By John M. Lindley

Navy's rigid airships of the 1930s represented a multimillion dollar weapons system which gradually passed out of service. But to explain their demise solely because of the competition for funding, the popularity of the airplane, or of their supposed vulnerability to attack is to overlook the presence of other alternatives in Naval Aviation at that time. Although several airship officers did grasp the idea that *Akron* or *Macon* could operate as a lighter-than-air carrier for scouting, this idea was never fully worked out prior to the crash of *Macon* and it certainly was not widely known to naval leaders outside of the lighter-than-air field. Lacking an appreciation for this potential doctrine for airship operation, critics of the rigids saw only the expense and publicity, not always favorable.

Even if this doctrine had gained widespread acceptance, it would probably have changed surface warfare tactics very little because it fitted in easily with the dominant tactics of the interwar period. The rigid airship as a scout was no threat to the battle line and the big gun. The rigids, with their heavier-than-air detachments, were basically scouts with no offensive combat roles; thus they required no substantial re-thinking of surface warfare organization or tactics.

The aircraft carrier, meanwhile, was still undergoing substantial technological development in the 1920s and 30s. Yet, because it was a new and an experimental ship type whose aircraft had a potential for both scouting and offensive air operations, it was bound to have a greater impact on surface warfare organization and tactics than the rigid airship had had. The degree of influence which the carrier would have on fleet organization and tactics depended principally on how success-

Capt. J. M. Reeves (left) and RAdm. W. A. Moffett aboard Langley, circa 1924-25.

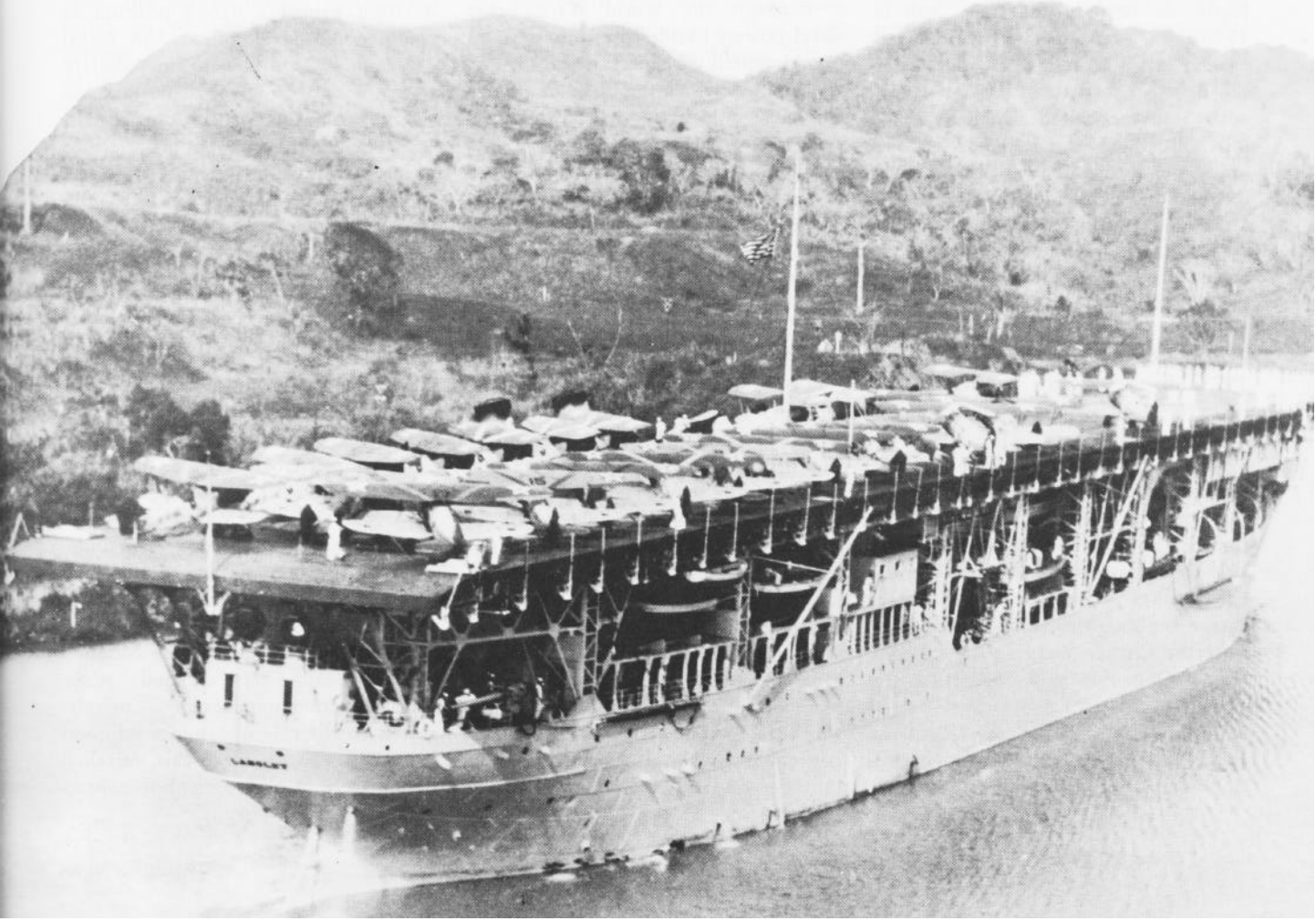
ful officers in the British, Japanese and American navies were in working out the implications of carrier operations for naval warfare. In short, how able they were in formulating an operational doctrine which not only included this new ship type, but also employed it to its fullest capabilities.

During the early interwar period the British were making headway in carrier building and development. Many American admirals were reluctant to try to catch up with or overtake the British; consequently they resisted the initial efforts of other U.S. Navy leaders to begin experimental development of carriers. At first the U.S. Navy concentrated upon developing seaplanes and flying boats. Float-equipped planes assigned to battleships and cruisers could either be flown off a turret or catapulted. Their use in gunnery spotting was considered essential to battle-line tactics. Like flying boats, these aircraft did not in any way restrict the arc of fire of the big guns on these warships. Once the planes had done their work as spotters, they could be recovered by cranes or by seaplane tenders.

Seaplanes and flying boats were also useful for long-range patrol or reconnaissance missions. Thus the Navy emphasized the development of patrol planes. The F5L flying boat of WW I never got into action in that conflict, but the Navy eventually bought a total of 227. The last of these flying boats was withdrawn from service in 1931. Following the flight of the NCs in 1919, the Navy built six more of this type of patrol plane, but they proved too unwieldy for routine operations. Thus the majority of the flying boats which the Navy built or bought during the 1920s were essentially structural variations of the basic F5L type with improved engines or other design improvements. The PN-9 which Commander John Rodgers flew to Hawaii had, for example, a hull made entirely of duralumin rather than laminated strips of wood.

The first monoplane flying boats in the U.S. Navy were the PY types whose prototype was built by Consolidated Aircraft with production models built by the Glenn L. Martin Company as P3M-1s, first delivered to the Navy in 1931. These were followed by improved Consolidated P2Ys. Beginning in 1936 the Consolidated PBYs began to replace the P2Ys for patrol duties with the fleet. The PBY (named the *Catalina* early in WW II) subsequently saw extensive service with the British RAF in the Atlantic and Mediterranean during the war, and it was the principal patrol-bomber flying boat in the U.S. Navy when America entered the war. To aid in operations involving seaplanes and flying boats, the U.S. converted several older ships to seaplane tenders. The first of these was completed in 1921 as USS *Wright*

Langley in Panama Canal



(AV-1). Seaplane tenders could neither carry nor launch seaplanes or flying boats, but they had great utility as advanced bases that provided servicing facilities for these planes and quarters for their crews.

The naval emphasis upon the development of flying boats in the interwar period was largely a product of their reliability and their range for long over-ocean flights.

The development of flying boats and other aircraft in the 1920s and 30s was assisted materially and psychologically by the Schneider Trophy Races. The French aviation buff Jacques Schneider had sponsored in 1913 an international aviation competition open to seaplanes of all nations. A trophy and prize of $5,000 went to the winner of each competition. In 1923 Lt. David Rittenhouse, USN, won the trophy with a Curtiss CR-3 flying at over 177 miles per hour. Two years later Lt. James Doolittle, USA, upped that winning speed to 232.57 miles per hour with a Curtiss R3C-2, the last biplane to win the Cup. Maj. Mario de Bernardi of Italy won in 1926 with a Macchi M-39 which averaged nearly 245 miles per hour. Then the British dominated the Cup Races with *Supermarines* designed by R. J. Mitchell flying at speeds up to 343 miles per hour. The British finally retired the Schneider Cup in 1931 after having won three straight races.

The nations which competed in these races took them seriously for more than the prize money, which generally covered little more than the expense of entering the races. After 1923 all the aircraft entered in the races were designed exclusively for racing.

The aircraft designed for carrier operations in this period were not as fast or as impressive as the racers. Carrier airplanes had to be sturdy and able to withstand the shocks of arrested landings. Widely used U.S. Navy carrier biplanes of the interwar period were the Chance-Vought O2U *Corsair,* the Boeing F3B and F4B, and the Martin T4M-1. The *Corsair* was a versatile scout able to use wheels or floats and be catapulted from battleships and cruisers as well as operating carriers. The F3Bs and F4Bs were Navy fighter planes with a maximum speed of 157 miles per hour in the F3B and 176 miles per hour in the F4B. The T4M-1 carried a torpedo, up to 1,500 pounds of bombs, and had a top speed of 114 miles per hour. It carried a crew of three.

The U.S. took a hesitant step toward the fast carrier task forces of WW II in 1919 when Congress authorized the conversion of the collier *Jupiter* to an aircraft carrier. Renamed USS *Langley* (CV-1: C for carrier, V for heavier-than-air), this first carrier had a flight deck 534 feet long and 64 feet wide. When she joined the fleet on March 30, 1922, she carried 34 airplanes and was nicknamed *The Covered Wagon.* Originally *Langley* had a short funnel on either side of the flight deck for exhaust gasses. Later this arrangement was modified so that both funnels were on the port side and hinged so that they would swing outboard of the ship during flight operations. Her first takeoff and landing took place in October 1922.

Between the World Wars, other naval powers besides the United States experimented with aircraft carriers and the aircraft which could be used with this new ship type. The British responded to the limitations on capital ships by converting two cruisers to carriers — rather than scrapping them. These ships were *Courageous* and *Glorious,* each capable of carrying 36 aircraft. Thus *Courageous* and *Glorious,* together with *Hermes* (laid down before the end of the war), *Furious* (modified as a flush-deck carrier in 1925), and a new *Ark Royal* (60 aircraft, maximum speed 30 knots) which was completed in 1938, gave the British five big carriers by 1939. However, the Royal Navy was not able to capitalize on the construction of these ships and develop carrier tactics and aircraft procedures during the interwar period because the RAF dominated fleet aviation until 1937 when the Fleet Air Arm finally gained separate status from the RAF. The main concern of the RAF had been the development of land-based forces; consequently Naval Aviation had to take a secondary role.

Following the completion of the "world's first built-for-the-purpose" aircraft carrier, *Hosho,* in 1923, the Japanese also converted two battle cruisers to carrier use. These ships were *Akagi* and *Amagi* (later damaged in an earthquake and scrapped). *Akagi* was a strange carrier by present-day standards. She had three flight decks in tiers and a port-side island which proved to be a problem because it produced disturbing air currents over the flight deck during landing operations. In 1928 the Japanese converted another capital ship to a three-deck carrier, *Kaga.*

A third generation of Japanese carriers joined the fleet in the 1930s. *Ryujo,* completed in 1933, was a small vessel of only 8,000 tons. She carried 36 aircraft. *Soryu* (34 knots, 55 aircraft) and *Hiryu* (34 knots, 55 aircraft) came along in 1937 and 1939. Two more carriers, *Shokaku* (34 knots, 72 aircraft) and *Zuikaku* (34 knots, 72 aircraft), followed these earlier ships in joining the Japanese Fleet in 1941.

In contrast to Japan where Naval Aviation gained a strong position in planning and development, U.S. Naval Aviation lost influence immediately after the end of WW I. This loss was partly the result of substantial cutbacks in financial appropriations which were politically popular in the 1920s. Equally as important were military problems.

Internally, many senior naval officers, who had received their training on the decks of battleships, felt that aircraft should be subordinate to ships' guns. The Navy's Gun Club saw no special need to promote aviation at the expense of capital ships and surface auxiliaries.

The external influence on Naval Aviation in the 1920s was spearheaded by General "Billy" Mitchell. Mitchell wanted the U.S. to have an independent air force similar to the RAF in Great Britain. This air force would concentrate on long-range strategic bombing and thereby (or so Mitchell and his supporters claimed) make Naval Aviation unnecessary — or relegate it to the role of a minor adjunct. In an effort to achieve this, Mitchell deliberately stirred up public contro-

versy. Typical of this were the controversial bombing tests in July 1921 during which the Army Air Corps sank the anchored and unmanned ex-German battleship *Oftsfriesland* and then claimed to have demonstrated that this feat proved aircraft had made navies obsolete.

Such controversy helped make the entire Navy more aviation conscious. Following Adm. Moffett's leadership, Naval Aviators vigorously defended aviation's place within the fleet. Congress was persuaded to give Naval Aviation greater status and influence by establishing the Bureau of Aeronautics in 1921 and the office of the Assistant Secretary of the Navy for Air in 1926.

The growing consciousness of aviation within the Navy, in conjunction with the Washington Naval Disarmament Treaty of 1922, led to the construction of two more carriers. Under the terms of the treaty all carriers already built or under construction were classified as experimental vessels. The signatories also agreed that the U.S. and Great Britain could each build up to 135,000 tons of new carriers and Japan could build up to 81,000 tons of carriers. Capital ships such as cruisers and battleships were limited according to a ratio of 5:5:3 on the basis of existing tonnage for Great Britain, the United States and Japan, respectively. Since the U.S. knew it would have to scrap several battle cruisers then under construction in order to comply with the treaty ratios, the Navy decided to convert two of these cruiser hulls to aircraft carriers. Eventually the two hulls became the carriers *Lexington* (CV-2) and *Saratoga* (CV-3).

Each carrier displaced 36,000 tons, had a maximum speed in excess of 33 knots, and carried 72 aircraft. Thus they were roughly equal to the third-generation carriers of the Japanese Navy. In addition to their aircraft, both carriers retained some of their original cruiser armament – twin turrets with 8-inch guns forward and aft of the superstructure. These guns as well as the bridge, funnels and other control stations formed a massive island on the starboard side of each vessel. When *Saratoga* and *Lexington* joined the fleet, toward the end of 1927, the U.S. Navy had begun a modest but determined carrier building program. Other carriers soon followed in the 1930s. Construction of *Ranger* (CV-4) began in 1931; *Yorktown* (CV-5) and *Enterprise* (CV-6) followed in 1934 and *Wasp* (CV-7) and *Hornet* (CV-8) in 1936 and 1939, respectively.

After *Langley* joined the fleet in the mid-1920s, the Navy began using its carriers extensively in fleet exercises and training problems. These problems trained personnel and tested the characteristics and capabilities of the carriers. When Naval Constructor Holden C. Richardson invented a practical turntable catapult for launching aircraft in 1921, he provided warships with an efficient device for launching small seaplanes. Thus catapults were widely used on battleships and cruisers to launch float planes which spotted naval gunnery fire. The carriers of the interwar period also had catapults, but generally they were used only for launching seaplanes. The use of catapults for launching wheeled aircraft did not come into widespread use until WW II. Prior to that, wheeled aircraft were usually able to take off from carriers under their own power. The catapults varied. *Langley* had a compressed air catapult while *Lexington* and *Saratoga* initially had whirling fly-wheel devices that powered their catapults. Shortly before WW II these machines were replaced with flush-deck hydraulic catapults. The Navy found that the operational advantages of the catapult were substantial. Catapults, by providing initial assistance at the moment of takeoff, increased the load-carrying capacity of aircraft thereby either lengthening effective range or enlarging the armament load. For seaplanes, launched from battleships and cruisers, the turntable catapult was especially useful. It made launches possible when rough seas would have prevented a conventional surface takeoff. Equally important, since the turntable catapult could be pointed into the wind, it was possible to launch aircraft without interrupting cruise formations by hunting a favorable wind.

The thorniest technological problem encountered in the development of carrier aviation was the design of suitable equipment for restraining planes once they touched down on a carrier's deck. While *Langley* was being constructed, a dummy deck was installed on a huge turntable at Naval Air Station, Hampton Roads. The

XS-2 seaplane preparing for launch aboard S-1 submarine (1926).

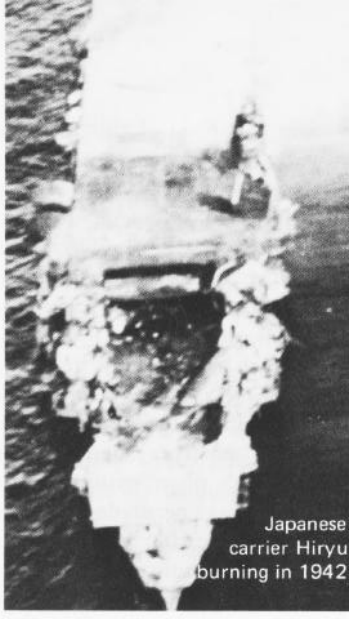
turntable was used because it could be turned so that the planes could head directly into the wind. On the deck a British-type arresting gear was installed, consisting essentially of cables running longitudinally the length of the deck. The theory was that these fore-and-aft lines would catch hooks mounted on the plane's axle and, through friction, gradually bring it to a halt. They would also guide the plane down the flight deck and prevent it from careening over the side.

Before Lt. A. M. Pride began testing this rig, other lines were mounted crosswise of the deck and attached to weights suspended from a tower. A larger hook was also secured to the bottom of the plane so that it would engage these athwartship lines and thus help retard the plane. This hybrid system was perfected and installed aboard *Langley* when LCdr. R. G. de Chevalier made the first landing aboard, October 26, 1922. A similar configuration was installed on the Navy's next carriers, *Lexington* and *Saratoga,* when they were commissioned. The fore-and-aft wires however proved very cumbersome. In January 1931 Squadron Leader W. R. D. Acland, RAF, gave a talk to the Royal Aeronautical Society on carrier landings in which he said the wires "in about nine cases out of ten turned a moderately good landing into a bad one. . . .Fore and aft wires were therefore abandoned" and the British returned to making unretarded landings.

The U.S. Navy also concluded that the fore-and-aft wires were a hindrance and removed them in 1929. The athwartship wire, which had been appended to the longitudinal wire system became the major element of arresting gear, particularly when attached to a hydraulic energy-absorbing mechanism. Thus the modern arresting gear came into being.

Carrier training exercises and problems also provided an opportunity for tactical experimentation. Bombing operations in WW I had shown that a higher percentage of hits resulted from low-altitude attacks. Post-war experiments with captured German warships also showed that attacks at about a 60-degree angle were very accurate although subject to possible heavy anti-aircraft fire. Consequently Navy and Marine Corps pilots began to develop the technique of dive-bombing in the mid-1920s. Soon thereafter, the Navy began designing aircraft specifically for this method of attack.


T4M over Saratoga


Japanese carrier Hiryu burning in 1942

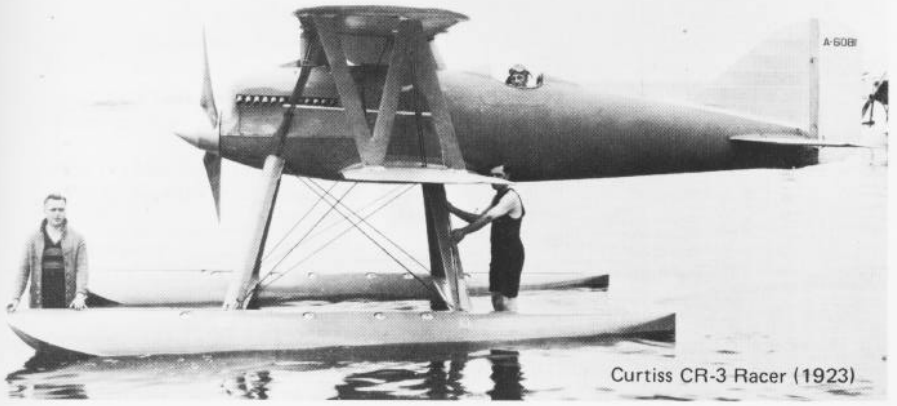

LCdr. Hunsaker

Although these operational tests and experiments in Naval Aviation technology and tactics were relatively crude in comparison with the sophisticated research and development carried out with present-day weapons systems, they did provide operational experiences which, in the words of one Navy aeronautical engineer, Cdr. J. C. Hunsaker, "reveal the past and present state of the art" and "show the trend of more successful designs." Thus Naval Aviators could determine the direction of the most promising future technological and tactical developments.

Fleet Problem IX of 1929 is a fine illustration of the experimental direction of Naval Aviation in the interwar period. This was the first fleet exercise for the new fast carriers *Lexington* and *Saratoga.* Black Forces operating in the Pacific, including *Saratoga* and *Langley*, were to attack the Panama Canal which was defended by the Blue Force of warships, *Lexington* and land-based Army airplanes. When *Langley* had a breakdown, the seaplane tender *Aroostook* was substituted – with one float plane representing *Langley's* 24-plane squadron.

While the Black Fleet was planning the attack, Rear Admiral Joseph M. Reeves persuaded Adm. William V. Pratt to let him divide his air power and attack from two directions. A task force consisting of *Saratoga* and the cruiser *Omaha* was to make a wide sweep to the south and then sail north along the South American Coast and attack the Pacific terminus of the canal. Simultaneously, *Aroostook* would launch its plane from extreme range, attack the Atlantic terminus and then land on the beach and surrender.

On the afternoon before the attack, *Saratoga* and *Omaha* encountered and disposed of an enemy destroyer. During the evening the cruiser *Detroit* encountered them, tracked them dur-



Curtiss CR-3 Racer (1923)

ing the night and provided the defending commander with position reports. At 4:58 a.m. on January 26, *Saratoga* launched her attack on the canal from a distance of 140 miles. Some 70 planes, including dive bombers, torpedo planes and fighters, arrived over the target, catching the enemy by complete surprise. The lone utility plane from *Aroostook,* aided perhaps by the fact that the Army had not been advised that one aircraft represented 24, was equally successful. Theoretically, the simultaneous bombings blew up the Miraflores and Pedro Miguel Locks and damaged the air fields at Forts Clayton and Albright.

Some writers have heralded this exercise as marking the birth of the fast carrier task force. More realistically, it was a dim portent of the future. There was much that had to be learned before the great carrier task forces of WW II could even be visualized. Fleet Problem IX, however, demonstrated clearly that aircraft carriers could successfully attack land-based aircraft and installations. Adm. Pratt called the air attack from *Saratoga* "an epic in the history of aviation." He said, "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." Admiral H. W. Wiley, Commander-in-Chief, U.S. Fleet, also commented that the use of stronger aircraft was the only method that either ships or coastal strong points could rely upon to beat off air attack. The admiral added that there was no "analysis of Fleet Problem IX fairly made which fails to point to the battleship as the final arbiter of naval destiny."

Adm. Wiley's statement was clearly a manifestation of what Adm. Chester Nimitz described as the enduring "controversy over the relative emphasis to be placed on carriers and heavy ships." Throughout the period between the World Wars and on into WW II, "Many officers regarded the carrier strictly as an auxiliary, of little use beyond reconnaissance and gunfire spotting. Others, including Adm. Moffett, saw the carrier as nothing less than the capital ship of the future."

Fleet exercises such as the one in 1929 gave some indication of the future uses of the carrier, but they were by no means conclusive in settling the problem of the role of this ship type in the fleet. The U.S. had the industrial capacity to produce the ships and planes necessary to provide for realistic tests of the carrier and its aircraft, but two practical factors hindered this type of experimentation. One factor, the extremely high rate of obsolescence of aircraft, slowed carrier development. The second factor, the reluctance of Congress to spend money on costly research and development, was equally important. Even after improved carrier aircraft such as the Chance Vought *Vindicator* bomber (SB2U), the Grumman *Wildcat* fighter (F4F), the Douglas *Devastator* torpedo plane (TBD) and *Dauntless* dive bomber (SBD) gradually became available for carrier operations between 1937 and 1941, realistic, full-scale maneuvers were not truly possible.

The uncertainty over the role of the aircraft carrier in the fleet was apparent in statements of fleet doctrine and in actual exercises. On the one hand, Admiral William S. Sims, as advocate of Naval Aviation, told a Congressional committee in 1925 that "A small, high-speed carrier alone can destroy or disable a battleship alone, ...a fleet whose carriers give it command of the air over the enemy fleet can defeat the latter, . . .the fast carrier is the capital ship of the future." Sims defined the fast carrier as "an airplane carrier of 35 knots and carrying 100 planes" which was "in reality a capital ship of much greater offensive power than any battleship." On the other hand, the official U.S. Navy War Instruction of 1934 stated that carriers were "simply mobile airplane bases and their use depends upon the employment of their aircraft." The War Instructions did not consider the carrier a capital ship. Her jobs were reconnaissance, shadowing the enemy, spotting gunnery fire in surface actions and shore bombardment, protecting herself and the fleet from submarine and air attacks and attacking a faster enemy to slow him down so that the battleships could do the fighting.

To be continued

Mitscher makes first landing on Saratoga.