

# American Blimp Corp.

Peter Lobner, 24 August 2021

## 1. Introduction

American Blimp Corporation (ABC) was founded in 1987 in Hillsboro, Oregon by Jim Thiele, with the goal of producing simple, easy to build, comparatively low-priced airships, with applications in aerial advertising. Thiele developed and patented illumination concepts for airships used as advertising media, which he called "Lightships." That term was first used in connection with ABC blimps in 1988 and is covered by trademark #74445159, which is registered to American Blimp Corporation. Since then, ABC has become a leading manufacturer of small-to-medium size blimps, primarily for advertising and media applications.



The proof-of-concept prototype, designated A-50, first flew in April 1988. It had a translucent envelope and was designed specifically for advertising, with two 1,000-watt light bulbs inside the envelope for nighttime operations.

The A-50 was followed by the larger A-60 (60,000 ft<sup>3</sup> envelope) production prototype, which received FAA type certificate AS1NM on 18 May 1990. The A-60+ entered production in 1991 and became the first series-produced ABC blimp. A later variant with Rotax engines, the A-60R, entered service in 2004.

In 1993, Lightship America was formed as an airship operator affiliate of ABC, initially operating a small fleet of A60+ blimps. Also in 1993, the larger A-130 blimp was introduced with a nine passenger gondola, but none were built.

The A-150 entered production in 1997 with the nine passenger gondola, which also was used in ABC's largest blimp, the A-170 introduced in 1999. An A-170 military variant, the MZ-3A, was delivered to the US Navy in 2006 and became the first Navy airship to fly in 44 years. SPECTOR™ was a military variant proposed in 2013 to Defence Canada, but not built.

After the acquisition of Thunder & Colt by Cameron Balloons Ltd. in 1995, ABC acquired the manufacturing rights and type certificate AS3EU for the T&C two-place GA-42 non-rigid blimp, which was the first blimp with fly-by-wire controls to receive an FAA type certificate with no mechanical backup. ABC subsequently transferred GA-42 manufacturing rights to Lindstrand Technologies.



*T&C GA-42 helium blimp.  
Source: The Big Black Bird*

Over the years, Lightship America evolved into The Lightship Group (TLG), and became the world's largest blimp advertising operator, primarily flying ABC's Lightship blimps. AirSign's Airships Division was formed with the acquisition of TLG, ABC, and the outdoor advertising company Van Wagner Airship Group. The AirSign Airship Group website is here: <http://www.airships.com>

While ABC airships function primarily as aerial advertising platforms, they can be configured to perform a variety of other missions for military and civil organizations, using state-of-the-art sensors on sorties lasting 12 or more hours. Such missions include:

- Border security
- Key installation security (i.e., ports, refineries, power plants)
- Airborne police patrols
- Maritime patrols
- Disaster relief

Under Project Atlas, ABC introduced optionally manned versions of two of their airships, now designated the A-60HA and A-170HA. Both are capable of functioning unmanned as an autonomous free-flyer or as a tethered aerostat, or when needed, with a pilot.

As of mid-2021, ABC has built 41 non-rigid airships, making them the most popular advertising airships in the world.

Model	Number built
A-60+	27
A-60R	3
A-150	8
A-170	2
A-170G / MZ-3A	1

In this article, we'll take a look at the American Blimp Corporation's airborne display panel patents, their manned blimps, and the Atlas optionally-manned blimp / aerostats.

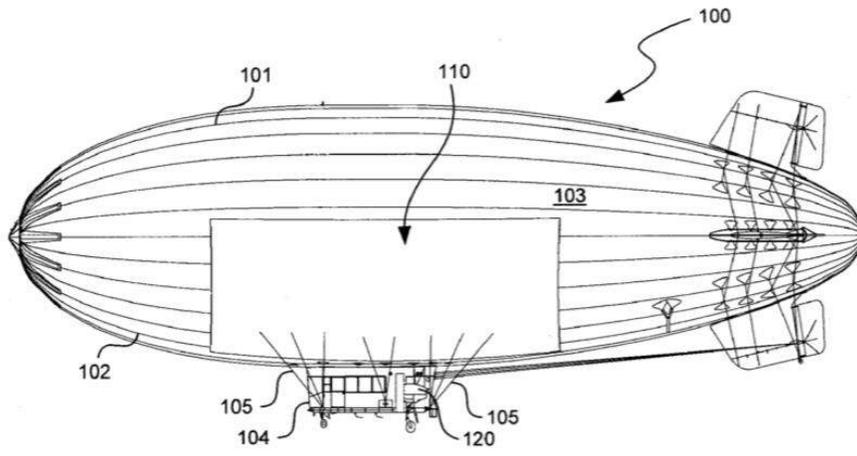
## 2. The Lightship Patents

Two US patents describing the how to design, install and operate flexible airborne emitter / receiver (transmission / reception) arrays on a blimp have been granted to ABC: US2008/0047176A1 and US8081141B2 (2011), both titled, "Airborne emitter / receiver arrays, and associated systems and methods." While ABC's immediate interest was a video display array for their Lightship advertising blimps, the patents apply generally to other types of flexible emitter / receiver arrays, such as, radar arrays and solar arrays.

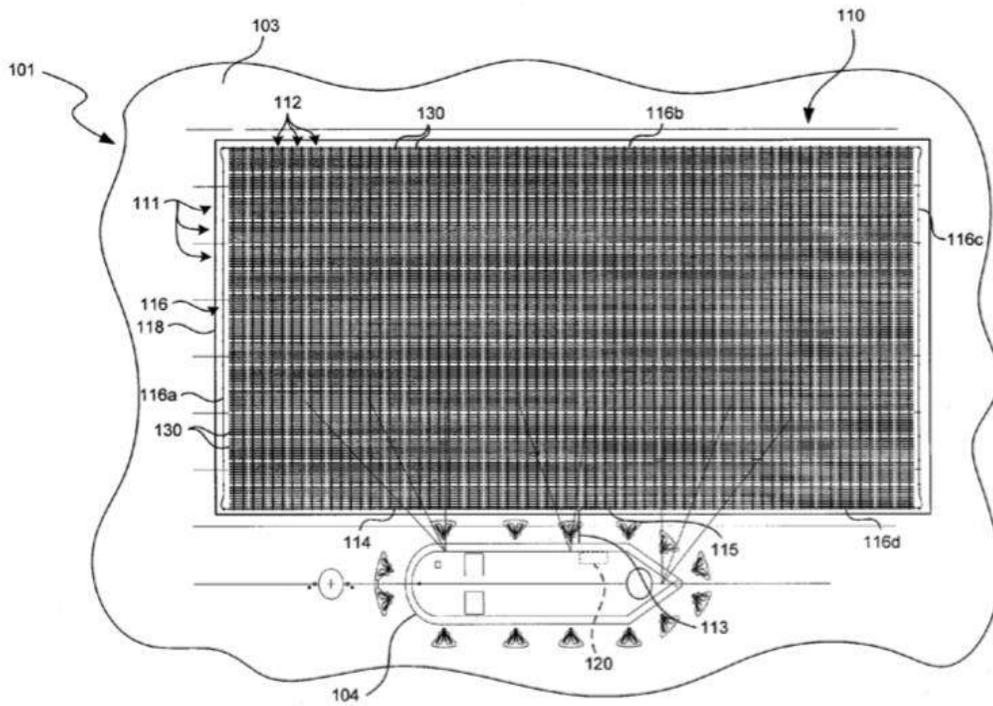
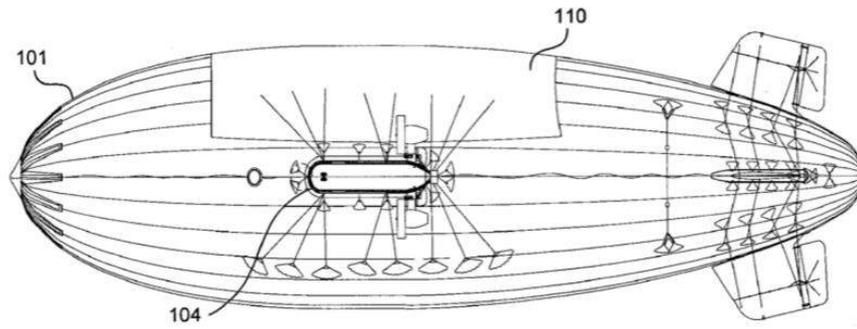
Patent Figures 1 and 2 are side and bottom views of a blimp (101), respectively. The video display array (110) is conformally attached to the double-curved external surface (103) of the gas envelope (102). The array can be configured to display static or video images under the direction of a controller (120) housed in the gondola (104), which is suspended under the envelope with several external catenary cables (105) that are secured to reinforced points around the bottom of the envelope.

The display device may be mounted on one or both sides of the blimp. If the display is mounted on only one side, as shown in patent Figure 2, then the weight of the display will cause the blimp to roll to one side. The airship control surfaces may be able to compensate for the roll, or other measures described in the patent may be taken.

**FIG. 1**



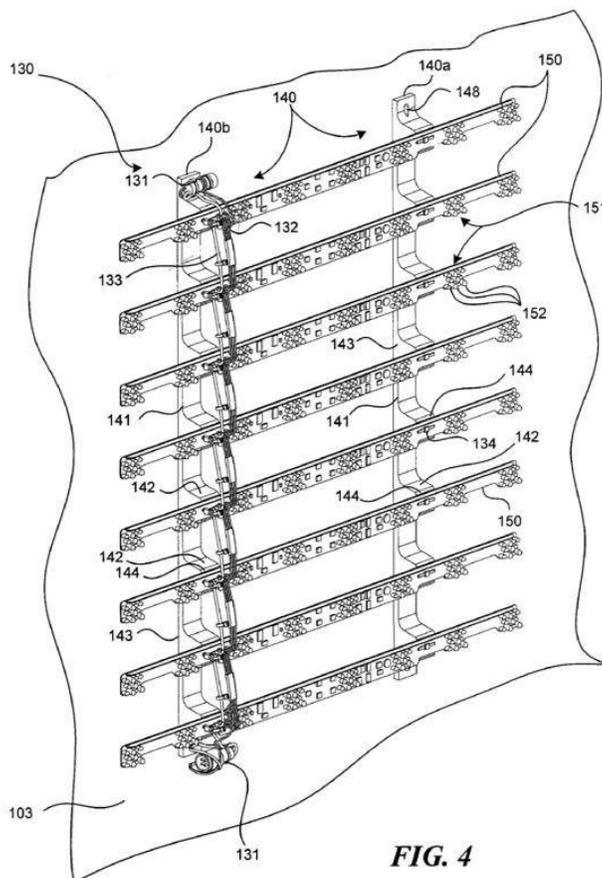
**FIG. 2**



**FIG. 3**

Patent Figure 3 shows an example of a rectilinear array (110) comprised of many electrically interconnected display units (130) arranged in rows (111) and columns (112). In this example, there are 15 rows and 35 columns. Each display unit measures 2 feet x 2 feet, so the array in this example measures about 70 feet long and 30 feet high (21.3 x 9.1 m), yielding a display area of 2,100 ft<sup>2</sup> (195 m<sup>2</sup>). The array is scalable to be compatible with the available display space.

An example display unit (130) is shown in patent Figure 4. In this “Venetian blind” arrangement, the horizontal elements (150) are the “pixel carriers,” and the flexible support members (140) are attached to the external surface of the blimp’s gas envelope.



The patent provides details on how that attachment is made. For video display applications, the “pixels” (emitters) are individually controllable LEDs (light emitting diodes). For radar and solar power applications, “display units” and “pixel carriers” specific to those applications would be installed.

### 3. Manned blimps

American Blimp Corporation's "simple design" philosophy is implemented with the following design features:

- Pressurized envelope
- Single ballonnet with manually operated air valves
- Two manually operated helium valves on top of the envelope
- Water ballast trim control system
- Two fixed (non-vectoring) engines mounted on each side of gondola with forward thrust propellers
- Mechanical wire controls for aerodynamic surfaces and valves
- X-tail (four fins in a "king-cross" configuration)
- Steel tube framework gondola
- External suspension system (The gondola is suspended by cables from reinforced load patches that distribute the load across the bottom of the envelope. There are no catenary curtains / cables inside the envelope).

For their primary missions as advertising and media platforms, the ABC blimps all include the following features.

- All can mount a large, static advertising banner on each side of the hull, using up to 32 shades of translucent material. The Lightships all are equipped with a special internal illumination system for use during advertising flights at night.
- Large, dynamic LED video display panels can be installed conformally on the outside of the envelope and managed with an on-board control system.
- All airships have a gyro-stabilized camera mounting and can serve as a platform for hi-definition TV/video filming.

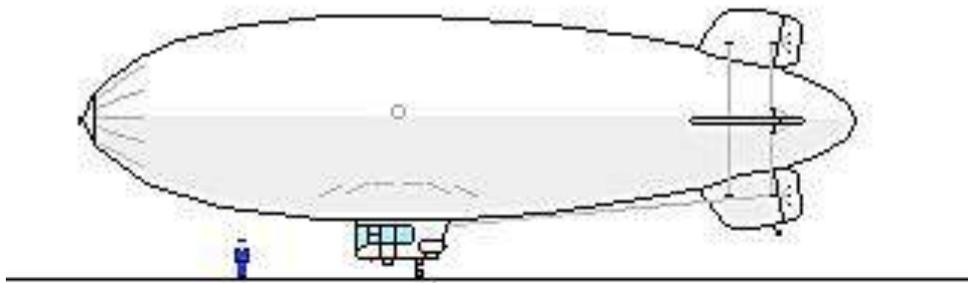
The airships are designed to be disassembled, loaded into shipping containers, shipped anywhere in the world and reassembled and ready for use in a matter of weeks.

Under its FAA approved production certificate, ABC has produced three basic models: the A-60+, A-150 and A-170. ILC Dover produces envelopes for ABC.

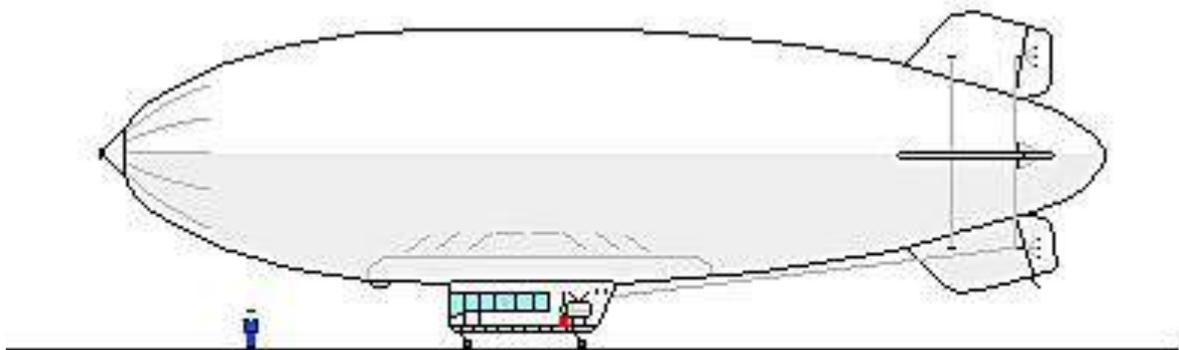
**American Blimp Corporation manned blimps  
general characteristics**

	<b>A-60+</b>	<b>A-150</b>	<b>A-170</b>
Type Certificates	FAA AS1NM LBA TC/TCDS No. 9006/AS 3 Feb 1999	FAA S00002SE 3 October 1997 EASA.IM.AS.500 22 Dec 2011	FAA S00002SE 25 March 2005 EASA.IM.AS.500 22 Dec 2011
Length, overall	39 m (128 ft)	50.3 m (165 ft)	54.3 m (178 ft)
Diameter, max	10 m (33 ft)	14 m (46 ft)	14 m (46 ft)
Height, overall	13.4 m (44 ft)	16.7 m (55 ft)	16.7 m (55 ft)
Envelope volume	1,925 m <sup>3</sup> (68,000 ft <sup>3</sup> )	4,200 m <sup>3</sup> (150,000 ft <sup>3</sup> )	4,800 m <sup>3</sup> (170,000 ft <sup>3</sup> )
Pressure max/min	2.0 / 1.0 inches H <sub>2</sub> O	2.0 / 1.3 inches H <sub>2</sub> O	2.0 / 1.3 inches H <sub>2</sub> O
Payload	680 kg (1,500 lb)	1,644 kg (3,625 lb)	2,109 kg (4,650 lb)
Gondola dimensions	L/W/H 2.7 / 1.5 / 1.9 m (8.8 / 5 / 6.3 ft)	L/W/H 3.5 / 1.5 / 1.9 m (11.4 / 5 / 6.3 ft)	L/W/H 3.5 / 1.5 / 1.9 m (11.4 / 5 / 6.3 ft)
Accommodations	Pilot & 3-4 pax	Pilot & 9 pax	Pilot & 9 pax
Propulsion	2 x Limbach flat-four, air-cooled engines @ 80 hp (60 kW) each	2 x Lycoming IO 360 flat-four, air-cooled engines @ 180 hp (134 kW) each, constant speed, variable pitch, reversible	2 x Lycoming IO 360 flat-four, air-cooled engines @ 180 hp (134 kW) each, constant speed, variable pitch, reversible
Speed, max level flight, IAS	60 mph	52 mph	52 mph
Altitude, max operating	6,000 ft (1,829 m)	10,000 ft (3,048 m)	10,000 ft (3,048 m)
Range	966 km (600 miles)	990 km (615 miles)	933 km (580 miles)
Endurance	15 hours	15 hours	
Ground crew	13	16	17

*Sources: Compilation from Type Cert, AirSign, and other sources*



**Lightship A-60+**



**Lightship A-150**



**Lightship A-170**

*Relative scale of the ABC Lightships.*

Source: Lightship Series by MotherbrainJr at DeviantArt.com  
<https://www.deviantart.com/motherbrainjr/art/American-Blimp-Corporation-Lightship-Series-Blimps-793036156>

## A-60+ and A-60R

The original A-50 prototype was followed by the larger A-60 (60,000 ft<sup>3</sup> envelope) prototype, which included additional features required for FAA type certification and a gyro-stabilized camera to support its use as a surveillance platform. It was approved under FAA Type Certificate AS1NM on 29 November 1991.

The A-60 was the basis for the first series-produced model, the A-60+, which had a larger envelope (68,000 ft<sup>3</sup> vs. 60,000 ft<sup>3</sup>) and first flew in October 1991 with two Limbach flat-four, air-cooled engines. The gondola can accommodate the pilot and 3 to 4 passengers. Maximum payload is 680 kg (1,500 lb).



*A-60+, tail number N605L.*

*Source: Kambui via Wikimedia Commons*

Goodyear leased an A-60+ Lightship and flew it in winter conditions over the 1994 Winter Olympic Games in Lillehammer, Norway.



While working with T-Mobile & Samsung on the launch of the Galaxy S9 smartphone, an A-60+ in T-Mobile colors set the first ever Guinness World Record for the greatest distance for water-skiing behind a blimp, 6.9 miles, (11.1 km), on 15 March 2018.

*Source: The Associated Press via NY Post*

The A-60R is a variant of the A-60+ powered by two Rotax 912F3 rated at 80 hp (60 kW) each. It was approved under FAA Type Certificate AS1NM on 22 December 2004. A key operational advantage is the ability to reverse the propeller on landing to enable the pilots to operate from much shorter landing strips.



*A-60R "Snoopy Two", tail number N615LG.*

*Source: Matthew Field, via Wikipedia*

## **A-130**

The A-130 was introduced in 1993, but none were built. The A-130 had a significantly larger gondola than the A-60+ and could accommodate a pilot and nine passengers. Similar gondolas were used on the later, larger A-150 and A-170 blimps.

<b>Parameter</b>	<b>A-130</b>
Length, overall	48.2 m (158 ft)
Diameter, max	12.5 m (41 ft)
Height, overall	16.5 m (53.5 ft)
Envelope volume	3,600 m <sup>3</sup> (130,000 ft <sup>3</sup> )
Payload	1,179 kg (2,600 lb)
Gondola dimensions	L/W/H = 3.5 / 1.5 / 1.9 m (11.4 / 5 / 6.3 ft)
Speed, max	106.2 kph (66 mph)
Range	1,046 km (650 miles)

## **A-150**

The larger A-150 was introduced and made its first flight in 1997. It became the first ABC production blimp with a nine passenger gondola. In addition to the advertising market, the larger gondola made the A-150 well suited for the sightseeing and military surveillance markets.

It was approved under FAA Type Certificate S00002SE on 3 October 1997. American Blimp Corp. built eight A-150 Lightships.



*A-150 tail number N155LG.  
Source: Sunil Gupta via Wikimedia Commons*



*Sanyo A-150 Lightship with a translucent envelope and internal lighting makes a night flight at the 1997 Miramar Air Show in San Diego, CA. Source: Screenshot from tvnshack video*

## A-170

The largest model, the A-170, was introduced in 1999 and was approved under FAA Type Certificate S00002SE on 25 March 2005. It has the same nine passenger gondola and propulsion system as the A-150.

As an advertising blimp, it has become well known because of its 70 x 30 foot (21.3 x 9.1 m) Video Lightsign, which can display television quality color video.



*A-170 Lightship at the Carroll County Regional Airport, Westminster, Maryland. Source: Acroterion via Wikipedia*



*The 70 x 30 foot Video Lightsign blank screen (left) and in operation (right). Source: Technovelgy.com (2006)*

## **MZ-3A (A-170G)**

The American Blimp Corp's MZ-3A was a one-of-a-kind modification of an A-170 series commercial blimp, known also as the A-170G. It was approved under FAA Type Certificate S00002SE on 7 April 2006.

The MZ-3A was delivered to the US Navy in May 2006 and was operated and intermittently stored thru 2017. It was the first Navy airship to fly in 44 years, since the Secretary of the Navy terminated the Navy's lighter-than-air (LTA) program in 1961, and the last naval airship flight occurred on 31 August 1962. The MZ-3A was given the Navy tail number 167811.



*MZ-3A at Naval Air Station Patuxent River, MD, in Nov. 2013, where it was operated by Scientific Development Squadron 1.*

*Source: US Navy*

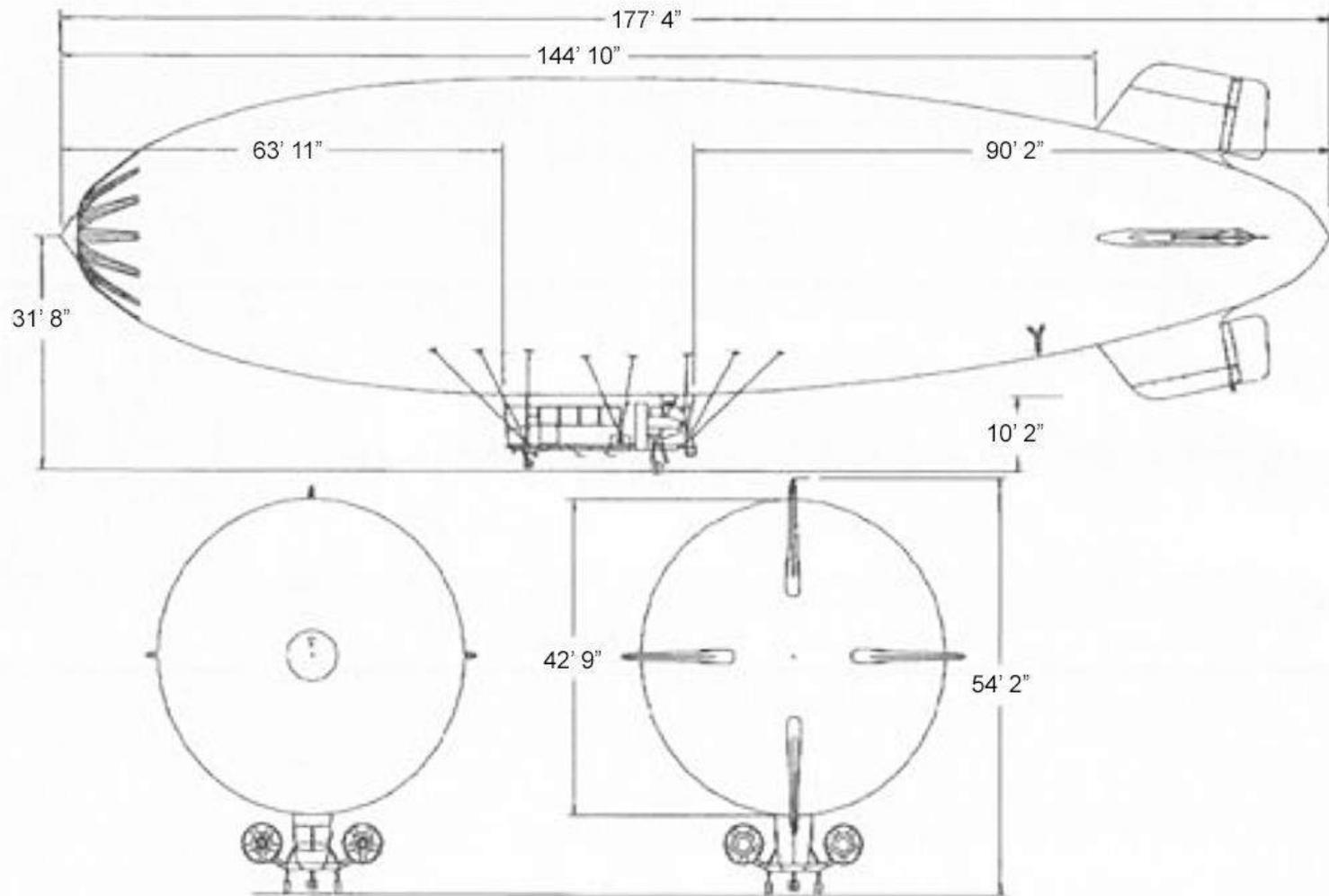
First flown in 2006 by Air Test and Evaluation Squadron 20, the MZ-3A operated initially from Naval Air Engineering Station Lakehurst, New Jersey. Over its Navy career the MZ-3A was redeployed several times and used as an advanced flying laboratory to evaluate

affordable sensor payloads and provide support for related naval research projects. For the Navy's *Centennial of Naval Aviation* celebration in 2011, the MZ-3A got red, white and blue striped tail fins, reminiscent of the Navy's airships just prior to World War II.

Parameter	MZ-3A / A-170G
Length, overall	54.0 m (177.3 ft)
Diameter, max	13.0 m (42.8 ft)
Envelope volume	4,814 m <sup>3</sup> (170,000 ft <sup>3</sup> )
Mass	2,858 kg (6,300 lb)
Payload	1,134 kg (2,500 lb)
Payload power	9.5 kW (28VDC); 2.5 kW (120VAC)
Speed	45 kts max cruise
Ceiling	2,896 m (9,500 ft)
Endurance	> 24 hours



*MZ-3A at Lakehurst, NJ in Oct. 2011 in its Centennial of Naval Aviation color scheme. Source: US Navy*



ABC's MZ-3A (A-170G) blimp. Source: NAVAIR, "Summary...DoD-funded LTA Vehicles" (2012)



*The MZ-3A flying at MCAS Yuma in June 2010.  
Source: Military.Wikia.org*

The Navy cancelled the MZ-3A program in December 2014. After three years in storage, the General Services Administration (GSA) auctioned the blimp in October 2017, and wound up selling the MZ-3A to the AirSign Airship Group.

The MZ-3A, now in civilian registration N157LG and known as the A-170G, took flight for the first time since being acquired from the Navy in June 2021. It currently is being used as a training platform for Sergey Brin's firm LTA Explorations & Research as they prepare for the first flight of a new airship they are developing.

## **SPECTOR™ proposed Canadian military version of the A-170**

In 2013, Defence R&D Canada conducted a survey of LTA platforms and communications relays for possible roles in Canada's evolving defense strategy, which included protecting Canadian territorial integrity and sovereignty in the Arctic. Surveillance missions of interest to the Canadian government were:

- Maritime patrol
- Border patrol
- VIP security
- Key installation security
- Counter narcotics
- Anti-smuggling
- Communications & signal intelligence (COMINT / SIGINT)

American Blimp Corporation submitted information on their SPECTOR™ Series of airships, which were military adaptations of the A-170 commercial design.

The Canadian reviewers reported:

“The American Blimp Corporation SPECTOR™ Series of airships are designed to carry payloads for each of the above missions (or multi-mission suites), and cruise at 40 knots, or 74 kph (46 mph), for over 24 hours with reserve fuel remaining. SPECTOR™ airships can fly at altitudes up to 1,500 m (4,921 ft), with more than 1 metric tonne (2,200 lb) available for mission crew and payload. Performance is dependent on the mission payload requirements.”

“For example, an airship equipped for providing surveillance of a border might have a mission system comprised of the following:

- Forward-Looking Infra-Red (FLIR) system with bore-sighted color TV camera
- Synthetic Aperture Radar (SAR)
- Workstation integrating data from the sensor suite

- Searchlight and loudhailer system
- Data link to provide surface forces with real time sensor data from the airship
- Radio relay could be added to this mission suite”

In the manned “classical airship” category, ABC was competing with the German firms WDL Luftschiffgesellschaft GmbH (WDL-1B), Zeppelin Luftschifftechnik GmbH (Zeppelin NT), and CargoLifter (CL160).

Canada did not procure any of the LTA or semi-buoyant platforms included in their survey.

### **Global Airship**

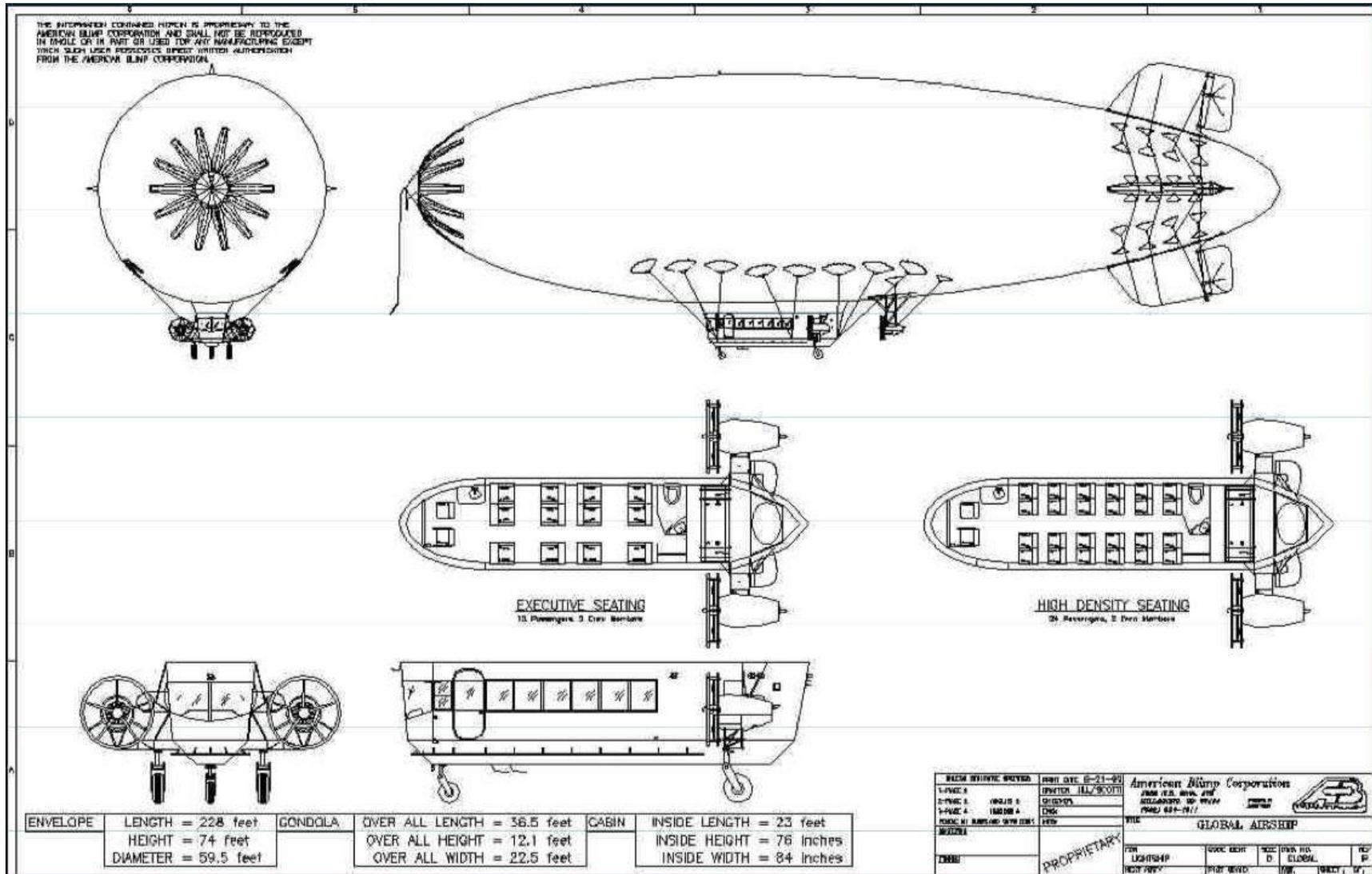
The Global Airship was a conceptual design described by ABC Engineering Manager Rudy Bartel in 2002 at the *Airships to the Arctic I Symposium* in Winnipeg, Canada. Based on experience with ABC’s FAA certified models, the Global Airship was an evolutionary design for a larger blimp intended primarily for the sightseeing market.

This airship would have been considerably larger than ABC’s largest production model, the A-170. The ellipsoid envelope had a length of 69.5 m (228 ft), which was 15.2 m (50 ft) more than the A-170. Envelope maximum diameter increased of 22.5 m (74 ft), 8.5 m (28 ft) more than the A-170. This would yield an envelope volume of approximately 590,000 ft<sup>3</sup> (16,707 m<sup>3</sup>), more than three times the volume of the A-170 envelope.

The airship was powered by three engines, two mounted at the aft end of the gondola and a third engine supported separately from the envelope on the airship centerline, behind the gondola.

In the following diagram, the 11-meter (36-foot) long gondola is shown configured for high-density seating with two crew and 24 passengers, and in a more spacious “executive seating” configuration for two crew and 12 passengers.

This impressive blimp was not built.



ABC's Global Airship design concept. Source: ABC via Airships to the Arctic I Symposium (2002)

#### 4. Project Atlas optionally manned airships / aerostats

Under Project Atlas, AirSign's Airship Group introduced optionally manned versions of two of the ABC airships, now designated A-60HA and A-170HA. Both Atlas airships are intended for persistent intelligence, surveillance and reconnaissance (PISR) missions and



are capable of functioning unmanned as an autonomous free-flyer or as a tethered aerostat, or when needed, with a pilot.

While in airship mode, Atlas airships can be controlled remotely or fly a programmed course. While in aerostat mode, if the tether is severed, Atlas automatically switches into autonomous airship mode with no loss to the unit or potentially sensitive equipment onboard.

Key performance capabilities for the Project Atlas airships include:

- Can operate for 7 days while in the free-flying autonomous airship mode
- Maximum cruise range of 1,200 miles (1,931 km) while in autonomous airship mode
- Can operate continuously in tethered aerostat mode for 30 days
- The A-60HA has a useful payload of 750 lbs (340 lb), and the A-170HA can carry 3,500 lbs (1,588 kg)

#### 5. For more information

##### Patents and trademark

- "Lightship" trademark registration, Application #74445159, filed 7 October 1993, registered 25 March 1997, trademark owner is American Blimp Corporation, USPTO report available here: <https://uspto.report/TM/74445159>
- US 2008/0047176A1, "Airborne Emitter / Receiver Arrays and Associated Systems and Methods," filed 20 August 2007, published 28 February 2008, available here:

<https://patents.google.com/patent/US20080047176A1/en?q=•US+2008%2f0047176>

- US 8081141B2, “Airborne Emitter / Receiver Arrays and Associated Systems and Methods,” filed 20 August 2007, granted 20 December 2011, assigned to ABC, available here: <https://patents.google.com/patent/US8081141B2/en?q=•US+8081141>
- US 2009/0272845A1, “Airship Handling Devices and Associated Systems and Methods,” filed 29 April 2009, published 5 November 2009, assigned to ABC, available here: <https://patents.google.com/patent/US20090272845A1/en?q=•US+2009%2f0272845>
- US 2013/0009006A1, “Airship Handling Devices and Associated Systems and Methods,” filed 14 September 2012, published 10 January 2013, applicant: ABC, available here: <https://patents.google.com/patent/US20130009006A1/en?q=•US+2013%2f0009006>
- US 8403260B2, “Airship Handling Devices and Associated Systems and Methods,” filed 14 September 2012, granted 26 March 2013, assigned to ABC, available here: <https://patents.google.com/patent/US8403260B2/en?q=•US+8403260>

## **Type Certificates**

- “Type Certificate Data Sheet AS1NM” Revision 9, for A-60, A-60+ & A-60R, Federal Aviation Administration, 26 Nov 2012: [https://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgMakeModel.nsf/0/c1e1b80e98880e6686257ad00077b967/\\$FILE/AS1NM\\_Rev\\_9.pdf](https://rgl.faa.gov/Regulatory_and_Guidance_Library/rgMakeModel.nsf/0/c1e1b80e98880e6686257ad00077b967/$FILE/AS1NM_Rev_9.pdf)
- “Type Certificate Data Sheet S00002SE” Revision 10, for A-150, A-170 & A-170G, Federal Aviation Administration, 26 Nov 2012: [https://rgl.faa.gov/Regulatory\\_and\\_Guidance\\_Library/rgMakeModel.nsf/0/86662e4ee8e91b7d86257ac50052982b/\\$FILE/S00002SE\\_Rev\\_10.pdf](https://rgl.faa.gov/Regulatory_and_Guidance_Library/rgMakeModel.nsf/0/86662e4ee8e91b7d86257ac50052982b/$FILE/S00002SE_Rev_10.pdf)
- “Type Certificate Data Sheet No. AS3EU” Revision 2, for Model GA-42, Federal Aviation Administration, 21 Nov 2000: [https://rgl.faa.gov/regulatory\\_and\\_guidance\\_Library/rgMakeMo](https://rgl.faa.gov/regulatory_and_guidance_Library/rgMakeMo)

[del.nsf/0/6c9e5d3010da375386256b7d0051145d/\\$FILE/AS3EU.pdf](https://del.nsf/0/6c9e5d3010da375386256b7d0051145d/$FILE/AS3EU.pdf)

- “EASA Type-Certificate Data Sheet, A-1 Series” European Aviation Safety Agency, 22 Dec 2011:  
[https://www.easa.europa.eu/sites/default/files/dfu/EASA-TCDS-AS.500\\_\(IM\)\\_American\\_Blimp\\_Corporation\\_A--1\\_Series-01-22122011.pdf](https://www.easa.europa.eu/sites/default/files/dfu/EASA-TCDS-AS.500_(IM)_American_Blimp_Corporation_A--1_Series-01-22122011.pdf)

## **Videos**

- Video: “Lighted Sanyo Airship (Blimp - Zeppelin) at Night,” (2:42 minutes), tvnshack, 1997:  
<https://www.youtube.com/watch?v=da2A456wqjM>
- Video: “T-Mobile & Samsung Galaxy S9 Set Guinness World Records,” (and longest water skiing behind a blimp)(1:43 minutes), T-Mobile, 15 March 2018:  
<https://www.youtube.com/watch?v=IWzQ6sCtTUQ&t=4s>

## **Other resources**

- Roland Escher, “American Blimp Corporation,” Airship and Blimp Resources, 2003:  
<http://www.myairstrip.com/database/abc.html>
- “American Blimp Corp Production List,” Airport-Data.com:  
[https://www.airport-data.com/manuf/American\\_Blimp\\_Corp.html](https://www.airport-data.com/manuf/American_Blimp_Corp.html)
- “American Blimp MZ-3,” Wikipedia:  
[https://en.wikipedia.org/wiki/American\\_Blimp\\_MZ-3](https://en.wikipedia.org/wiki/American_Blimp_MZ-3)
- Dan Grossman, “Breaking News – U.S. Navy Airship Program Canceled; MZ-3A Blimp Grounded,” 8 December 2014:  
<https://www.airships.net/blog/breaking-news-navy-airship-program-canceled/>
- Rudy Bartel, “American Blimp Corporation,” presentation summarized in “Airships to the Arctic I Symposium – Conference Proceedings,” pp. 98 - 107, Winnipeg, Manitoba, Canada, 22 – 24 October 2002: <https://www.isopolar.com/wp-content/uploads/2013/03/Airships-to-the-Arctic-I-Applications-For-Northern-Transportation.pdf>
- Ian Glenn, et al., “Survey of COTS-MOTS Lighter Than Air Platforms and Communications Relays,” Section 3.2.1,

- “American Blimp Corporation SPECTOR™”, Defence R&D Canada, March 2013: [https://zbook.org/read/d154\\_s-of-cots-mots-li-than-air-p.html](https://zbook.org/read/d154_s-of-cots-mots-li-than-air-p.html)
- “Summary Report of DoD Funded Lighter-Than-Air Vehicles,” “MZ-3A,” pp. 53 – 54, 1 November 2012: <https://www.hsdl.org/?view&did=728733>
  - Bill Christensen, “A-170 Video Lightsign Airship Brings Blade Runner Blimp To Sky Near You,” Technovelgy.com, 4 May 2006: <http://www.technovelgy.com/ct/Science-Fiction-News.asp?NewsNum=617>
  - “Blimps to show ‘TV in the sky,’” The Associated Press, 19 June 2006: <https://www.nbcnews.com/id/wbna13413957>

### **Related *Modern Airship* articles**

- Thunder & Colt GA-42 small helium blimp
- Lindstrand Technologies - GA-42 and GA-22 small blimps