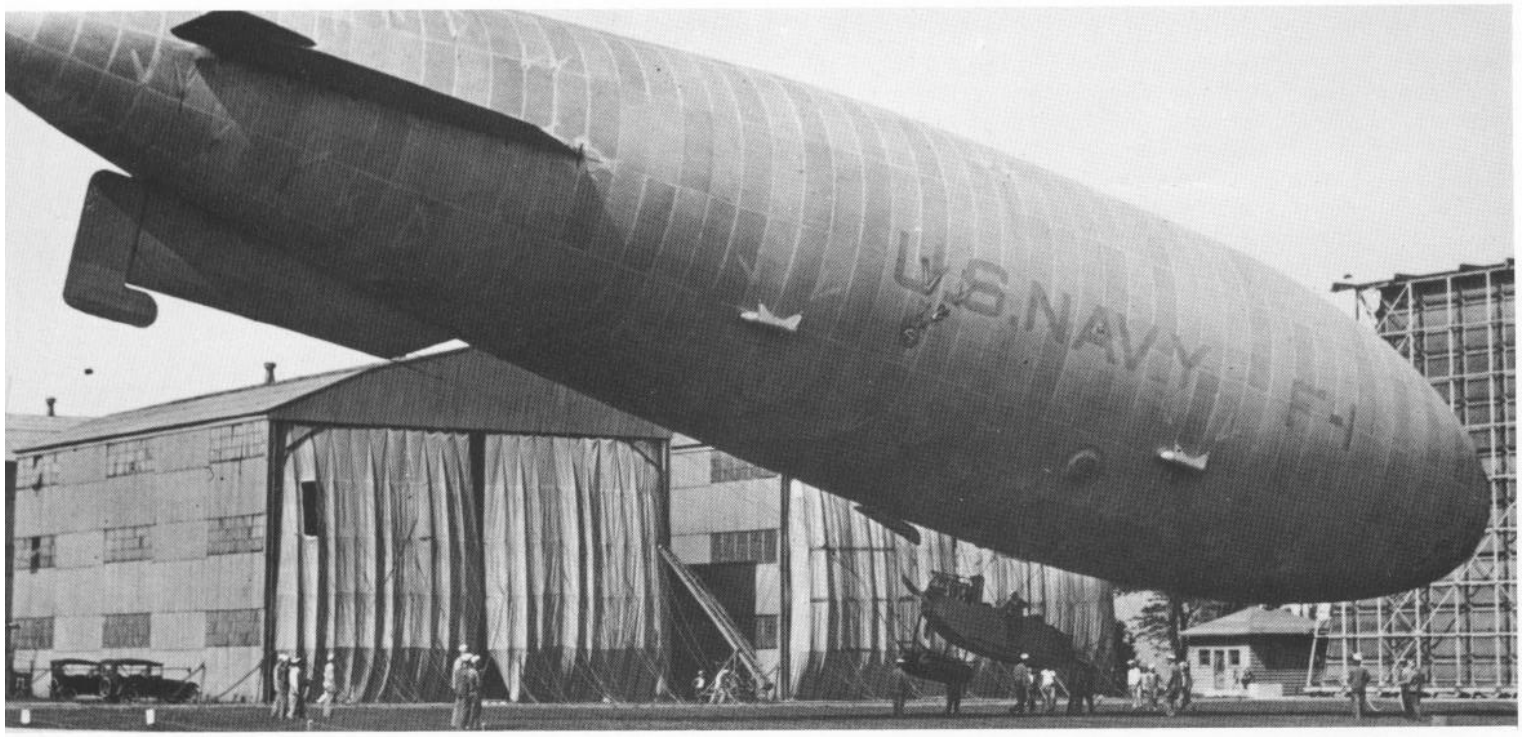


The F series consisted of only one airship. It was originally constructed for commercial purposes by Goodyear and then acquired by the Navy.

Bureau of Construction and Repair's Aircraft Division and was a major advance over the B-class. The improvements in the C-class provided increased endurance for longer on-station time for convoy and patrol duties; more power for additional speed to handle head winds; and more power reliability with the addition of twin engines. It also had a much larger useful lift capacity which permitted a greater load of depth charges to be carried in its ASW role.

Contracts were placed with Goodyear and Goodrich for 30 C-class airships. The cars were to be built by the Curtiss Company. Only a few of the C-class were completed before the Armistice and so the design improvements were not tested under actual combat conditions.

The first C-class airship was completed in September and made her maiden flight on September 30, 1918. She was delivered to the Navy on October 22 after flying nonstop from Akron to Anacostia, D.C., where she was refueled and then continued on to NAS Rockaway, N.Y. This was the beginning of many "firsts" for the C-class airship: the first to carry an airplane aloft and launch it in flight; to demonstrate the practicability of aerial refueling from ships at sea by taking on fuel from a submarine chaser; to use helium as her lifting gas; to complete a transcontinental flight across the U.S.; and to make numerous record-setting distance flights.

A C-class airship, the C-5, also was used in an attempted flight across the Atlantic. She was modified for the scheduled crossing and Lieutenant Commander E. W. Coil was assigned as commander. On May 14, 1919, the airship lifted off from NAS Montauk, with a crew of six, and headed for St. John's, Newfoundland. This flight was part of the test to determine whether they would attempt the Atlantic crossing. On the morning of May 15, the C-5 landed at Pleasantville, St. John's The distance covered was 1,022 sea miles and the time in the air was 25 hours and 50 minutes. The flight had demonstrated the airship's long-distance cruising range, and the airworthiness of the C-5 to operate under varying weather conditions.

Permission was granted for the Atlantic crossing and the ground crew began the work of refueling and gassing the C-5. Wind conditions were gusty and variable during reprovisioning. After the ground crew experienced numerous handling problems, it became evident that the airship had to be deflated. The ripcord was pulled but there were problems with the pulloff patch on the envelope. Before any other action could be taken, another gust of wind parted the final lines holding the C-5. The airship drifted rapidly away, heading out to sea with no personnel on board, and was lost.

Lt.Cdr. Coil, in his report on the C-5 flight, indicated that the performance of the C-5 between Montauk and St. John's made a nonstop transatlantic crossing entirely feasible. Had it not been for the weather and the fact that a mooring mast had not been developed, the C-5 might have been the first aircraft to cross the Atlantic.

When the Armistice was signed, only a few C-class airships had been delivered to the Navy. Demobilization led to a reduction in the number of airships constructed and, eventually, only 10 were built of the 30 originally ordered. The last C-class was delivered on March 19, 1919. Two were transferred to the Army.

VII. New Airship Classes in the Post-WW I Period

The postwar period saw developments in non-rigid airships that were more advanced than the capabilities offered in the C-class. The success of the C-class was tempered by criticism from pilots about certain unsatisfactory features. Criticism was aimed primarily at the control car which was crowded, noisy due to engine placement, and susceptible to propeller blasts. As a result, the D-class design was developed and authorized by the Secretary of the Navy on July 16, 1918. Goodyear received a contract to build three of the airships, the

D-1, 2 and 4, while Goodrich had the contract for the D-3 and 5.

A C-type envelope was used in the D-class. Added to the envelope was an extra six-foot panel which increased its volume by 8,000 cubic feet, The control car was redesigned and the fuel tanks, which had been inside the C-class control car, were placed along the envelope's equator. The engines were positioned as far aft on the car as possible to eliminate the unsatisfactory features but created others. The placement of the fuel tanks made them difficult to service, and the long fuel lines to the engines far astern of the control car tended to develop leaks.

The first D-class airship to fly was the D-3 on July 13, 1920. The D-1 had been completed earlier but was destroyed in a fire on June 19, before she had her first flight test. The four remaining D-class airships were eventually transferred to the Army.

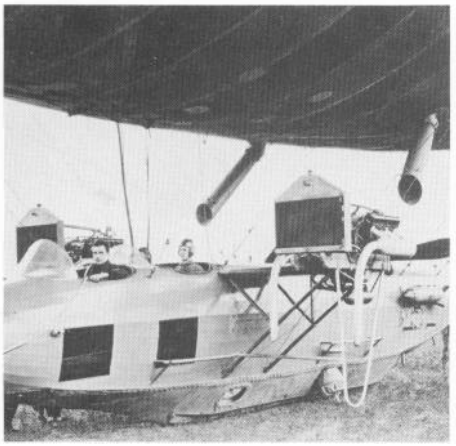
An airship designated the D-6 was built by the Naval Aircraft Factory, Philadelphia, Pa., but her design was sufficiently different to separate her from the other five D-class airships. One of the distinguishing features was the all-enclosed control car, which had a boat-type hull with fuel tanks on the inside. The D-6 was assigned to NAS Rockaway when she was destroyed in a hanger fire on August 21, 1921.

While Goodyear was building airships according to Navy specifications, it also was engaged in constructing airships of its own designs for possible commercial use. In 1918, Goodyear offered several of these airships to the armed forces. Under separate contracts dated June 5 and July 7, the Navy procured one E-class airship (E-1) and one F-class (F-1).

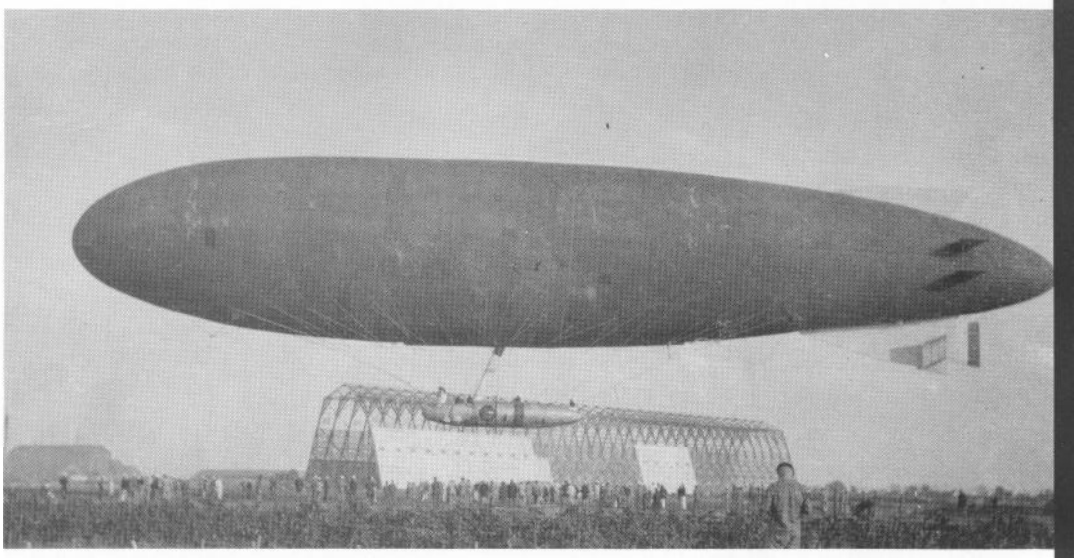
The E-1 and F-1 had identical envelopes and differed slightly in control car design. Engine design and installation were the major differences between the two airships. The E-1 had a Thomas pusher-type engine and the F-1 had a Union engine.

The E-1 was flown at Akron and then shipped to Pensacola on December 16, 1918, where she remained in service for her entire operating life span. She was placed in storage in 1924 because of her worn condition, was surveyed and removed from the Navy's inventory on September 5, 1924.

The F-1 had a similar career. She made her first flight at Akron on February 11, 1919, and continued on to NAS Hampton Roads. On the way, difficulties were encountered and the F-1 was forced to land near Catlett, Va. The envelope was ripped during the landing and the airship



A close-up of the C-class control car. The twin engines provided improved performance over the single-engine B-class. Note the bomb attached to the rear part of the control car.



The Capitaine Caussin at NAS Paimboeuf, France, prior to the completion of the hangar.

The C-class set many "firsts" in Naval Aviation. This particular airship, the C-7, was the first airship to be inflated with helium.

was deflated. She was flying again in April 1919, and remained assigned to NAS Hampton Roads until removed from the inventory on November 9, 1923.

In the summer of 1918, during the development of the D-class, plans were being made for a G-class airship, It was designed as a very large, long-endurance patrol/ASW airship. The initial envelope capacity was set at 360,000 cubic feet, which was later increased to 400,000. It was designed to have an enclosed control car with sleeping quarters for the crew. The armament was to consist of a three-inch antisubmarine gun and a heavy bomb load. This G-class design was never built, because it was felt the airship was too large for a non-rigid and designs for rigid airships were under consideration at that time. A different type of G-class was constructed and will be discussed later.

The H-type airship was developed in response to a strong recommendation by Cdr. Maxfield before the General Board on April 14, 1919, for a small airship that could double as a towed kite balloon, or fly and maneuver independently like a dirigible. It was an attempt to overcome the weaknesses of the kite balloon and allow operations in adverse weather that were beyond the capability of the ordinary kite balloon.

A contract was given to Goodyear on June 30, 1920, for the H-type airship. The H-1 (the only one built for the Navy) was delivered by rail to NAS Rockaway on May 3, 1921. She was often referred to as the "animated kite balloon."

Various trial flights were conducted with the H-1 On August 5, 1921, a malfunction in the engine caused her to come down. The landing was especially hard and the car tipped overthrowing the crew out. With the H-l lighter, minus her crew, she ascended again and flew off on her own, making a gentle landing in a pasture near Scarsdale, N.Y. A farmer found the airship and tied her to a tree. Unfamiliar with LTA vehicles, he used the cord attached to the airship's rip panel for securing the airship. During the night, the wind caused a strain sufficient to pull open the rip panel and deflate the H-1. The airship was recovered and returned to the hangar at NAS Rockaway where, on August 31, 1921, she was destroyed in a fire.

The development of the J-class began in the Aircraft Division of the Bureau of Construction and Repair. The design called for a twin-motor coastal airship, similar to the C and D-classes but using a single ballonet like those found in the French Zodiacs from WW I. The control car was to be designed to land on water.

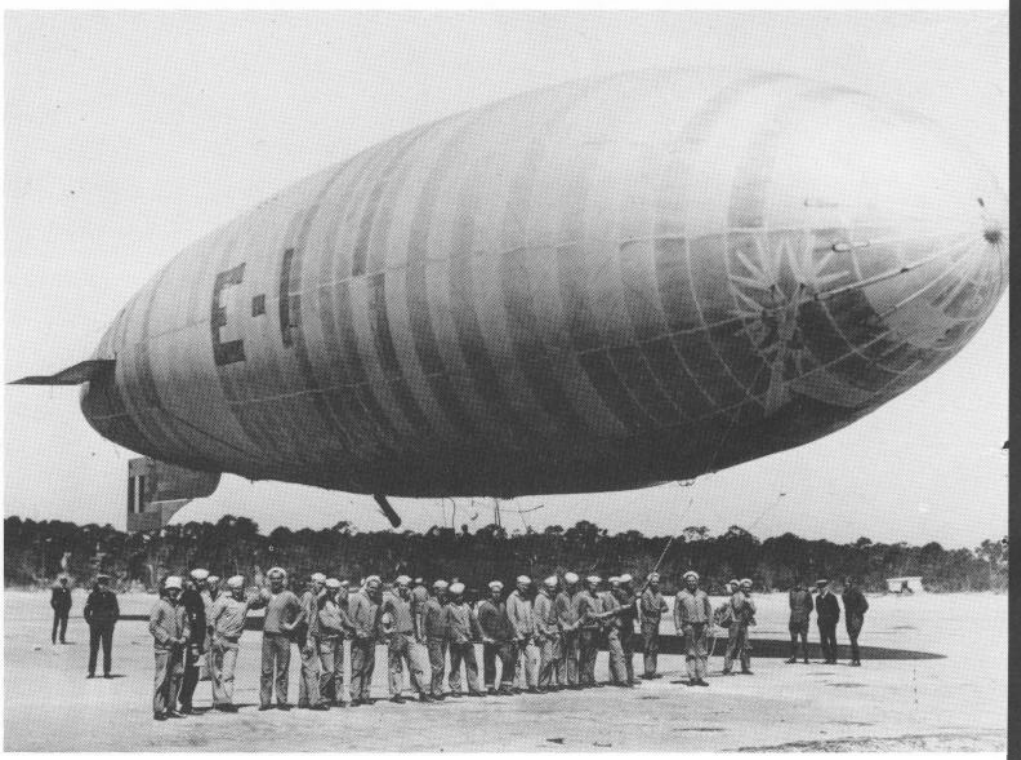
A design was drawn up by the Bureau of Aeronautics working jointly with a representative from Goodyear. In 1921 a contract was awarded to Goodyear for two J-class airships. The J-1 was built and so was the control car for the J-2, but the envelope for the 2 was put on hold. On August 31, 1922, the J-1 made her first flight. Various trial flights showed the single ballonet was not adequate for airship operations. It caused the airship to surge excessively, the response was sluggish and the trim was difficult to control These problems, combined with a switch to helium as the lifting gas, led to the cancellation of the J-2 envelope. The last known records on the J-1 indicate she was at NAS Hampton Roads in 1923 and then transferred to NAS Lakehurst. At Lakehurst, she was used for preliminary LTA training of personnel connected with the operation and maintenance of *Shenandoah* and for general LTA training. The J-1 was stricken from the records while at Lakehurst but no date is given. The control car for the J-2 remained in the Navy's inventory, but a J-2 airship never flew for the Navy.

In 1925, the Navy obtained an Army TC-type envelope and mated it with the J-2 control car. The match was designated J-4 and became operational in 1927. Before the J-4 became operational, the Navy acquired a TC-type airship from the Army and designated it J-3. The J-3 was test flown on October 12, 1926. She remained in the Navy's inventory until she was lost on April 4, 1933, while searching for survivors of the crash of the rigid airship USS *Akron* (ZRS-4). The J-4 remained in the Navy's inventory until she was surveyed in 1940.

During the mid to late 1920s. the major interest was in rigid airships. The J-3 and 4 airships were the only non-rigids in the Navy's LTA inventory from 1928 until the latter part of 1931 when the first K-type was introduced.

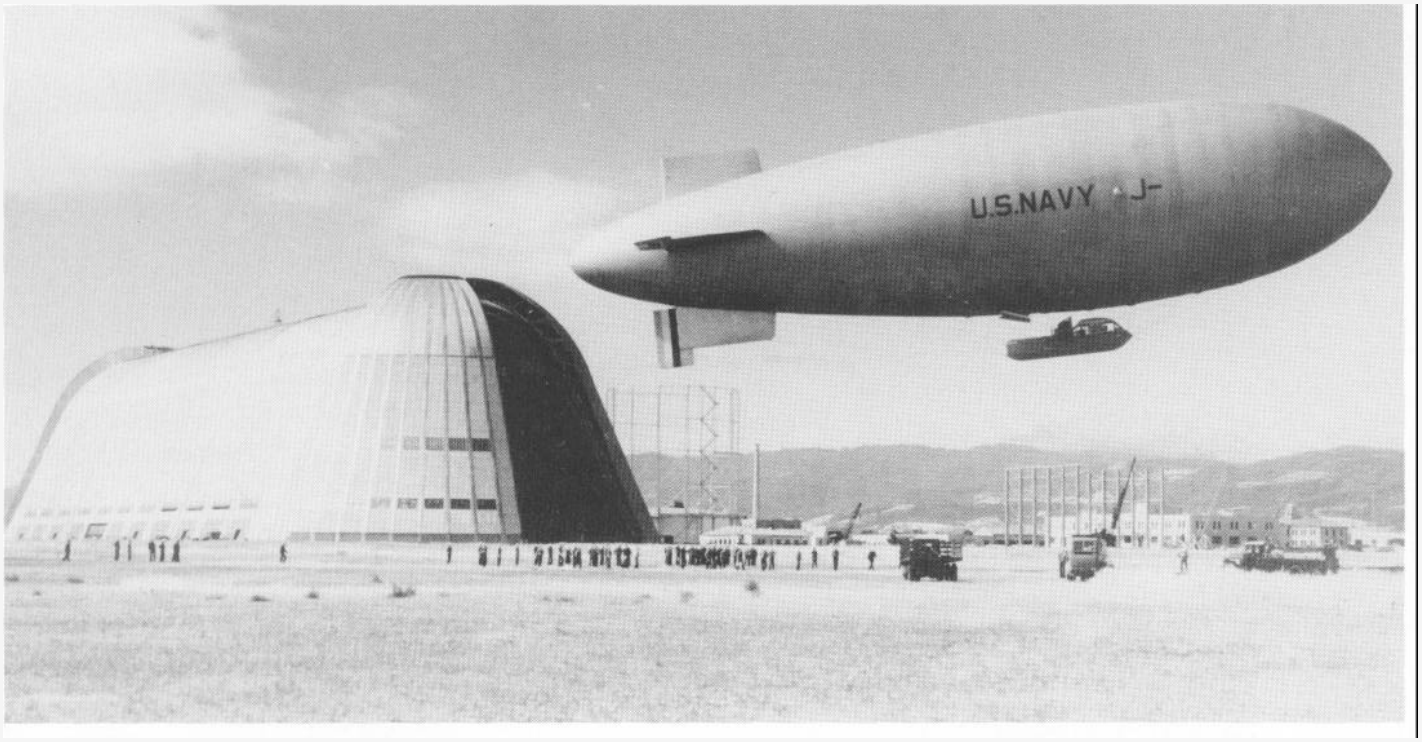
VIII. The Demise of the Kite Balloon

With the end of WW I, the Navy had a large inventory of kite balloons. Their primary mission after the Armistice was as tow balloons for gunfire spotting (gunnery observation). A major difference of opinion evolved between the Atlantic and Pacific fleets regarding the utility of the kite balloon. The feeling



Above, the E-1 preparing for a training flight at NAS Pensacola, Fla. Above right, a J-class airship at NAS Sunnyvale (later Moffett Field), Calif., in 1933. Note the unique boat-shaped control car. Right, the H-1 was an unusual airship designed to mate the missions of the kite balloon and the airship into one vehicle. She was the only airship of her class built.

in the Atlantic Fleet was that the kite balloon was of dubious value and that all its functions could be performed satisfactorily by an airplane, once an adequate turret platform was available. This view was supported by Captain N.E. Irwin's testimony before the General Board in March 1919 in which he stated "such planes were twice as effective as kite balloons in spotting work." Cdr. Maxfield, the "flagbearer" for LTA at that time, suggested the kite balloon could be of value in protecting the battleship from gas attack or strafing by low flying aircraft. Captain Thomas T. Craven, when he was Director of Aviation in 1919, issued an order to limit future use of kite balloons to tenders and shore



stations, and not assign them to first-line ships. The Pacific Fleet continued to utilize the kite balloon despite Craven's order. In the Atlantic, the order was more closely followed, however, a limited number were used aboard Atlantic Fleet ships. The Atlantic Fleet Kite Balloon Detachment was renamed the Hampton Roads Detachment and continued East Coast experimentation with balloons.

In March 1921, during individual ship target practice, the kite balloons operated by USS *Nevada* and *Florida* "dished in" and dove into the water. This was one of the last acts before the final curtain fell on kite balloon operations aboard ship.

USS *Wright* (AZ-1) was commissioned on December 16, 1921. She had been built as an LTA aircraft tender, with a unique "balloon well" built into the hull. This feature enabled her to fly a kite balloon, and then retrieve it and stow it in the balloon well. By the time the ship was commissioned, kite balloon operations aboard ship had almost come to an end. *Wright* deployed in the Caribbean in the spring of 1922 and conducted experiments with her kite balloon. Upon returning from her cruise, the ship performed tending duties along the East Coast, On July 16, 1922, while at Hampton Roads, *Wright* flew her kite balloon for the last time. She then transferred it ashore to NAS Hampton Roads, and this was the final curtain call for kite balloon operations aboard ship.

The Navy kept kite balloons in its inventory for a long time after 1922. Many were maintained at NAS Hampton Roads, Lakehurst and Brown Field, Quantico, Va. The Marines used them for spotting and, at NAS Lakehurst, the Navy used them in testing parachutes. The Navy still had a kite balloon at NAS Lakehurst in 1936.

IX. The Switch to Helium

One of the most significant changes in the Navy's LTA operations was the switch to helium as the lifting gas. Helium's primary value was in its noninflammability. The development of a practical method to extract helium from natural gas in sufficient quantities made the gas a viable alternative to hydrogen. This new development, combined with the discovery of helium fields in Texas, led to a joint venture between the government and two commercial companies in which helium-producing plants were established at Petrolia and Fort Worth, Texas, during WW I.

The amount of helium delivered before November 11, 1918, was insufficient for LTA operations. But with the advantage gained from heavy investments and research during the war, the plants in Texas were able by 1919 to begin the accumulation of helium gas for the LTA fleet which was built during the 1920s.

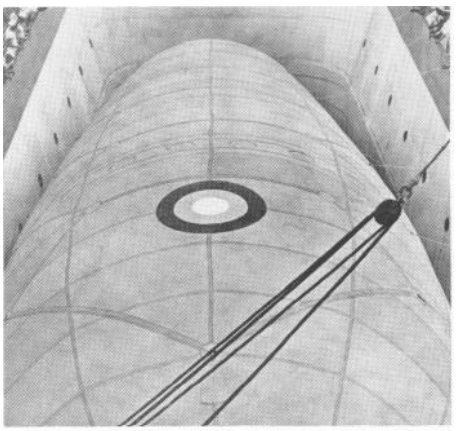
In fiscal year 1922, the production of hydrogen was concentrated at NAS Hampton Roads, the site of almost all LTA activity. Hydrogen had been shipped to Lakehurst for storage for the expected arrival of the rigid airship ZR-2, built for the U.S. Navy by the Royal Air Force.

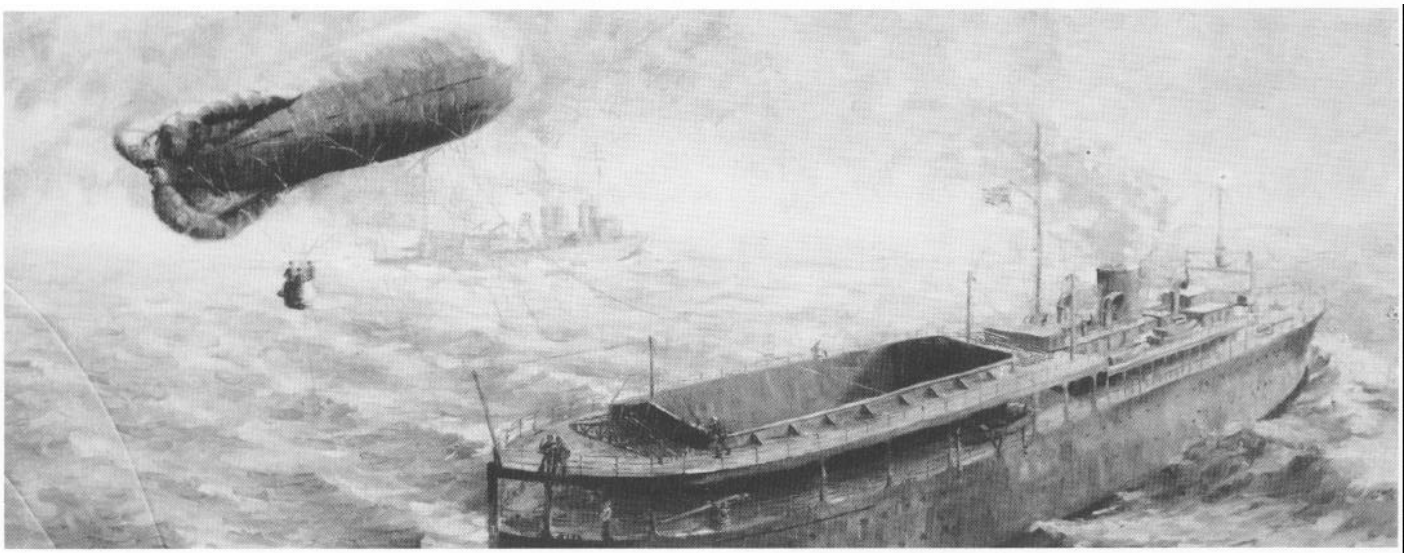
With the loss of the ZR-2, the Navy seriously investigated the safety and structural requirements for the ZR-1 which was being assembled at Lakehurst. In December 1922, the Navy began the procurement of equipment for a helium purification plant to be located at NAS Lakehurst. The helium safety factor was one of the major reasons for the switch from hydrogen to helium. Practically all hydrogen production ceased because of limited LTA activities in fiscal year 1923 and also due to a large supply of hydrogen stored in cylinders at the Naval Aircraft Factory.

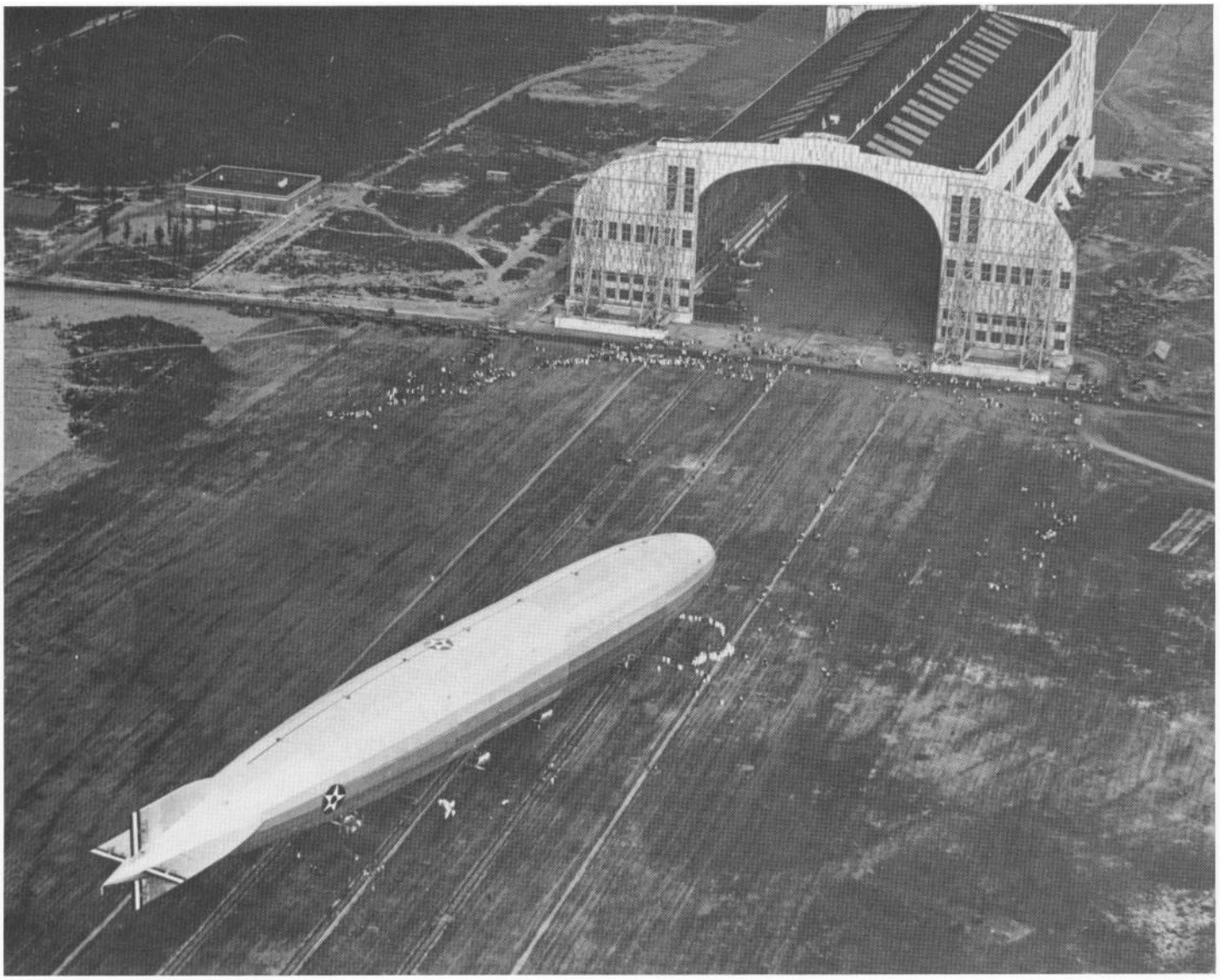
During fiscal year 1923, the J-1 had been flight tested and then was transferred to Hampton Roads, but it was not inflated. During fiscal year 1924, the only airship flying was the C-7 until *Shenandoah* was completed, the first rigid airship to be inflated with helium.

In fiscal year 1925, the helium production plant operated continuously and great progress was made toward efficient and economical production. The helium purification plant at NAS Lakehurst was also operating successfully and repurifying all the helium for *Shenandoah* and *Los Angeles.*

Airship operations during fiscal year 1926 were restricted due to the shortage







Left, a kite balloon in the "balloon well" of USS Wright (AZ-1) in July 1922. Left below, an artist's rendering of Wright. The ship was designed and built as an LTA tender, with kite balloon operations as her primary mission. Above, USS Shenandoah (ZR-1), the Navy's first rigid airship, at NAS Lakehurst, N.J. Lakehurst was to become synonymous with the operation and development of LTA in the Navy.

of costly helium. Further operations were limited by the need for a gas-cell and structural overhaul of *Los Angeles,* and the lack of non-rigid airships in satisfactory flying condition. When *Shenandoah* was lost, *Los Angeles* was the only airship, rigid or non-rigid, in operational condition in the Navy inventory. This was true until October 1926, when the J-3 non-rigid airship made its first flight.

In the spring of 1927, a commercial company proposed a contract to produce helium from a Kansas field. This offer was accepted by the government and a contract was signed for the delivery of helium. To transport the helium, a tank car was procured, designed for both helium transport and storage. Besides a saving in transportation costs, there was less leakage than had been the case when helium was transferred in small cylinders. The tank car also added a great deal of mobility to the helium supply.

The helium supply tended to fluctuate, but by the end of the 1920s it was adequate for airship operations because of increased storage, transportation and additional supplies both from a commercial concern and the government's helium plants. The development and use of helium would not have progressed as rapidly as it did had it not been for the pioneer work begun by the Navy and other government agencies during WW I.

X. The Development of LTA's Home Base and the Rigid Airship Program

A center for LTA operations was established in August 1921 at NAS Lakehurst, which was destined to become the Navy's most important LTA base. Construction work had begun on the LTA hangar there in 1919. It was completed just prior to the establishment of the naval air station in August 1921. Work began immediately on the Navy's first rigid airship.

In the late 1920s and early 193Os, NAS