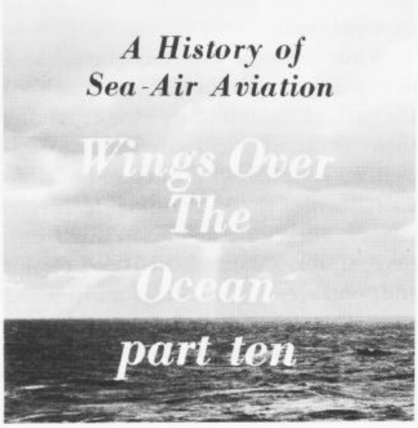


By John M. Lindley

In the conclusion of Part Nine, Mr. Lindley reported the death of E. H. Dunning when he was blown over the side of HMS Furious while attempting to land a wheeled plane on her flying-off deck in 1917.

Dunning's death helped convince the Admiralty that *Furious* needed a landing deck aft. *Furious* went back to the yards where she was fitted with a 300-foot landing deck in place of her 18-inch guns. Another hangar for 10 aircraft was provided under this deck. To facilitate the fore and aft movement of aircraft from landing to takeoff platforms, the shipyard installed a trackway around both sides of the ship's funnels and superstructure. This trackway worked satisfactorily but now the pilot who landed aft had a short landing platform. An even more serious drawback was the presence of hot stack gasses, from the funnels over the landing platform, which produced hazardous air currents during recovery operations. Pilots found that these air currents were very difficult to deal with. Thus, when seven Sopwith *Camels* from *Furious* bombed the German airship base at Tondern on July 18, 1918, three of the planes landed in Denmark, three ditched in the sea near *Furious* where they rested on air bags until picked up by destroyers, and one vanished without a trace. Nevertheless the attack on Tondern destroyed two zeppelins in their shed and demonstrated the power of a true air strike from the sea. *Furious* was a big step in the evolution of the aircraft carrier.

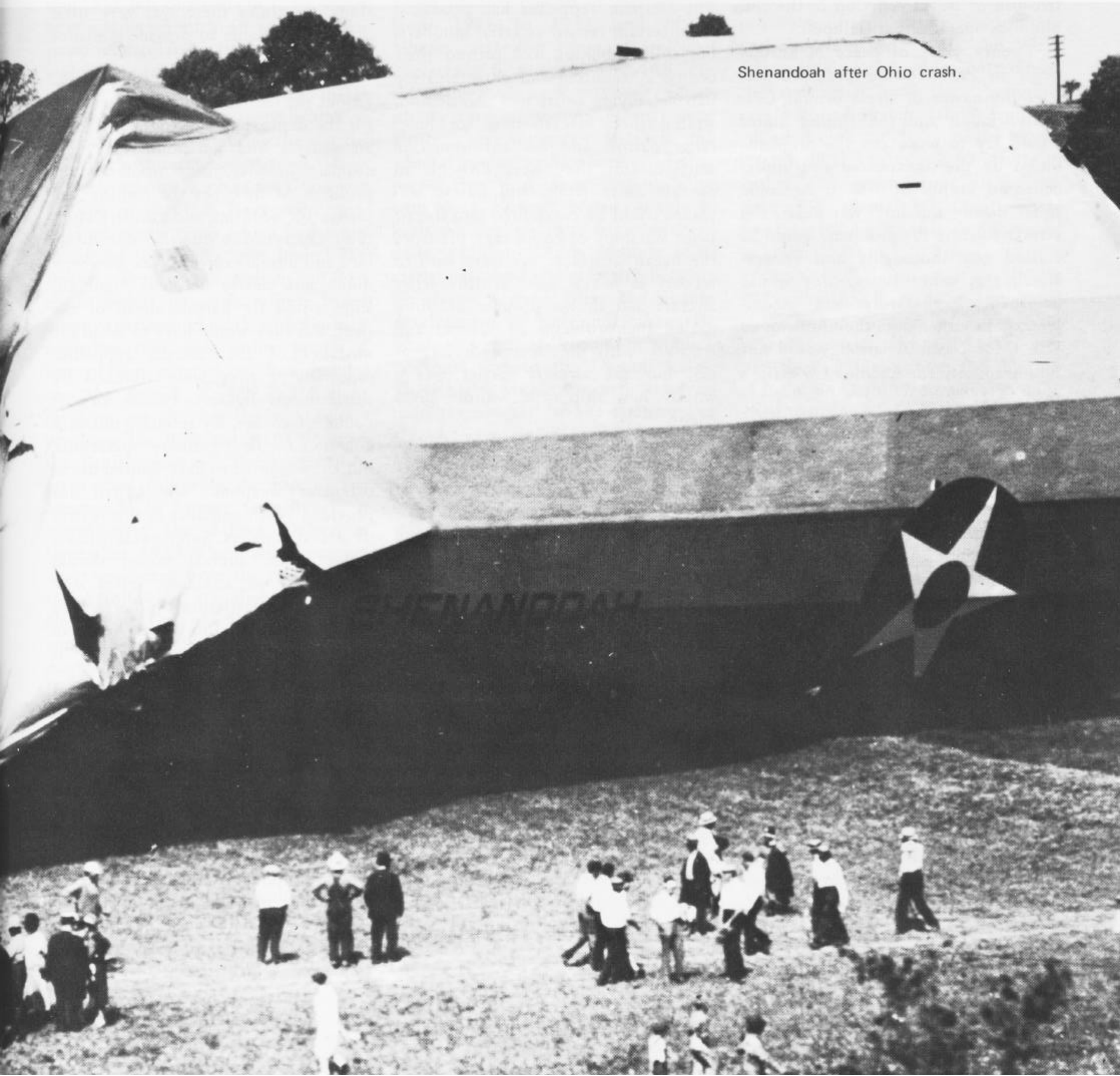
Although an improvement over her predecessors, *Furious* was still a cross between a capital ship and an aircraft carrier. Consequently, in 1916 the Royal Navy converted an Italian liner, which it had purchased, to an aircraft carrier with a full-length flight deck. HMS *Argus*, was commissioned in September 1918. Her flight deck was 550 feet long and she could steam at nearly 21 knots. She carried 20 aircraft. The chart house of *Argus* rested on an elevator so that it could be lowered out of the way during flight operations. Another design feature of *Argus* was the funneling of exhaust gasses astern, so that they did not produce unusual air conditions over the flight deck. The unconventional design of *Argus*, resulted in the nickname, *Flatiron*.

A second flush-deck carrier, *Eagle*, named after the American eagle, was a converted capital ship. She was launched in June 1918 and completed in April 1920, well after the war was over. *Eagle* was bigger than *Argus* and could carry 21 aircraft. Her maximum speed was 24 knots. *Eagle* introduced another design improvement to carriers – her bridge, mast and funnel

were all on the starboard side. This was the first offset-island design. Naval architects tried this solution to the problem of hazardous air currents because the natural torque of the screws of most ships is to the left. Thus a bridge and superstructure to starboard would tend to counter this torque. *Eagle* also introduced the two-level hangar.

The first British ship built as an aircraft carrier from the keel up was a new HMS *Hermes* which was begun in January 1918 and completed in July 1923. Similar to *Eagle, Hermes* joined *Argus* and *Eagle* as the first generation of aircraft carriers. Although the French Navy converted several cross-Channel steamers to seaplane carriers, the Japanese Navy laid down a true carrier, *Hosho,* in December 1919, and the U.S. began converting a collier to the carrier *Langley* that same year. No other navy had contributed as much to carrier development by the end of WW I as the Royal Navy. Improving upon the British innovations, the U.S., Japan and the Royal Navy would bring the carrier to maturity in World War II.

The Armistice came too soon for the U.S. Navy to have begun building an aircraft carrier and only the battleship *Texas* had been fitted with a flying-off platform on one of her turrets. More significantly, American Naval Aviation had grown markedly during the war. The U.S. entered the war with 43 qualified Naval Aviators, 239 Enlisted Aviators and 54 aircraft. At the end of the conflict, U.S. Naval Aviation included 6,716 officers, 30,693 enlisted men, 2,107 airplanes and 12 air bases at home and 27 overseas. In addition, the Marine Corps had begun



Shenandoah after Ohio crash.

to build its own aviation branch. Naval Aviators had convincingly shown, with both airplanes and airships, that once they were trained and properly supplied, they could fight the Germans as skillfully and as bravely as any of their Allied counterparts.

WW I had several unexpected results: the building of aircraft carriers, the failure of the rigid airship as a war-winning weapon, and the unprecedented involvement of civilian populations as a consequence of strategic bombing by aircraft and zeppelins. Equally as important as these unprecedented events was the first tentative use of Naval Aviation in the amphibious operations at Gallipoli.

Twenty years of peace in Europe began in 1919. During these two decades the navies of Great Britain, Germany, Japan and the United States would try to work out the problems raised by the unexpected and unprecedented events of WW I. At some times during the inter-war years, the efforts to solve the problems would be carried out thoroughly and systematically; at other times, they would be made haphazardly and incompletely. In either case, the problems of WW I for Naval Aviation would not be solved until the middle of WW II.

Naval Aviation Between the World Wars

When Bellerophon mounted Pegasus for his aerial assault on the Chimaera, he probably had no doubts as to the way he should employ his winged steed in subduing this dreaded monster. Unconsciously Bellerophon must have followed the example of the cavalry horseman in devising an effective tactical plan for destroying the evil beast. Like the mounted warriors of the ancient world, this mythical youth and his fabulous horse could trust cavalry tactics to provide them with the guidance necessary to defeat their awesome adversary.

Naval Aviators in the period between WW I and WW II were not as fortunate. They had no military precedent to draw upon in taking aviation to sea with the fleet. Two problems, one technological and one doctrinal, confronted those naval leaders. Technologically, naval planners had four possible ways to take aircraft to sea. They could operate dirigibles from land bases or from specially equipped auxiliary vessels during fleet operations. They could deploy flying boats from land bases or from seaborne platforms. They could launch seaplanes by catapult from capital ships. They could operate modified wheeled aircraft from the decks of aircraft carriers. Although all of these possibilities had been tried in WW I, none of them was a mature weapons system. Each had its strengths and weaknesses. The German zeppelins had produced an uncertain record as aerial bombers, but Allied blimps had proved their utility in scouting and antisubmarine patrols. Flying boats had also demonstrated their effectiveness for long-range patrols and for antisubmarine warfare, but they were difficult to operate away from land bases. Seaplanes could be catapulted into the air from warships or could take off from the ocean's surface, yet were hard to recover in heavy seas. British carrier aircraft had shown promise of eliminating the problems of takeoff and recovery with the fleet underway at sea, but the aircraft carrier was a wholly new ship type without precedent.

Because the carrier was considered an experiment, naval planners were not at all sure what size, design or capabilities it should have. Some carriers had big guns such as the British *Furious* in WW I or the American *Saratoga* and *Lexington* in the 1920s. Others had these big rifles removed – as the Royal Navy eventually decided to do with *Furious*. No one was sure how many flight decks a carrier should have. Some carriers had only one deck, but others like the Japanese *Akagi* and *Kaga* had as many as three. The location of the carrier island was another serious question. On most carriers it was on the starboard side, but a few had it on the port. The speed needed was an additional problem. Some of these vessels could only make a moderate 15-20 knots, others were among the fastest vessels in the fleet at 30-35. Many other technological questions confronted naval ship designers in the interwar years and, although sometimes they might have been decided by expediency, more often they had to be decided in terms of what naval strategists thought a carrier should do when it was operating with the fleet, essentially a question of doctrine.

Doctrine was supposed to be the "golden bridle" of control for naval aviation, providing the "heading" which naval commanders could take in making strategic or tactical plans. Yet, during the interwar years, uncertainties over doctrine compounded the problems raised by technological questions. At times there was very little doctrine available to provide guidance to fleet commanders.

In WW I, Allied naval leaders worked out the tactical guidelines necessary for the deployment of flying boats for air patrols and antisubmarine operations. Similarly, they mastered the problem of how best to employ seaplanes for scouting and gunnery spotting. Operational doctrine for dirigibles and aircraft carriers was, however, much less clearly defined. Rigid airships could fly patrols ahead of the fleet, but they would have to avoid the mistakes of the German zeppelins, especially if they were attacked by carrier-based fighters. Carrier aircraft could, of course, fly scouting missions and spot for fleet gunnery operations, but they seemed to have limited use as offensive weapons. WW I had not provided much guidance in this matter of aircraft carriers. Some naval officers believed the aircraft carrier should operate as an auxiliary vessel supporting the battleships; others, who saw great potential in the carrier as an offensive weapon, argued that it should operate as a capital ship.

With the technological development of the carrier so uncertain and with the operational utility of the rigid airship still in doubt, naval planners in the interwar period, especially in the U.S., tended to pursue, simultaneously, as many of the four alternatives as possible. They hoped that once these weapons systems were technologically mature, they would provide the necessary doctrine for guidance. Thus the U.S. Navy, for example, continued its work with flying boats and seaplanes and initiated new programs to build carriers and rigid airships. Other major navies tended to focus their developmental efforts more narrowly. Thus the course of Naval Aviation between 1919 and 1940 was confused and uncertain. Not until the battles of 1942-1943 would technology and doctrine come of age and the fast carrier task force emerge as the major naval weapon.

By the time naval leaders in the U.S., Great Britain and Japan had brought carrier technology and doctrine to maturity in WW II, the rigid airship had passed from Naval Aviation. Yet few observers in 1919 would have predicted such an outcome because immediately after WW I there was great enthusiasm about the future of the rigid airship. All the major aviation nations had used airships of one sort or another during the war for scouting or hunting submarines. Many of these airships, such as the Goodyear C type of the U.S. Navy, were nonrigid or blimp types which had a top speed of 60 miles per hour. The British, French and Italians all had rigid airship programs, often based upon experimental work with German zeppelins that were either prizes of war or war reparations. But one by one the British, French and Italians gave up on the big rigids. Disasters involving the R38 and R101 doomed the British program. The French program died following the loss of the *Dixmunde* (a former zeppelin) in a storm over the Sahara Desert in December 1923. The Italian program never recovered from the crash of the *Italia* following its flight over the North Pole. Only the Germans kept up with the big rigids, building the commercial airships *Graf Zeppelin* and *Hindenburg* in the 1930s. In contrast, the American post-WW I effort concentrated upon military uses.

From its inception, the U.S. Navy's rigid airship program in the interwar years seems to have been pulled in two directions. On the one hand, lighter-than-air flyers decided that since the German zeppelins had been largely ineffective as aerial bombers, they would have to be used as scouts. Consequently, Navy leaders expected to put their rigids through various training exercises that would show how the dirigible could be used to aid the fleet in locating the enemy. They did not explicitly use the term doctrine to describe what they were attempting, but they were, in effect, groping toward a formulation of airship doctrine.

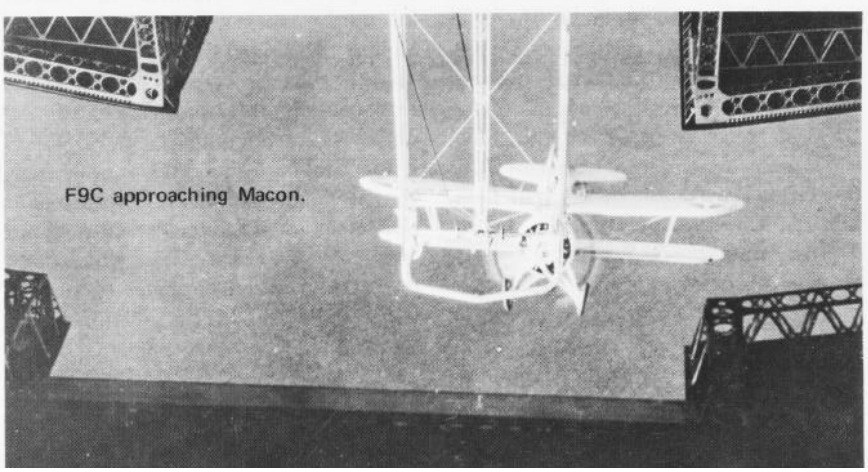
On the other hand, the U.S. Navy had acquired responsibility for the American airship program partly out of rivalry with the Army air program and Brigadier General William (Billy) Mitchell. As Eugene E. Wilson tells the story in his autobiography, *Slipstream,* Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics from 1921 to 1933, and BGen. Mitchell attended a joint Army-Navy conference in the early 1920s to consider which service would have responsibility for airship development. Since Moffett was senior to Mitchell, the admiral seems to have exercised that prerogative and kept responsibility with Navy, perhaps, in part, simply to keep the airships away from Mitchell.

In addition RAdm. Moffett accurately perceived the publicity benefits the Navy derived from the airship development it had undertaken. He often sent various dirigibles on publicity tours around the United States. These highly visible appearances advertised the program to the country and served to counter the publicity BGen. Mitchell always seemed to produce for the Army or his plan for an independent air force. Once when the Army was about to conduct a new series of tests, bombing some surplus warships, Moffett announced that he would probably have USS *Shenandoah* (ZR1) make a flight over the North Pole. Naturally the national press played up Moffett's announcement and gave scant attention to the Army's latest bombing tests. Publicity for the Navy's airship program also had its negative side, however, because newspapers gave extensive coverage to any airship crash. Since four out of five of the Navy's rigids were destroyed in various crashes between 1925 and 1935, Moffett's publicity strategy was of uncertain value. In addition, critics charged that the publicity tours tended to interfere with serious training exercises for the crews and with regular maintenance.

The United States began its program in rigid airship development in 1923 when *Shendandoah* made its first flight. The Navy had been studying the principles of rigid airship construction and operation since 1913, and it had followed airship developments during the war when some Navy personnel received rigid airship training from the Allies. A clear indication of the Navy's interest in the rigids was its efforts to ensure the construction of helium-producing plants in Texas where sources of the gas had been discovered in 1905.

Since it had no rigid airships in 1919, the U.S. Navy began simultaneously to build and to buy them. That year, Congress authorized the construction of *Shenandoah* and the purchase of an airship from Great Britain. This British rigid was the R38 (to have been designated ZR2), but it crashed during one of its trial flights over England in August 1922, killing 44 persons of whom 16 were U.S. Navy personnel. While making a publicity tour in the midwest, *Shenandoah* subsequently broke up in a severe thunderstorm over Byesville, Ohio, on September 3, 1925. Eight of the 37 crewmen aboard were killed.

After *Shenandoah* crashed, the Navy had only one rigid, USS *Los*



F9C approaching Macon.

Angeles (ZR3), built by Luftschiffbau Zeppelin Co. and delivered in 1924. *Los Angeles* was sturdy and serviceable, but it was too small, in total gas volume, for military purposes. Because of the limitations, the lighter-than-air section of the Bureau of Aeronautics developed requirements for a rigid which could be used militarily: it was to have a 5-6 million cubic feet gas capacity and be about 800 feet long. Congress moved slowly on the Navy's request for two rigids of this great size because of the projected $8 million cost for the pair in a time of budget reductions and public uncertainty about the safety of the airship. Congress finally agreed to fund construction of the two rigids in 1928. Thus the Goodyear-Zeppelin Co. of Akron, Ohio, built *Akron* (ZRS4; Z for lighter-than-air; R for rigid; S for scout) and Macon (ZRS5), which made their first flights on September 25, 1931, and April 21, 1933, respectively.

ZRSs 4 and 5 were different from any previous rigid airships because they carried a detachment of heavier-than-air craft. Initially these aircraft had had two roles: to protect the airship from fighter attack and to scout for the fleet, using the airship to relay information to the surface forces. The U.S. Navy was not the only organization to have flown airplanes from a rigid airship. The British had also done that with the R33 in 1926, but it had been a temporary experimental feat and not a permanent design feature as was the case with *Akron* and *Macon*. With these two airships, takeoffs and hookups were regularly made by F9Cs. There was no danger of the engines of the airplanes exploding the gas in the airships because these rigids were filled with nonflammable helium. The presence of the heavier-than-air detachments aboard gave the two airships the capability of scouting an ocean area up to 250 miles wide. Thus the Navy rigids provided, in the words of R.K. Smith, "a remarkable measure of flexibility in scouting operations."

Just when the U.S. Navy's lighter-than-air program appeared to be making substantial progress in operating these big airships, *Akron* met disaster. While flying from its base at Lakehurst, N.J., to Newport, R.I., *Akron* encountered a dangerous storm front. It headed out to sea trying to avoid the storm, but in the fog, rain and lightning on the night of April 3, 1933, its lower fin hit the sea, perhaps because the lower air pressure of the storm front had thrown the aneroid barometer out of calibration, which meant that it was flying dangerously lower than the watchstanders thought. Of the 76 persons on board, just four were picked up by a nearby German merchant ship. Only three survived.

Following the *Akron* disaster, critics tried to put an end to the Navy's airship program. Congress carefully investigated the circumstances of the crash and decided to continue the airship program with *Macon*. This sister airship received two valuable legacies from its unfortunate predecessor: a knowledge of the technique of flying airplanes from the trapeze on the underside of the dirigible and a hazily defined notion of the mission of the rigids as "lighter-than-air carriers."

During training flights in 1931 and 1932, members of the heavier-than-air detachment on *Akron* tried to clarify exactly what the mission of the F9Cs was. The aviators found, during their training exercises, that their primary job could be serving as the "eye" for the airship which, in turn, would be the "eyes" for the fleet. Consequently they would only incidentally provide fighter protection for the airship since, if maneuvered properly, it should never have to make contact with enemy air or surface forces. By remaining unobserved, the airship would not be vulnerable to attack. In 1934 the personnel attached to *Macon* hesitantly worked out this potential airship doctrine of the rigid as a "lighter-than-air carrier" while *Macon* was undergoing intensive training under C.O. Commander H.V. Wiley. Wiley and other lighter-than-air personnel concluded that *Macon* could not be an aerial scout; instead it would have to be an aerial carrier which took its detachment of airplanes to an area which needed scouting. The job of the airship would be to provide the necessary mobility and endurance which the airplanes of the early 1930s lacked.

Yet *Macon* was ill-fated. On February 12, 1935, while returning to Moffett Field from fleet training exercises off the coast of southern California, *Macon* was hit by a big gust of wind as she was turning to port. Structural weakness in the tail caused one fin to break off and, in doing so, deflated three of its gas cells in the tail area. As the cells deflated, the tail dropped toward the sea. In the control car up forward, the watch let go too much ballast in an effort to regain equilibrium. The airship shot upward because it was too light. This caused precious helium to be valved off automatically. The loss of additional helium made *Macon* aerodynamically heavy. There was not enough helium to sustain it in the air, so it plummeted to the sea about 12 minutes after the initial casualty occurred. Fortunately only 2 of its 83 crew members were lost as nearby Navy ships came immediately to the scene of the disaster off Point Sur, Calif.

The loss of *Macon* accelerated the demise of the rigid airship in the U.S. Navy. By 1940 the Navy had ended all its experimental work with rigids. *Akron* and *Macon* had had a chance to prove their value to the fleet between 1932 and 1934, but had failed. Despite the advantage of a range four to six times greater than the largest airplanes then available and a speed possibly two-thirds as great, the rigids lost out, partly because of the competition among surface ships, airplanes and airships for the budget dollar. Many airplanes could be built for the cost of one rigid airship. The airplane in the 1930s had a great technological future. It was only beginning to come into its own as a monoplane and as a multi-engine aircraft. The rigid airship, in contrast, was a weapons systems which, according to R. K. Smith, was "nearing its technological end point." Many admirals felt the airship was vulnerable to attack and lacked offensive punch; thus they argued that it would fail in combat.

To be continued