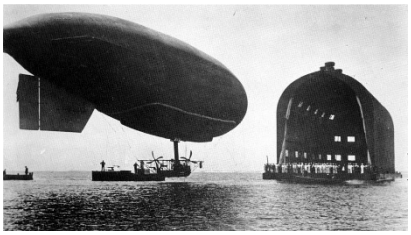
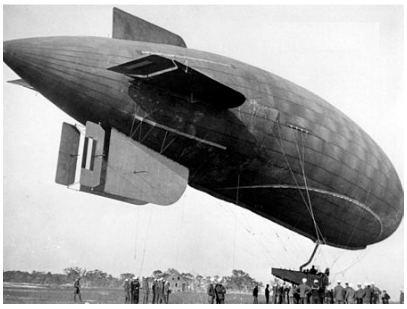
LTA Primer, V. 1

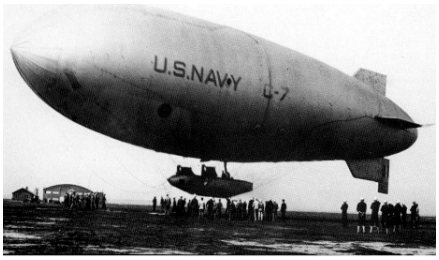
April 12, 2022



The **DN-1** was the United States Navy's first airship. After its demise the DN-1 came to be considered the **A class**. Such designation was never officially used by the Navy, nor was it used during **DN-1's** short life. First flight Pensacola, 20 April 1917, scrapped April 29th; one built.

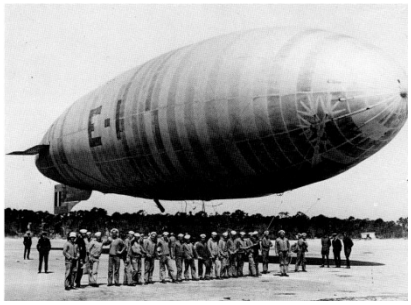


The **B class blimps** were patrol airships operated by the United States Navy during and shortly after World War I. First flight 24 May 1917, at White City Amusement Park hangar in Chicago, IL.

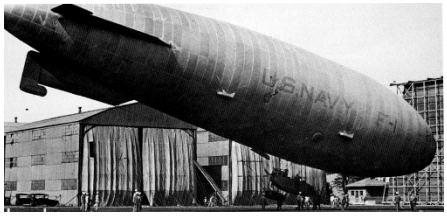


The **C-class blimp** was a patrol airship developed by the US Navy shortly after World War I, a systematic improvement upon the B-type which was very suitable for training, but of limited value for patrol work. Larger than the **B-class**, these blimps had two motors and a longer endurance. In 1921, the **C-7** was the first airship ever to be inflated with helium. First flight 30 September 1918, at Wingfoot Lake; retired 14 Aug 1920, 20 built.

The **D class blimp** was a patrol airship used by the US Navy in the early 1920s. The D-type blimps were slightly larger than the **C-type** and had many detail improvements. The Navy continued the practice of dividing the envelope production between Goodyear and Goodrich. The control cars were manufactured by the Naval Aircraft Factory. First flight 13 July 1920 at Wingfoot Lake, Ohio, retired in 1924, 6 built.

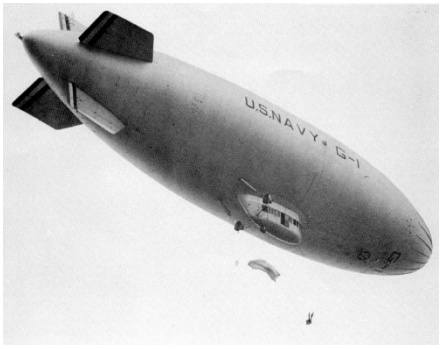


The **E class** of US Navy blimps comprised a single airship, built during World War I by Goodyear as one of a group of three small blimps offered to the US government. Two were purchased for the US Navy and one for the US Army and used primarily as training airships. The Navy blimps were designated **E-1**, **F-1**, and the Army airship **A-1**. These airships had identical envelopes but different cars. First flight at Pensacola in December of 1918, retired in 1924; one built.



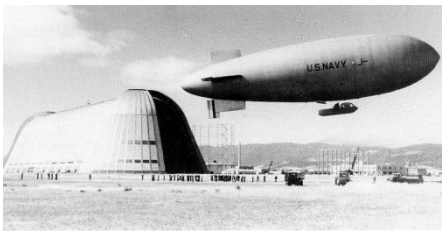
The **F class** of US Navy blimps comprised a single airship, built during World War I by Goodyear as one of a group of three small

blimps offered to the US government. Two were purchased for the US Navy and one for the US Army. The Navy blimps were designated **E-1**, **F-1**, and the Army airship **A-1**. Classified as an "Experimental Engine Testing Dirigible." **F-1** had the same envelope size as the **E-1**, due to the use of a tractor mounted 125 hp Union engine, the performance was different. First flight at Hampton Roads in 1918, retired in November of 1923; one built.



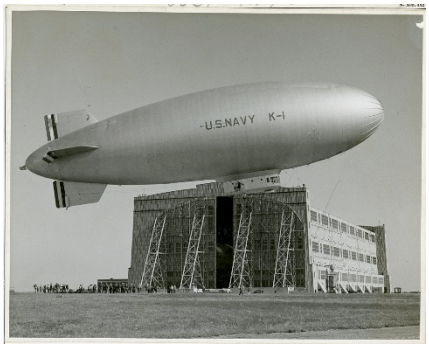
The ***G*-Class Blimps** were a series of non-rigid airships (blimps) used by the United States Navy. In 1935, instead of developing a new design airship, the Navy purchased the Goodyear Blimp *Defender* for use as a trainer and utility airship assigning it the designator **G-1**. *Defender* was built by the Goodyear Aircraft Company of Akron, Ohio and was the largest blimp in the company's fleet of airships that were used for advertising and as passenger airships. Goodyear built additional **G-class** airships for the Navy during World War II to support training needs. As the Navy needed additional training airships during the World War II war time build up, a contract was awarded on 24 December 1942 for seven more *G*-class airships. These were assigned the designation **Goodyear ZNN-G**. (Z = lighter-than-air; N = non-rigid; N = trainer; G = type/class). The envelope size of these new **G-class** blimps was increased over that of **G-1** by 13,700 cu ft (390 $m^{3)}$. Airships **G-2** through **G-5** were delivered by late 1943 and **G-6** through **G-8** followed in early 1944. They were used for training mainly from the two major lighter-than-air bases, NAS Lakehurst and NAS Moffett Field on the southern edge of the San Francisco Bay. Introduced September 1935, retired 1944-45. 10 built.

The **H-class blimp** was an observation airship built for the U.S. Navy in the early 1920s. The original "**H**" Class design of 1919 was for a twin engine airship of approximately 80,000 cubic feet volume. After test flights at Wingfoot Lake, **H-1** was shipped to Rockaway in May 1921. During the summer of 1921, **H-1** completed six flights and, on its seventh, a hard landing pitched the crew out of the control car. **H-1** free ballooned as far as Scarsdale, New York where a farmer was able to grab the rip cord and tie the blimp down. During the night, hydrogen began leaking from the envelope and by morning it was completely deflated. The deflated **H-1** was shipped back to Rockaway in time to be destroyed in the hangar fire of August 31, 1921. A second **H-type** was acquired on a Navy contract but supplied directly to the U.S. Army which operated it as the **OB-1.** OB-1 varied in several ways from the **H-1**. The shift from hydrogen to helium lift gas in 1923 seriously degraded the **OB-1's** performance. The **OB-1** was damaged on 6 October 1923 and never flew again as the forthcoming TA type airship would meet the training role. **OB-1** was declared surplus at the end of 1923. First flight May, 1921; surplused December 1923; 2 built.



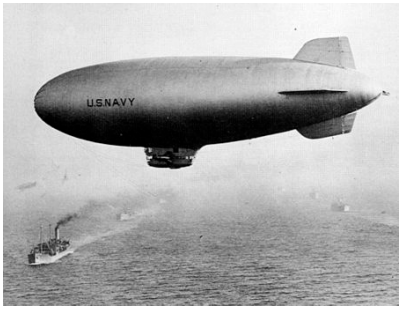
The **J-class blimps** were non-rigid airships designed by the Navy Bureau of Aeronautics and Goodyear Tire & Rubber Company in

the early 1920s for the US Navy. **J-types** were to be improvements upon the **D-type**. Improvements included a smaller envelope (174,800 cu ft), more powerful engines, a new, simple boat style control car capable of water landings and a single ballonet to reduce weight as tried in the **H-1**. Two airships, designated **J-1** and **J-2** were ordered. **J-1** first flew 31 August 1922 at Wingfoot Lake. **J-3** was assembled from an Army **TC-type** envelope and control car, modified to suit the Navy. Instrumentation came from the **J-1**. The **J-3** first flew 12 October 1926. Lakehurst was the only naval air station which the **J-3** served at. Its role was to train crews for the **ZR-3** and **ZRS-4** and **5**. Retired in 1940, 3 built.



The **K-1** was an experimental blimp designed by the United States Navy in 1929. Due to the inability to get Congressional approval for the construction of an airship the navy used the ploy of ordering a "universal" control car (**type J/K**) which could be used on the **J-type** airships from the Naval Aircraft Factory. An order was placed with Goodyear Tire and Rubber Company for an envelope to hold "experimental gases". To complete the deception, there is no record of the US Navy assigning a serial number to the **K-1**, Standard Army **TC-type** tail fins were procured from Goodyear.

Unlike past Navy blimps, the control car was not suspended from external cables, but was hung from cables attached to the top of the envelope, and the car was carried flush against the envelope as in modern blimps. **K-1** was assembled at Lakehurst, New Jersey in late 1931. After tests it was based at Cape May. In November 1931 **K-1** was being moved into the hangar when a gust of wind blew it into a barbed wire fence. The rip cord was pulled and **K-1** deflated. The **K-1** was shipped to Goodyear at Akron for repair. While under repair the **K-1** was fitted with more powerful Wright R-975-20 engines. In mid-1933 the **K-1** was sent to Lakehurst and after the departure of **J-4** to Sunnyvale, was with the **ZMC-2**, the only flying airships at Lakehurst until 1937. The **K-1** last flew in September 1940 and was subsequently used for mooring and snow removal experiments until it was scrapped in October 1941. The **K-1** was not a popular airship, tending to fly tail low, and was, despite its amenities, thought to be 'uncomfortable." The **K-1** was not the prototype of the later "**K Class**." First flight 1931, Scrapped in October 1941. 1 built.



The **K-class blimp** was a class of blimps (non-rigid airship) built by the Goodyear Aircraft Company of Akron, Ohio for the United States Navy. In 1937, **K-2** was ordered from Goodyear as part of a contract that also bought the **L-1**, (Goodyear's standard advertising and passenger blimp). **K-2** was the production prototype for future **K-class** airship purchases. **K-2** flew for the first time at Akron, Ohio on December 6, 1938 and was delivered to the Navy at NAS Lakehurst, New Jersey on December 16. The envelope capacity of the **K-2**—404,000 ft^3 (11,440 m^3)—was the largest for any USN blimp up to that time. **K-2** was flown extensively as a prototype, and continued to operate testing new equipment, techniques, and performing whatever tasks were needed, including combat patrols in World War II.
On October 24, 1940, the Navy awarded a contract to Goodyear for six airships (**K-3** through **K-8**) that were assigned the designation **Goodyear ZNP-K**. These blimps were designed for patrol and escort duties

and were delivered to the Navy in late 1941 and early 1942. **K-3** through **K-8** had only minor modifications to **K-2's** design, the only major change was in engines from Pratt & Whitney R-1340-16s to Wright R-975-28s. The Wright engine/propeller combination proved excessively noisy and was replaced in later **K-ships** with slightly modified Pratt & Whitney engines. The **K-3** cost $325,000. A series of orders for more **K-class** blimps followed. Twenty-one additional blimps (**K-9** through **K-30**) were ordered on 14 October 1942. On 9 January 1943, 21 more blimps (**K-31** through **K-50**) were ordered. The envelope size of K-9 through **K-13** was increased to 416,000 ft^3 (11,780 m^3) and those delivered thereafter used an envelope of 425,000 ft^3 (12,035 m^3).

The final contract for the **K-class** blimp were awarded in mid-1943 for 89 airships. Four blimps from this order were later canceled. The remaining deliveries were assigned numbers **K-51** through **K-136**. But the number **K-136** was not assigned to a specific airship as the control car assigned for **K-136** was used to replace the car for **K-113**. The original car for **K-113** was destroyed in a fire. The US Navy's experiences with **K-ships** in tropical regions showed a need for a blimp with greater volume than the **K-class** to offset the loss of lift due to high ambient temperatures. Goodyear addressed these concerns with a follow-on design, the **M-class** blimp, which was 50% larger. First flight December 6th, 1938, retired in 1959. 134 built.

After World War II several **K-class** blimps were modified with more advanced electronics, radar, sonar systems and larger envelopes. These modified blimps were designated:

ZNP-K
The original designation of the *K*-class blimps. Individual blimps were identified by a sequential suffix number, e.g. **ZNP-K-2**, **ZNPK-8** etc. In everyday use only the K and numerical suffixes were used. Batches of blimps were built with sometimes major differences, but the designations remained in the **ZNP-K** range, until the later versions, listed below, emerged.

ZPK
Revised designation of the **ZNP-K** series.

ZP2K
A larger envelope with the volume increased to 527,000 cu ft (14,900 m^3), sensors and other improvements re-designated **ZSG-2**.

ZP3K
A larger envelope with the volume increased to 527,000 cu ft (14,900 m^3), with systems and controls even more advanced than the **ZP2Ks**, re-designated **ZSG-3**.

ZP4K
Delivered in 1953, retaining the 527,000 cu ft (14,900 m^3) envelope volume and length of 266 ft (81.08 m), re-designated **ZSG-4** in 1954.

The **L-class blimps** were training airships operated by the United States Navy during World War II. In 1937 the United States Navy awarded a contract for two different airships, **K-class** blimp designated **K-2** and a smaller blimp based upon Goodyear's smaller commercial model airship used for advertising and passenger carrying. The

smaller blimp was designated by the Navy as **L-1**. It was delivered in April 1938 and operated from the Navy's lighter-than-air facility at Lakehurst, New Jersey. In the meantime, the Navy ordered two more **L-Class** blimps, the **L-2** and **L-3**, on September 25, 1940. These were delivered in 1941. **L-2** was lost in a nighttime mid-air collision with the **G-1** on June 8, 1942. When the United States entered World War II, the Navy took over the operation of Goodyear's five commercial blimps. These were the *Resolute*, *Enterprise*, *Reliance*, *Rainbow*, and *Ranger*. These airships were given the designations **L-4** through **L-8** even though their characteristics and performance varied among them. The next four **L-Class** airships were built in the assembly and repair shops at NAS Moffett Field. These blimps, **L-9** through **L-12** were completed by April 1943. The last lot of **L-Class** airships were ordered from Goodyear under a contract of February 24, 1943. This was a lot of ten airships designated **L-13** through **L-22**. All the blimps were delivered by the end of 1943. As training airships these blimps operated mainly from the two major lighter-than-air bases, Lakehurst, and Moffett Field. While too small for any extensive operational use, they were used on some coastal patrols; the **L-8** delivered B-25 modification parts to the aircraft carrier USS *Hornet* before the Doolittle Raid, 1942. First flight 1938, retired 1945; 22 built.

M-class blimps were built for the US Navy as the follow-on to the **K-class** anti-submarine warfare blimp used during World War II. It was a significantly larger airship, 50% larger than its predecessor. Four airships, designated **M-1** through **M-4**, were delivered in early 1944. A contract was awarded to the Goodyear Aircraft Company for the prototype **M-class** blimp on August 16, 1943. This contract was followed by another contract on September 11, 1943, for 21 **M-class** blimps. These airships were given the Navy designation of **ZNP-M**, (Z = lighter-than-air; N = non-rigid; P = patrol; M = type/class.) However, on November 22, 1943, the quantity of blimps was reduced to four. These were delivered to the Navy in February, March, and April 1944. The **M-Class** airships were retired from service by 1956. 4 built.

The **N-Class**, or as popularly known, the "NAN ship", was a line of non-rigid airships built by the Goodyear Aircraft Company of Akron, Ohio for the US Navy. The initial version, designated **ZPN-1**, was a follow-on to the **M-class** blimp for patrol missions. An initial contract was awarded to the Goodyear Aircraft Company for the prototype **N-class** blimp in the late 1940s, with delivery of the first on in 1952. The **ZPN-1** designation was changed to **ZPG-1** in 1954, and then to **SZ-1A** in 1962. The envelope capacity for the **ZPN-1** was 875,000 cu ft (24,777 m^3) and used the gas helium for lift. The **ZPN-1** was followed by an order for four improved **N-class** blimps that were delivered in 1954. These airships were designated **ZP2N**, and re-designated in 1954 as the **ZPG-2**. Three of the **ZP2N** airships were modified for an airborne early warning mission in the mid-1950s and were designated, originally, **ZP2N-1W** but at delivery were designated **ZPG-2W**. Their designation was changed to **EZ-1B** in 1962. The envelope capacity of these airships exceeded 1×10^6 cu ft (28,317 m^3).

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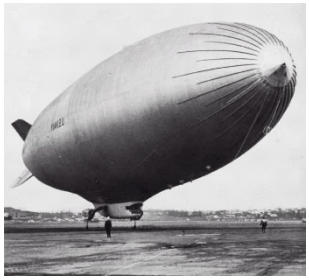

The **ZPG-2W** was equipped with the AN/APS-20 radar with its antenna installed beneath the gondola. An AN/APS-69 height-finding radar antenna was mounted on top of the envelope. The engines were installed in the control car and drove the propellers through extended shafts. The airship carried a crew of 21 to 25 and had an endurance capability of over 200 hours. The first **ZPG-2W** was delivered to the Navy at NAS Lakehurst in May 1955. Under the designation system established in April 1947, the first **N-class** airships were given the Navy designation of **ZPN-1**, (Z = lighter-than-air; P = patrol; N = type/class). In April 1954, the designation system was changed to mimic that used for heavier-than-air naval aircraft. With this change, the designation for the **ZPN-1** became the **ZPG-1** (Z = lighter-than-air; P = patrol; G=Goodyear (manufacturer); 1=first version). In the 1962 system, the **ZPG-1** designation was changed to **SZ-1A** (S=anti-submarine warfare; Z=lighter-than-air type; 1=first vehicle in the type; A=first model in the series). The designations for later model blimps followed similarly. 18 total variants.

The **ZMC-2** (Zeppelin Metal Clad 200,000 cubic foot capacity) was the only successfully operated metal-skinned airship ever built. Constructed at Naval Air Station Grosse Ile by The Aircraft Development Corporation of Detroit, the **ZMC-2** was operated by the U.S. Navy at Lakehurst, New Jersey from 1929 until its scrapping in 1941. While at Lakehurst it completed 752 flights, and logged 2265 hours of flight time

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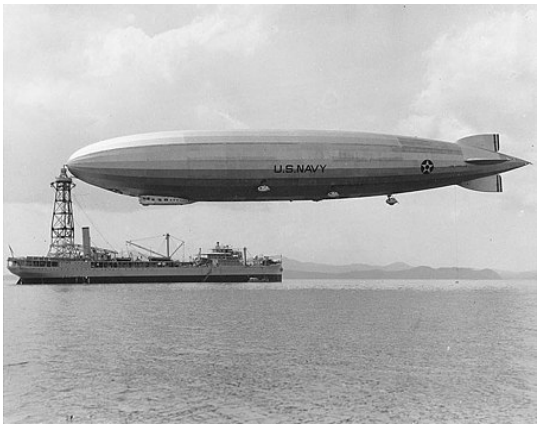
Rigid Airships

The United States rigid airship program was based at Lakehurst Naval Air station, New Jersey. USS *Shenandoah* (**ZR-1**) was the first rigid airship constructed in America, and served from 1923 to 1925, when it broke up in mid-air in severe weather, killing 14 members of its crew. USS *Los Angeles* (**ZR-3**) was a German airship built for the United States in 1924. The ship was grounded in 1931, due to the Depression, but was not dismantled for over 5 years. A pair of large airships, the *Akron* and *Macon*, that both functioned as flying aircraft carriers were procured by the US Navy. However, they were both destroyed in separate accidents. the *Akron* was flown into the sea in bad weather and broke up, resulting in the deaths of over seventy people, including one of the US Navy's proponents of airships, Rear Admiral William A. Moffett. *Macon* also ended up in the sea when it flew into heavy weather with unrepaired damage from an earlier incident, but the introduction of life-jackets following the loss of the *Akron* meant only two lives were lost

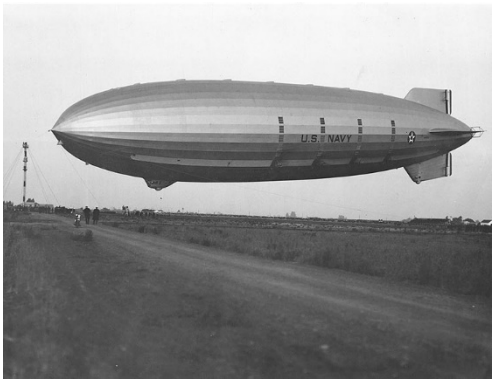
USS *Shenandoah* was the first of four United States Navy rigid airships. It was constructed during 1922–1923 at Lakehurst Naval Air Station, and first flew in September 1923. *Shenandoah* was originally designated **FA-1**, for "Fleet Airship Number One" but this was changed to **ZR-1**. The airship was 680 ft (207.26 m) long and weighed 36 tons (32,658 kg). It had a range of 5,000 mi (4,300 nmi; 8,000 km), and could reach speeds of 70 mph (61 kn; 110 km/h). *Shenandoah* first flew on 4 September 1923. While passing through an area of thunderstorms and turbulence over Ohio early in the morning of 3 September, 1925 during its 57th flight, the airship was caught in a violent updraft that carried it beyond the pressure limits of its gas bags. It was torn apart in the turbulence and crashed in several pieces near Caldwell, Ohio. Fourteen crew members, including Commander Zachary Lansdowne, were killed.



USS *Los Angeles* was a rigid airship, designated **ZR-3**, which was built in 1923–1924 by the Zeppelin company in Friedrichshafen, Germany, as war reparations. It was delivered to the United States Navy in October 1924 and after being used mainly for experimental work, particularly in the development of the American parasite fighter program, was decommissioned in 1932. *Los Angeles* was first flown on 27 August 1924, and after completing flight trials began the transatlantic delivery flight on 12 October under the command of Hugo Eckener, arriving at the US Naval Air Station at Lakehurst, New Jersey, after an 81-hour flight of 4,229 nautical miles (7,832 km; 4,867 mi). The airship was commissioned into the US Navy on 25 November 1924 at Anacostia, D.C. with Lieutenant Commander Maurice R. Pierce in command. On its

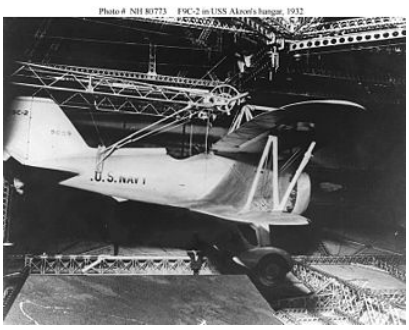
arrival in the United States, its lifting gas was changed from hydrogen to helium, which reduced payload but improved safety. At the same time the airship was fitted with equipment to recover water from the exhaust gases for use as ballast to compensate for the loss of weight as fuel was consumed, so avoiding the necessity to vent scarce helium to maintain neutral buoyancy.

The airship went on to log a total of 4,398 hours of flight, covering a distance of 172,400 nautical miles (319,300 km; 198,400 mi). Long-distance flights included return flights to Panama (USS Patoka), Costa Rica and Bermuda. It served as an observatory and experimental platform, as well as a training ship for other airships. *Los Angeles* was decommissioned in 1932 as an economy measure but was recommissioned after the crash of USS *Akron* in April 1933. She flew for a few more years and then retired to her Lakehurst hangar where she remained until 1939, when the airship was struck off the Navy list and was dismantled in her hangar. *Los Angeles* was the Navy's longest-serving rigid airship. Unlike *Shenandoah*, *Akron*, and *Macon*, the German-built *Los Angeles* was the only Navy rigid airship which did not meet a disastrous end



USS *Akron* (ZRS-4) was a helium-filled rigid airship of the U.S. Navy, the lead ship of her class, which operated between September 1931 and April 1933. She was the world's first purpose-built flying aircraft carrier, carrying F9C Sparrowhawk fighter planes, which could be launched and recovered while she was in flight. With an overall length of 785 ft (239 m), *Akron* and her sister ship *Macon* were among the largest flying objects ever built. Keel laid on 31 October 1929 (commenced), and launched on 8 August 1931, *Akron* was destroyed in a thunderstorm off the coast of New Jersey on the morning of 4 April 1933, killing 73 of the 76 crewmen and passengers.

The accident involved the greatest loss of life in any airship crash. There were 12 gas cells, numbered 0 to XI, using Roman numerals and starting from the tail. While the 'air volume' of the hull was 7,401,260 cu ft (209,580 m^3), the total volume of the gas cells at 100 percent fill was 6,850,000 cu ft (194,000 m^3). At a normal 95 percent fill with helium of standard purity, the 6,500,000 cu ft (180,000 m^3) of gas would yield a gross lift of 403,000 lb (183,000 kg). Given a structure deadweight of 242,356 lb (109,931 kg), this gives a useful lift of 160,644 lb (72,867 kg) available for fuel, lubricants, ballast, crew, supplies and military load (including the skyhook airplanes). Eight Maybach VL II 560 hp (420 kW) gasoline engines were mounted inside the hull. Each engine turned a two-bladed, 16 ft 4 in (4.98 m) diameter, fixed pitch, wooden propeller via a driveshaft and bevel gearing which allowed the propeller to swivel from the vertical plane to the horizontal.



Akron and *Macon* (which was still under construction) were regarded as potential "flying aircraft carriers", carrying parasite fighters for reconnaissance. On 3 May 1932, *Akron* cruised over the coast of New Jersey with Rear Admiral George C. Day, and the Board of Inspection and Survey, on board, and for the first time tested the "trapeze" installation for in-flight handling of aircraft. The aviators who carried

out those historic "landings"—first with a Consolidated N2Y trainer and then with the prototype Curtiss XF9C-1 Sparrowhawk—were Lieutenant D. Ward Harrigan and Lieutenant Howard L. Young. The following day, *Akron* carried out another demonstration flight, this time with members of the House Committee on Naval Affairs on board; this time, Lieutenants Harrigan and Young gave the lawmakers a demonstration of *Akron*'s aircraft hook-on ability

USS *Macon* (ZRS-5) was a rigid airship built and operated by the United States Navy for scouting and served as a "flying aircraft carrier", designed to carry biplane parasite aircraft, five single-seat Curtiss **F9C** Sparrowhawk for scouting or two-seat Fleet **N2Y-1** for training. In service for less than two years, in 1935 the *Macon* was damaged in a storm and lost off California's Big Sur coast, though most of the crew were saved. Less than 20 ft (6.1 m) shorter than *Hindenburg*, both *Macon* and her sister ship *Akron* were among the largest flying objects in the world in terms of length and volume. Construction began 7 November 1929, commissioned 23 June 1933. Displacement: 7,401,260 cu ft (209,580.3 m^3); Length: 785 ft. (239.3 m); Hull diameter (beam): 133 ft. (40.5 m); Height (draft): 146 ft. 5” (44.6 m). Engines: 8 Maybach VL II 12 cyl, water cooled, fuel injected V-12 engines, producing 560 Hp per engine. *Macon* was essentially a clone of the *Akron*, specification-wise.

Quick USN Blimp Designations Crib:

- **K-type** (aka ZPK) – 135 Built
- **L-type** – 22 Built (6 for Goodyear, 16 for the Navy)
- **G-type** (aka ZTG) – 8 Built (1 for Goodyear, 7 for the Navy)
- **M-type** – 4 Built
- **N-type** – 18 Built of different variants (AEW, etc.)

“Z” nomenclature

- **ZP2K** – converted from K-type blimps; redesignated ZSG-2
- **ZP3K** – converted from ZP2K blimps; redesignated ZSG-3
- **ZP4K** – 14 Built; redesignated ZSG-4
- **ZP5K** – 18 Built; redesignated ZS2G-1
- **N-type** (“NAN” ship, aka ZPN) – 1 Built; redesignated ZPG-1
- **ZP2N-1** – 12 Built; redesignated ZPG-2, then SZ-1B
- **ZP2N-1W** – 5 Built; redesignated ZPG-2W, then EZ-1B
- **ZPG-3W** – 4 Built; redesignated EZ-1C

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Goodyear ZNN-G. (Z = lighter-than-air; N = non-rigid; N = trainer; G = type/class).
Under the designation system established in April 1947, the first N-class airships were given the Navy designation of **ZPN-1**, (Z = lighter-than-air; P = patrol; N = type/class). In April 1954, the designation system was changed to mimic that used for heavier-than-air naval aircraft. With this change, the designation for the **ZPN-1** became the **ZPG-1** (Z = lighter-than-air; P = patrol; G=Goodyear (manufacturer); 1=first version). In the 1962 system, the **ZPG-1** designation was changed to **SZ-1A** (S=anti-submarine warfare; Z=lighter-than-air type; 1=first vehicle in the type; A=first model in the series). The designations for later model blimps followed similarly.