Goodyear - N-Class blimps

Peter Lobner, 24 August 2021

1. The Navy’s post-WWII blimps

At the time of the Japanese attack on Pearl Harbor on 7 December 1941, the US Navy had a small lighter-than-air (LTA) program operating 10 non-rigid airships. From 1942 to 1945, Goodyear Aircraft Company in Akron, Ohio built 155 airships in four classes for the U.S. Navy for patrol duty in the Atlantic, Pacific and Mediterranean theaters of WW II.

- 134 K-class blimps
- 10 L-class blimps
- 7 G-class blimps
- 4 M-class blimps

After WW II, the Navy’s blimps were rapidly retired from service. The Naval Airship Association reports: “From more than 125 airships in 15 squadrons patrolling roughly 3 million square miles off the coasts of 4 continents, by the end of 1946 there were only 2 squadrons remaining. Airship Squadron 31 (ZP-31) based at NAS Santa Ana, CA was designated ZP-1 and maintained a small detachment at NAS Moffett Field. Subsequently, by August 1947, squadron ZP-1 was transferred to NAF Weeksville, NC, thus ending all LTA operations on the west coast.”

WW II-era K-class (ZPN-K) blimps were upgraded and operated after WW II as ZP2K blimps (and later as ZSG-2), which were equipped for long endurance patrol flights with in-flight refueling equipment and attachments for picking up sea water for ballast. Thirty of these were re-designated ZP3K (and later ZSG-3) after being further updated for anti-submarine warfare (ASW) operations and for carrier-based operation.

By 1948 the Navy showed renewed interest in the unique and long range capabilities of airships. The ZP4K (later designated ZSG-4) became the first post-WW II new-construction blimp. These were a
modernized ASW variant of the basic WW II K-class design and were ordered from Goodyear in 1951. The first of 15 units was delivered in June 1954.

The next new-construction blimps were the ZP5K (later designated ZSG-5), which were ordered from Goodyear in 1952. The first of these ASW blimps was delivered in May 1955. A unique feature was the inverted “Y” tail. The Navy received a total of 12 ZP5Ks.

Next came the N-class blimps, which were much larger than their WW II-era predecessors. Originally conceived by the Bureau of Aeronautics as an ASW airship, a 1947 competition between Goodyear Aircraft Company and Douglas Aircraft Company led to the selection of the Douglas design, which the Navy purchased. However, responsibility for manufacturing the large blimps was assigned to Goodyear, which built the blimps in their giant Airdock in Akron, Ohio. A total of 22 N-Class blimps were delivered to the Navy between 1952 to 1960. Most had very short operational lives.

On 21 June 1961, the Secretary of the Navy announced the termination of the Navy's lighter-than-air (LTA) program. Patrol Squadrons ZP-1 and ZP-3 were disestablished by the end of October 1961. Two N-class blimps that had been kept at Lakehurst for research were retired on 31 August 1962 after making a final ceremonial flight. It was the end of an era in naval aviation.

Airship ZPG-2 (Serial #141559) made the last flight for a U.S. Navy airship on August 31, 1962, thus ending a continuous 45-year period of naval LTA service that began with the DN-1, the Navy's first airship. Source: U.S. Naval Institute
2. Nuclear weapons and blimps

In the post WW II-era, the Navy introduce a variety of nuclear weapons to the fleet, including the following nuclear depth charges.

- Mk 90 Betty, with a 32 kT Mk 7 nuclear warhead, entered the stockpile in the early 1950s and was withdrawn from service in 1960.
- Mk 101 Lulu, with an 11 kT boosted-fission W34 nuclear warhead, entered the stockpile in 1958.

With many blimps in service as armed ASW platforms, the Navy needed to know if a nuclear depth charge could be used during wartime without endangering the airship and crew that launched it. This issue was addressed in a 1960 Bureau of Weapons report by D.A. Gilstad, et al., in which the authors reported:

“Four Model ZSG-3 airships, U. S. Navy Bureau of Aeronautics Nos. 40, 46, 77, and 92, participated during Operation Plumbbob to determine the response characteristics of the Model ZSG-3 airship when subjected to a nuclear detonation in order to establish criteria for safe escape distances for airship delivery of antisubmarine warfare special weapons. Restrained response data for 0.40-psi overpressure input were obtained during Shot Franklin with the ZSG-3 No. 77 moored tail to the blast. Unrestrained response data for 0.75-psi overpressure input were obtained during Shot Stokes with the ZSG-3 No. 40 free ballooned, tail to the blast, 300 feet aboveground. The first airship exposed to overpressure experienced a structural failure of the nose cone when it was rammed into the mooring mast, together with a tear of the forward ballonet which necessitated deflation of the envelope. The second airship broke in half and crashed following a circumferential failure of the envelope originating at the bottom of the envelope, forward of the car.”

This publicly available information doesn’t really answer the question of whether an ASW blimp could escape safely after launching a nuclear depth charge that would detonate underwater. However, even at the top speed of a N-Class ZPG-2 ASW blimp (70 knots), a blimp-launched nuclear weapon doesn’t seem to be a good idea.
3. The N-Class blimps

The N-Class production run consisted of the following 22 airships:

- 1 ZPG-1
- 12 ZPG-2 ASW blimps
- 5 ZPG-2W airborne early warning (AEW) blimps
- 4 ZPG-3W AEW blimps

Visual cues for identifying these N-class variants are:

- The ZPG-1 and -2 airships do not have the height-finding radar radome on the top of the envelope. The ZPG-1 is smaller.
- The ZPG-2 and -2W have a large radome under the gondola and small propeller nacelles on outriggers. The engines are in the gondola. The -2W has a radome on top of the envelope.
- The ZPG-3W has large nacelles housing the engines on outriggers, no radome under the gondola and a radome on top of the envelope.

A ZPG-3W airship in the foreground, with a ZPG-2W above and a K-type blimp in the background, circa 1960. Source: US Navy photo

The ZPG-1

Originally designated ZPN-1, the ZPG-1 was the smallest of the N-Class blimps, with an envelope volume of 875,000 ft³ (24,777 m³). It was designed for ASW missions. Two Wright R-1300 Cyclone 7 air-cooled radial engines on outriggers provided propulsion. It was re-designated SZ-1A in 1962.
# General characteristics of the Goodyear ZPG-2W & ZPG-3W

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ZPG-2W</th>
<th>ZPG-3W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>342.6 ft (104.4 m)</td>
<td>403 ft (123 m)</td>
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<tr>
<td>Diameter, max</td>
<td>75.4 ft (23.0 m)</td>
<td>85 ft (25.9 m)</td>
</tr>
<tr>
<td>Height, overall</td>
<td>107.2 ft (32.7 m)</td>
<td>117 ft (35.7 m)</td>
</tr>
<tr>
<td>Envelope volume</td>
<td>1,011,000 ft³ (28,628 m³)</td>
<td>1,465,000 ft³ (41,484 m³)</td>
</tr>
<tr>
<td>Ballonets</td>
<td>247,300 ft³ (7,003 m³)</td>
<td></td>
</tr>
<tr>
<td>Primary radar</td>
<td>• AN/APS-20E search radar, power 1.75 MW, installed under the gondola.</td>
<td>• AN/APS-70 search radar, power 2 MW, installed inside the helium envelope.</td>
</tr>
<tr>
<td></td>
<td>• AN/APS-62 height finder radar on top of the envelope.</td>
<td>• AN/APS-62 height finder radar on top of the envelope.</td>
</tr>
<tr>
<td>Powerplants</td>
<td>• Two Wright R-1300-3A Cyclone 7 air-cooled, 7-cylinder supercharged engines @ 700 hp (522 kW) continuous, each</td>
<td>• Two Wright R-1820-88 Cyclone 9 air-cooled, 9-cylinder, radial engines @ 1,275 hp (951 kW) continuous, each.</td>
</tr>
<tr>
<td></td>
<td>• Engines installed inside the double-deck control car, driving outboard propellers in external nacelles attached by outriggers to the gondola</td>
<td>• Engines installed in external nacelles attached by outriggers to the gondola</td>
</tr>
<tr>
<td></td>
<td>• Engines accessible for maintenance in flight.</td>
<td></td>
</tr>
<tr>
<td>Speed, cruise</td>
<td>35 knots</td>
<td>35 knots</td>
</tr>
<tr>
<td>Speed, max</td>
<td>70 knots</td>
<td>82 knots</td>
</tr>
<tr>
<td>Empty weight</td>
<td>47,700 lb (21,622 kg)</td>
<td>71,080 lb (32,241 kg)</td>
</tr>
<tr>
<td>Takeoff weight</td>
<td>66,800 lb (30,300 kg)</td>
<td>93,100 lb (42,229 kg)</td>
</tr>
<tr>
<td>Static heaviness</td>
<td>6,000 lb (2,722 kg)</td>
<td>10,500 lb (4,763 kg)</td>
</tr>
<tr>
<td>Takeoff run</td>
<td>1,850 ft (564 m) over a 50 ft (15.2 m) obstacle</td>
<td>2,350 ft (716 m) over a 50 ft (15.2 m) obstacle</td>
</tr>
<tr>
<td>Crew</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Operational ceiling</td>
<td>3,000 ft (914 m)</td>
<td>5,000 ft (1524 m)</td>
</tr>
<tr>
<td>Range</td>
<td>Demonstrated: 9,448 miles (15,205 km) unrefueled (Snow Bird)</td>
<td>Normal mission: about 3,000 n miles (5,556 km)</td>
</tr>
<tr>
<td>Endurance</td>
<td>Demonstrated: 11 days (264.2 hours, Snow Bird)</td>
<td>Normal mission: 80 hours @ 35 knots @ 5,000 ft</td>
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</table>

Source: NAVAER Characteristics Summary and other sources
The ZPG-2 & -2W

Originally designated ZPN-2N, the ZPG-2 was designed for antisubmarine warfare (ASW) patrols of 2-3 days duration. It was equipped with sonobuoys and could be armed with “lethal stores” (bombs, torpedoes, depth charges) loaded on launchers mounted externally, near the aft end of the gondola. The ZPG-2 was equipped with a Hazeltine / General Electric AN/APS-20 S-band search radar. The 33 ft wide by 8 ft tall (10 x 2.4 m) rotating antenna was installed in a large radome beneath the gondola. The ZPG-2 made its first flight in March 1953.

Above: ZPG-2 gondola layout for an ASW mission with a crew of 21. The AN/APS-20 search radar is in the bulbous radome under the gondola.

Right: Details of the AN/APS-20 radar antenna.

Source, both diagrams: NAVWEPS 01-195PBA-2
The ZPG-2W introduced in 1956 had a more comprehensive radar suite that was tailored for all-weather airborne warning (AEW) missions. The ZPG-2W carried the AN/APS-20 search radar under the gondola and an AN/APS-69 height-finding radar in a prominent radome on top of the envelope.

One ZPG-2 was built or modified with external engines to test the configuration planned for the ZPG-3W, and is sometimes referred to as a ZPG-2 1/2. The Lighter-Than-Air-Society reported that the last ZPG-2Ws were equipped the search radar antenna installed inside the envelope.

Since 1957, the ZPG-2 named Snow Bird has held the world records for airship unrefueled distance and time of flight. GlobalSecurity describes the record flight as follows:

“On Monday, March 4, 1957, at 1832 (EST) Snow Bird lifted off from Naval Air Station, South Weymouth for her epic-making flight. The record for continuous non-refueled flight was 200 hours and 12 minutes aloft. Snow Bird officially eclipsed this record at 0245 (EST) on March 13, and broke a second record later that day. The distance record established by the German airship Graf Zeppelin in August 1929 fell when Snow Bird passed the 6,980-mile mark in her tricontinental journey. Snow Bird continued her flight, having established two new world records. On March 15, 1957, at 1844, Snow Bird landed at NAS
Key West. The voyage took 264.2 hours and covered a distance of 9,448 miles. No airship of any type had ever flown that far or remained aloft that long without refueling. For his contributions as commander and pilot of Snow Bird's record flight, Cdr. Hunt was awarded the Harmon International Trophy on November 12, 1958. The award was presented to him by President Eisenhower.”

Snow Bird departs NAS South Weymouth, MA, 4 March 1957. Source: Naval History and Heritage Command (80-G-1009746)

Snow Bird route map, 4 – 15 March 1957. Source: Flying magazine via This Day in Aviation
North Atlantic's worst proves

The ship that can go up and stay there!

Navy reveals amazing details of airship all-weather endurance flight test

On January 14th, the Naval Air Development Unit at South Weymouth, Massachusetts, working closely with Airship A.E.W. Squadron No. 1 of Lakehurst, N.J., assigned four Goodyear-built ZPG-type blimps to 10 continuous days and nights of radar sentinel duty over the storm-tossed North Atlantic.

On January 25th, the last airship reported back to its air dock — the group having established a weather endurance record unparalleled in the history of flight:

For ten days, working as a team, these latest airships maintained uninterrupted radar patrol of the sea approaches to the nation's northeast coast — flying the assigned area in spite of weather which included a 37-hour blizzard, severe icing conditions, and long spells of "zero-zero" visibility, over seas whipped by 60-knot winter gales.

It is convincing proof of the increasing importance of the role the airship is destined to play — in defending the nation which has sole control of the nonflammable helium that makes the modern lighter-than-aircraft possible.

Armed with the latest homing type weapons and the largest airborne radar, the blimp looms as the most dependable and practical aerial sentinel yet posted at the Free World's rim.

Goodyear N-class blimp advertisement, circa mid-1950s.

Source: AW&ST magazine
The ZPG-3W, Vigilance-class blimps

The ZPG-2W was followed by the larger ZPG-3W blimps designed for the AEW mission and carrying a more powerful search radar. The ZPG-2W and ZPG-3W were equipped with a radar platform at the top of the envelope, which supported the AN/APS-62 height-finding radar in a radome extending above the envelope. On the ZPG-3W, the large, low frequency General Electric AN/APS-70 search radar was installed inside the helium envelope, supported from the bottom of this radar platform.

The AN/APS-70 search radar had a rotating antenna measuring 40 feet wide by 6 feet high (12.2 x 1.8 m). It was capable of detecting distant flying objects through multiple layers of cloud clutter. An IFF (interrogation friend or foe) antenna was attached at the bottom of the AN/APS-70 antenna.
The Navy’s largest blimp, the ZPG-3W, before its maiden flight and the smallest blimp in service, the ZS2-G1.
Source: AW&ST magazine, Oct. 1958

Navy N-class ZPG-3W early warning blimp of airship airborne early warning squadron ZW-1 at Naval Air Station Lakehurst, New Jersey (USA), circa 1960. Source: US navy photo via Wikimedia Commons
The ZPG-3W mockup was completed at the end of 1955, followed by the Navy’s order for four airships. The maiden flight occurred in July 1958 and the four airships were delivered to the Navy between December 1958 and April 1960.

Squadron ZW-1, based at NAF Lakehurst, NJ, was the only squadron operating the ZPG-3W. They began conducting ZPG-3W AEW radar barrier patrols over the North Atlantic on 20 February 1960. The on-station endurance capabilities of the four ZPG-3Ws compared favorably to the coverage provided by five USAF EC-121 Super Constellations operating in rotation. While on station, the ZPG-3W crew could refuel by retrieving a floating fuel bag that had been left for them by a surface ship. Squadron ZW-1 was re-designated airship patrol squadron ZP-1 on 3 February 1961.

On 6 July 1960, ZPG-3W registration #144242 was at 300 feet (91 m) altitude when an explosion occurred on board. The aircraft fell into the sea 15 miles (24 km) off Long Beach Island, New Jersey and sank in 60 feet (18 m) of water. There were 21 crew members on board at the time, 18 of them died in the crash. The airship was searching for two yachts that were reported missing during a race from Newport, RI to Bermuda.

On 31 October 1961, ZP-1 Squadron was decommissioned, ending ZPG-3W operations after only 20 months.
ZPG-3W external arrangement. Source: adapted from NAVAER 01-195PDA-504 (1959)
ZPG-3W envelope & balloonets. Source: adapted from NAVAER 01-195PDA-504 (1959)
ZPG-3W catenary system. Note the separate suspension systems for the fore and aft fuel tanks.
Source: adapted from NAVAER 01-195PDA-504 (1959)
Radar platform showing the height-finder radar installation in the external radome.
Source: adapted from NAVAER 01-195PDA-504 (1959)

AN/APS-70 search radar and IFF (bar antenna) installation supported from the bottom of the radar platform, inside the envelope.
Source: adapted from NAVAER 01-195PDA-504 (1959)
ZPG-3W gondola exterior view.
Source: adapted from NAVAER 01-195PDA-504 (1959)

ZPG-3W gondola interior arrangement and crew deployment.
Source: adapted from NADC-80149-60 (1980)
ZPG-3W at Lakehurst in 1960. Source: Major Edward Martin Helm, USAF via U.S. Naval History and Heritage Command

You can watch a 2012 tour of this ZPG-3W gondola at the following link: [https://www.youtube.com/watch?v=o0so94Bl6zM](https://www.youtube.com/watch?v=o0so94Bl6zM)
4. After the N-class retired

After they had been retired from service in 1961, the ZPG-2W and ZPG-3W were “posthumously” re-designated in 1962 as the EZ-1B and EZ-1C, respectively. The anti-submarine ZPG-1 became the SZ-1A and the ZPG-2 became the SZ-1B.

Thirteen years later, in 1975, the National Aeronautics and Space Administration (NASA) initiated a study called “Feasibility of Modern Airships – Phase I.” The Navy joined Phase II of that study in 1976, and continued studying naval airship applications for three decades without developing an operational naval airship. These Navy studies were:

- Feasibility of Modern Airships – Phase II (1976 – 77)
- Assessment of Selected LTA Vehicles for Mission Tasks of the US Coast Guard (1975 – 1978)
- Maritime Patrol Airship (MPA) Program (1980)
- Naval Airship Program (NAP) (1982 – 1989, with DARPA taking over the program thru 1995)
- Navy Hybrid Ultra Large Airship (HULA) program (2001 – 2003, and continued support since 2006 (after Project WALRUS was terminated) from Naval Air Systems Command (NAVAIR) Advanced Development Program Office (ADPO) – Airship Concepts

You’ll find more information in my separate articles on ANVCE, MPA, Sentinel 1000 & 5000 (NAP), HULA, and WALRUS.

After all of the above studies, the Navy finally received its first new airship in 44 years, the MZ-3A blimp manufactured by the American Blimp Corporation. The MZ-3A, delivered in June 2006, is a variant of the production model A-170 commercial blimp. It was operated and intermittently stored thru 2017. More information on the MZ-3A is in my separate article on American Blimp Corporation.
Since 1957, the ZPG-2 named Snow Bird has held the world records for airship unfueled distance and time of flight. Since their last flight in 1962, the ZPG-3W blimps remain the largest non-rigid airships ever to fly. They also were the last airships to be built in the massive Goodyear Airdock in Akron, OH, which, in 1980, was designated a Historic Civil Engineering Landmark by the American Society of Civil Engineers.

5. For more information

Post WW II US naval airship overview

- “USN LTA: Cold War History,” Airship History: https://airshiphistory.com/wp/1-page-postwar-era/
ZPG-2 & -2W

- Video: “US Navy ZPG-2W airborne early warning (AEW) airship (late 60s),” (1:12 minutes), Aviation video archives, 2021: https://www.youtube.com/watch?v=p80vcooV7Qs

ZPG-3W

• Video: “Tour of the US Navy airship ZPG-3W” (4:35 minutes), Bob Hudson Video, 16 December 2014: https://www.youtube.com/watch?v=o0so94Bl6zM

Related *Modern Airship* articles

• US Navy - YEZ-2A (Sentinel 1000 & 5000)