deck. Significantly, Reeves used the flight deck as a "deck park" whenever possible, unlike the British and Japanese carriers, which "parked" their aircraft in the hangar when not being launched or recovered.

He considered a plan whereby each of his three carriers — *Lexington*, *Saratoga* and *Langley* — would handle only one type of plane, fighters, scout-dive bombers or torpedo bombers. That would avoid the delay of reshuffling planes on the flight deck to have a certain type ready to launch. However he ultimately decided against such an arrangement because the loss of one carrier would deprive the fleet of one type aircraft.

Reeves also wanted all carrier fighters to carry a 500-lb. bomb. Delivery of the F4B-l in August 1929 provided the first carrier-based fighter able to deliver such a large bomb in a near-vertical dive. (Ironically, the subsequent F4B-2 had a strengthened landing gear for carrier operations that made it impossible to carry a large bomb on the aircraft's centerline.)

***In January 1929 two large aircraft carriers participated in an exercise near the Panama Canal, dubbed* Fleet Problem IX.**

Saratoga was the Black Force, commanded by ADM William V. Pratt in the Pacific Ocean, tasked with attacking the Panama Canal with 10 battleships, one light cruiser, 42 destroyers and 15 submarines. *Langley* was unable to participate with the Black Force because her overhaul had not been completed in time. The Panama Canal was defended by *Lexington's* Blue Force of four battleships, five light cruisers, 29 destroyers, 24 submarines and Army and Navy planes based at the Canal.

Saratoga's attacking Black Force was far superior to the defending Blue Force in firepower (24 16-in. and 84 14-in. guns against 42 12-inchers). On the air side the defending Blue Force was superior, with 152 effective aircraft against 116 for the Black Force.

Before the Black Force ships could attack the Canal, Blue Force ships including *Lexington* passed through the Canal and into the Pacific. Pratt moved to "destroy" the Canal before the remainder of the Blue Force could enter the Pacific. Reeves in *Saratoga* provided the plan. *Saratoga* would take a wide swing to the south and launch her planes for an attack on the Pacific end of the Canal. This maneuver would allow *Sara* to strike from an unexpected direction, possibly avoiding the Blue Force air and sea patrols. Simultaneously, a plane from seaplane

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RADM Joseph M. Reeves

Above: *VF-5* Red Rippers *F4B-1s. These airplanes replaced the F2B and F3B in VN-5 as training planes.*

Opposite page: *RADM Joseph M. Reeves' attack on the Panama Canal with* Saratoga *during* Fleet Problem IX *proved the aircraft carrier's capability as an independent and offensive naval weapon.*

tender *Aroostook* (CM-3) — representing *Langley's* squadrons — would make a long-range attack, beyond its ability to return to the ship, and bomb the Atlantic side of the Canal, after which its pilot would land and surrender.

At 0458 about 140 miles from Panama, *Saratoga* began launching aircraft: 49 F2B and F3B fighters and bombers, 17 T4Ms carrying bombs, three O2U-2 scouts and one OL-8 seaplane for communications relay between the carrier and the attacking planes. At about this time the seaplane tender *Aroostook*, operating to the north, launched her single plane. Later in the morning *Saratoga* flew off a second strike consisting of 13 O2U *Corsair* bombers.

The attacking Navy planes arrived over their targets without interference because the Army had not been told that a lone seaplane was representing *Langley's* squadrons and may have let that plane slip through unknowingly. But there was no mistaking the aerial armada from *Sara*.

The attack was a complete success. The single *Aroostook* plane "bombed" the Atlantic side of the Canal, landed and its pilot surrendered. *Saratoga* planes "destroyed" the locks and airfields on the other side of the Canal and then headed back to sea. Four planes landed ashore because of low oil pressure, and one F3B ran out of fuel while approaching *Saratoga*. It came down at sea with its pilot quickly rescued. The remaining 78 planes landed safely aboard *Saratoga*.

This demonstration of carrier air power had a profound effect on the U.S. Navy. The Commander-in-Chief, U.S. Fleet, ADM Henry A. Wiley, stated, "The launching of eighty-three planes from *Saratoga's* deck is and will remain an epic in the history of aviation. No single air operation ever conducted from a floating base speaks so eloquently for the advanced state of development of aviation as an integral part of the Fleet." Pratt called *Saratoga's* strike "the most brilliantly conceived and most effectively executed naval operation in our history."

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ADM William V. Pratt

More exercises employing the carriers followed. There were two in 1930, both in the Caribbean. In the first, planes from *Lexington* "knocked out" *Saratoga* and *Langley*, and damaged several battleships in a short period of time, showing how quickly air attacks could reduce the strength of a fleet at sea. In this exercise it took five days for the opposing fleets to make contact.

Reeves had provided the core of tactics and policies for these strikes. On 1 April 1931, he became the U.S. Navy's first carrier division commander — *Carrier Division 2* — with the additional title of commander, *Aircraft U.S. Fleet*.

In both numbers of aircraft embarked and the pace of takeoff and landing cycles, U.S. aircraft carriers were superior to foreign carriers. The efforts of Reeves, 1925–1931, were the basis for those capabilities. Reeves left Naval Aviation in 1931 and rose to full admiral within two years.

Carrier exercises continued into the late 1930s, all pointing to a new era in naval warfare. In the 1938 war games *Saratoga's* planes made a surprise mock attack on Army and Navy installations around Pearl Harbor, a favorite target of U.S. carrier fliers that would not go unnoticed by the Japanese military. However, at the time the *U.S. Fleet* was based on the California coast, and the benefits from an enemy carrier attack on Pearl Harbor would not have been significant.

Ed. Note: *Part II will expand coverage of Naval Aviation's aircraft carriers into WW II — War at Sea.*

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