Alpha & Alizé lenticular airships

Peter Lobner, updated 6 November 2022

1. Introduction

The Alpha and Alizé lenticular airships were designed by Pierre Balaskovic, who was a strong proponent of lenticular (lens-shaped) airships. Both airships were built and flown in France.

2. Alpha (1999 – 2002)

Balaskovic's remotely piloted Alpha semi-rigid lenticular experimental airship was built in collaboration with the French firm Airstar and its CEO, Pierre Chabert, and with support of John Goelet from LTA Corp.

Alpha flew in France between 1999 and 2002 and demonstrated the maneuverability of a lenticular hull. The design of the remote piloting system benefited from the academic work of d'Animatlab and de l'ENST.

Alpha stern view. Source: LTA Solutions (2015)

Key patent

The design of the Alpha airship is described in French patent FR2830838A1, with Pierre Balaskovic and Pierre Chabert identified as the inventors and Airstar listed as the assignee:

- FR2830838A1, “Semi-rigid airship has hull including rigid intrados (the lower arch) and deformable extrados (the upper arch) delimited by lower and upper canvases, lower canvas held taut on frame and upper canvas held in shape by gas holder tank (the ballonet)”
- Filed: 12 October 2001
- Granted: 1 September 2004

The general arrangement of the semi-rigid lenticular airship shown in patent Figures 1, 2 and 3 closely resembles the Alpha airship.

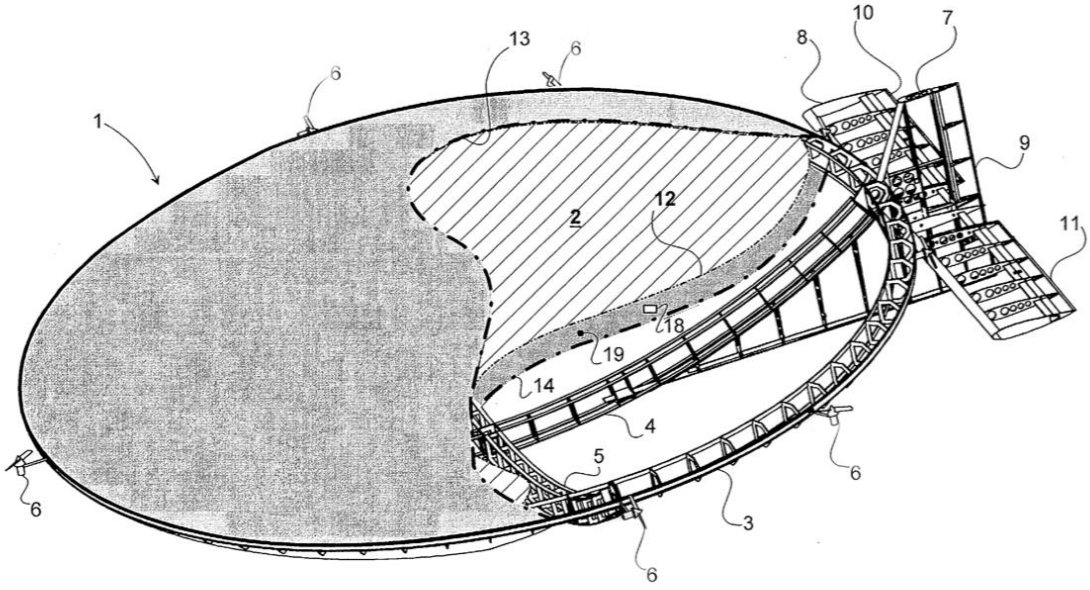
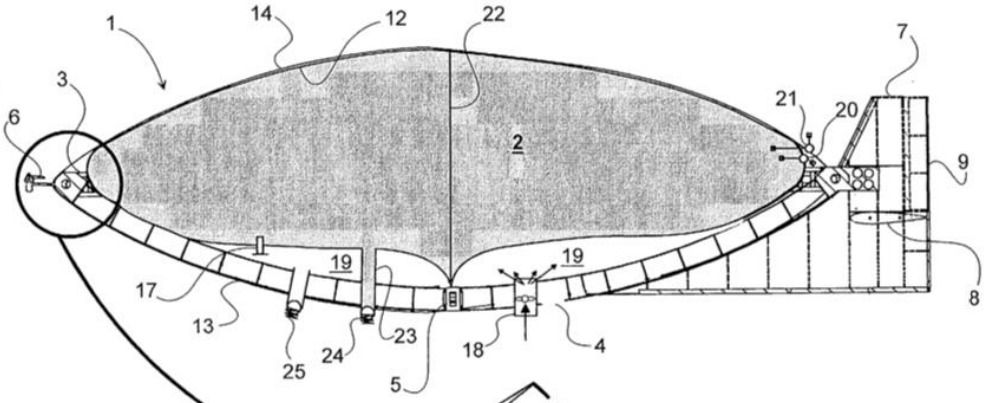


fig. 1

Legend
(1) Hull, (2, 12) Lifting gas in a lifting gas cell, (3, 4, 5) Rigid frame components, (6) Thrusters, (7, 9) Vertical tail fin and rudder, (8, 10, 11) Horizontal stabilizer and elevators, (13, 14) Upper and lower hull fabric skins, (18) Ballonet fan, (19) Ballonet

General arrangement of the semi-rigid lenticular airship
Source: adapted from FR2830838A1, Fig. 1

fig. 2



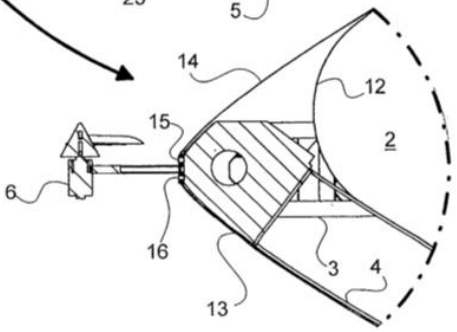


fig. 3

Legend

(1) Hull, (2, 12) Lifting gas in a single lifting gas cell, (3, 4, 5) Rigid frame component, (6) Bow thruster, (7, 9) Vertical tail fin and rudder, (8) Horizontal stabilizer, (13, 14) Lower and upper hull fabric skins, (18) Ballonet fan, (19) Ballonet, (22) Lifting gas cell partitioned into two or more compartments, (22, 23) Lifting gas vent sleeve & valve, (24) Lifting gas cell safety valve, (25) Ballonet safety valve

Longitudinal cross-section of the semi-rigid lenticular airship.
Source: FR2830838A1, Figs. 2 & 3

3. Alizé (2005 – 2006)

Alizé was a two-seat, semi-rigid, lenticular, ultralight (ULM category) experimental airship designed by Balaskovic as an evolutionary development of the Alpha airship. Alizé was funded and built by LTA Corporation at Rochefort, France in 2005 and flight tested there through 2006.

Key patents

The Alizé design and controls are described in a series of patents with Pierre Balaskovic identified as the inventor and LTA Corporation identified as the assignee. The earliest patent was:

- US7866601B2, “Lenticular Airship,”
- Filed: 18 October 2007
- Granted: 11 January 2011.

The following three diagrams are from that patent. The general arrangement of the airship is shown in patent Figure 1A. The lenticular hull (22) in this particular diagram has a set of propulsion units in three locations (31) set 120° apart, as shown in Figure 5A, and attached to the rigid equatorial frame (120, aka “keel hoop”) of the airship. Other propulsor arrangements are possible.

Pitch, roll and yaw controls can be provided by the propulsion units (532, 533 & 534), which have thrust vectoring capabilities and can be coordinated in a variety of ways to maneuver the airship and also provide thrust for vertical and horizontal motion. The horizontal thrusters (541 & 541) propel the airship and may be installed on fixed or thrust vectoring mounts. The Alizé prototype had the following:

- A single vectorable propulsor is installed at the bow.
- Compound propulsors are installed on each flank, each consisting of a vectorable propulsor and a separate (lower) longitudinal thruster.

There also are aerodynamic control surfaces on the vertical and horizontal stabilizers.

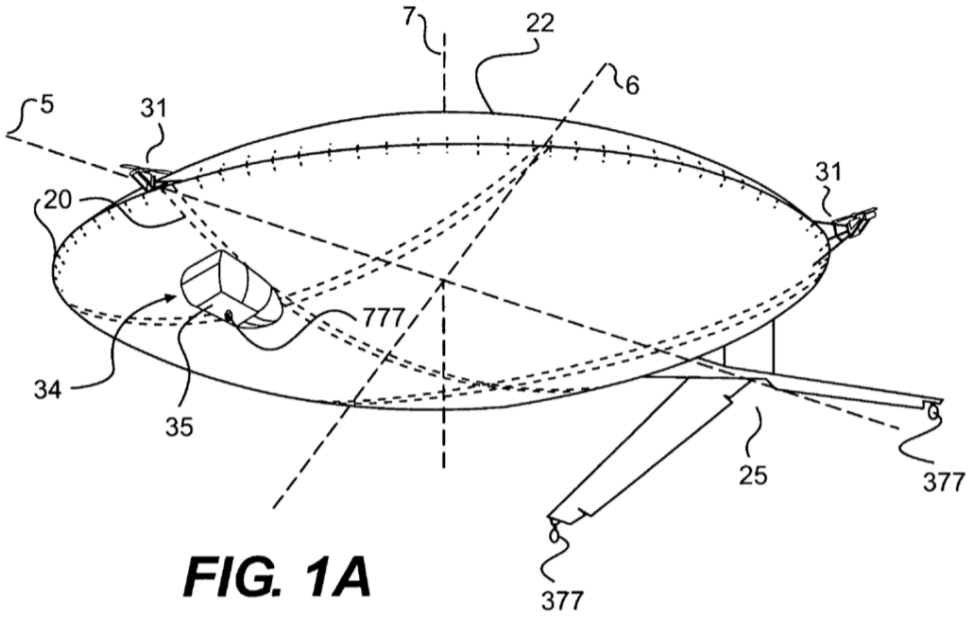


FIG. 1A

Isometric view showing the general arrangement of the semi-rigid lenticular airship. Source: US7866601B2, Fig. 1A

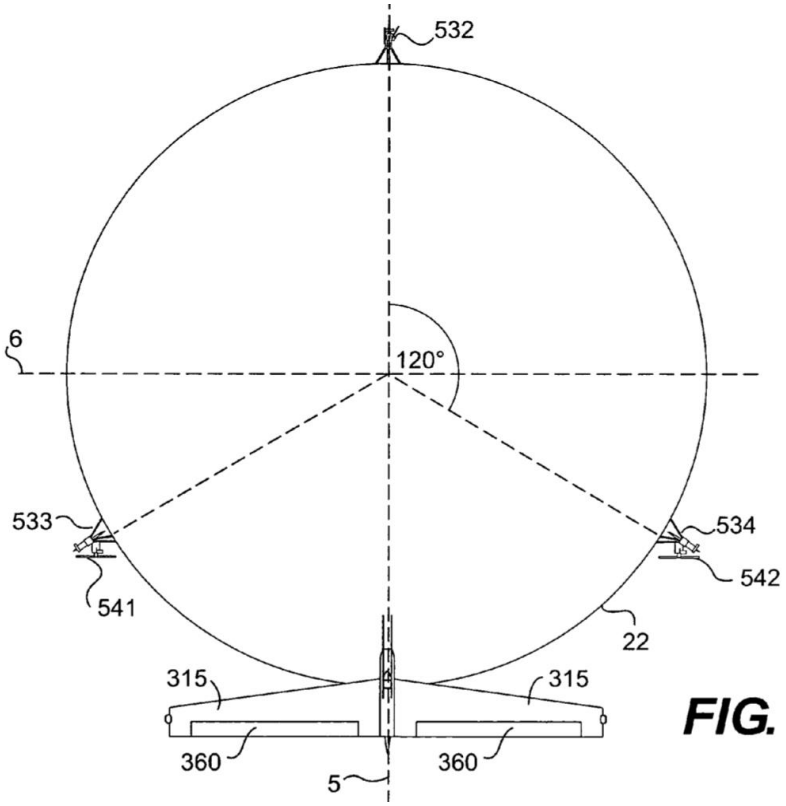
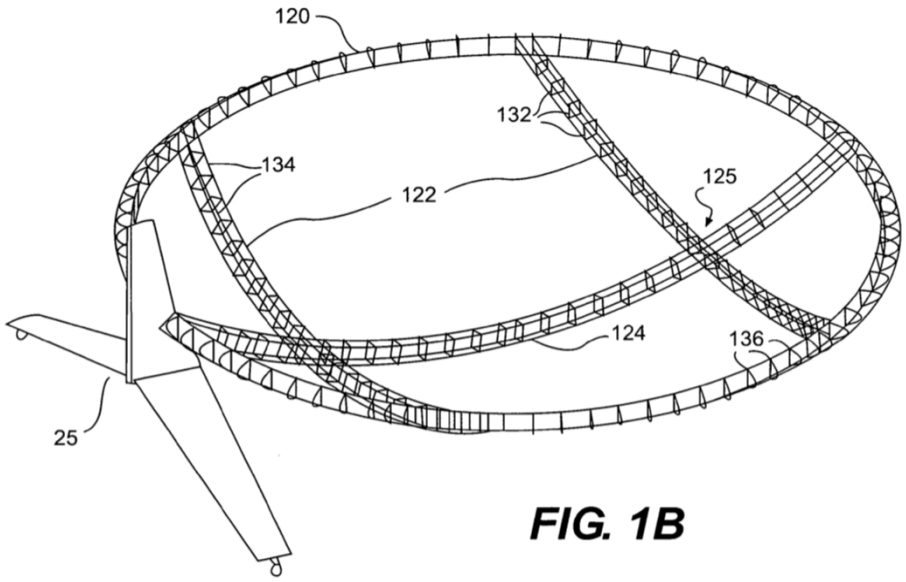


FIG. 5A

Overhead view of the semi-rigid lenticular airship. Source: US7866601B2, Fig. 5A

The rigid frame of the airship shown in patent Figure 1B consists of the circumferential equatorial keel hoop (120), which is connected across the lower hemisphere (the intrados) by two rigid transverse frame members (122) and one rigid longitudinal frame member (124). There are no rigid frame members installed across the upper hemisphere (the extrados). A multi-layer flexible fabric envelope is installed over the rigid frame. The lenticular shape of the semi-rigid airship is established when the envelope is inflated.



Rigid structure & empennages of the semi-rigid lenticular airship.
Source: US7866601B2, Fig. 1B

Alizé with its lower skin removed showing the internal rigid structures.
Source: Association Moulin Rouge (2006)

Flight testing

Early flight testing was done by remote control to validate basic handling characteristics. Initially, the gondola was not installed.

Alizé stern view. Source: LTA Solutions (2015)

Alizé first flew by remote control, without the cockpit gondola installed. Source: LTA Solutions (2015)

Alizé with a basic open cockpit installed. Source: Pasternak (2009)

Alizé demonstrated its ability to take off and land vertically. The

airship had an attitude stabilization system that made it possible to perform hovering flights in ground effect.

You can watch a short video, “Airship Alizé” (6:07 minutes), that shows low altitude tests with two different stern propulsors here: https://www.youtube.com/watch?v=QxHO8OMgi5c

The following photos are screenshots from that video.

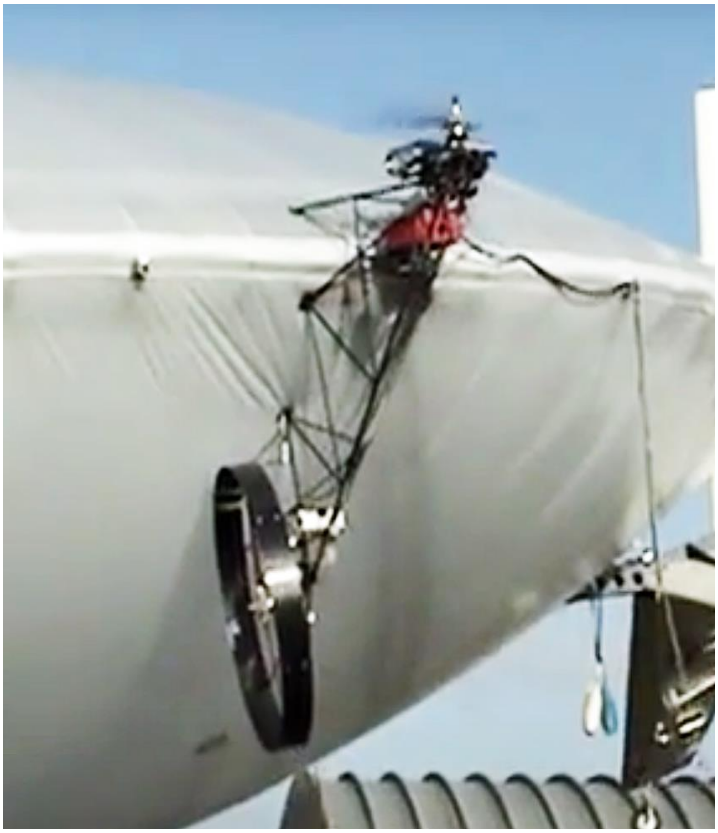
Profile view showing the placement of the bow and flank compound thrusters. Note the short duct surrounding the propeller on the flank longitudinal thruster.

Stern view showing the tail aerodynamic surfaces and the placement of the flank compound thrusters. Source, two photos: Screenshots

Alizé with enclosed cockpit. Note that the cockpit's support struts connect directly to the rigid framework of the hull.

Alizé cockpit, Source, two photos: Screenshots

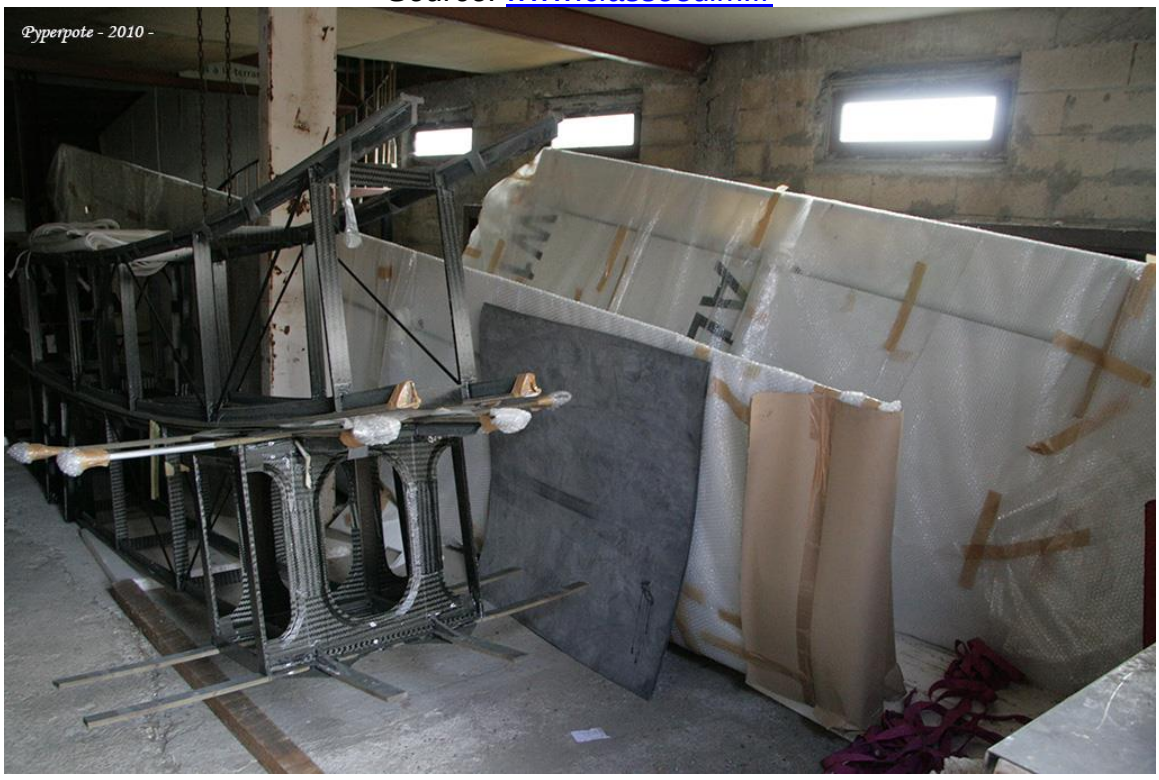
Bow vertical thruster unit



Flank compound thrusters.
Source, two photos: Screenshots

On 7 September 2006, Alizé was donated to the Museum of Naval Aviation in Rochefort, where it currently is in storage in a disassembled state.

Alizé outdoors at Rochefort Air Museum, September 2006.
Source: www.classe5ulm.fr



Alizé in storage. Source: Pyperpote, 2010

4. For more information

- “Pierre Balaskovic - Balloons and Dirigibles” https://balaskovic.pagesperso-orange.fr/ballons-et-dirigeables.html
- Lin Liao & Igor Pasternak, “A review of airship structural research and development,” Progress in Aerospace Sciences, Vol. 45, pp. 83–96, 2009: https://www.researchgate.net/publication/222528776_A_review_of_airship_structural_research_and_development
- “Dirigible Pierre Balaskovic ‘Alizé’ W17OD,” (presentation to the Museum of Naval Aviation in Rochefort), 2010: http://www.pyperpote.tonsite.biz/listinmae/index.php/les-appareils-en-reserve/les-reserves-du-musee-de-l-air/229-dirigeable-pierre-balaskovic-alize-w17od
- Charles Luffman, “LTA Solutions - A Lighter-than-air Aircraft Design/Engineering Practice - Lenticular Airships An Exposition,” LTA Solutions, 7 May 2015: https://docplayer.net/64482432-Lta-solutions-a-lighter-than-air-aircraft-design-engineering-practice-page-1-of-16-lenticular-airships-an-exposition.html

Video

- “Airship Alizé” (6:07 minutes), posted by Anuta Anosova, 14 April 2016: https://www.youtube.com/watch?v=QxHO8OMgi5c

US Patent applications

- US2008/0179454A1, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 18 October 2007, granted 11 January 2011 as patent US7866601B2: https://patents.google.com/patent/US20080179454A1/en
- US2010/0320314A1, “Lenticular Airship and associated controls,” Inventor Pierre Balaskovic, filed 7 August 2008, granted 23 December 2010 as patent US8297550B2: https://patents.google.com/patent/US20100320314A1/en
- US2011/0163200A1, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 1 December 2010, granted 7 February 2012

as patent US8109462B2: https://patents.google.com/patent/US20110163200A1/en

- US2012/0160959A1, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 3 January 2012, granted 16 April 2013 as patent US8418952B2: https://patents.google.com/patent/US20120160959A1/en
- US2013/0043353A1, “Lenticular airship and associated controls,” filed 11 October 2012, granted 31 December 2013 as patent US8616503B2: https://patents.google.com/patent/US20130043353A1/en
- US2014/0070050A1, “Lenticular airship and associated controls,” Inventor Pierre Balaskovic, filed 14 November 2013, granted 12 December 2017 as patent US9840318B2: https://patents.google.com/patent/US20140070050A1/en
- US2018/0155001, “Lenticular Airship and associated controls,” Inventor Pierre Balaskovic, filed 8 November 2017, published 7 June 2018, abandoned: https://patents.google.com/patent/US20180155001A1/en

Patents

- FR2830838A1, “Semi-rigid airship has hull including rigid intrados and deformable extrados delimited by lower and upper canvases, lower canvas held taut on frame and upper canvas held in shape by gas holder tank,” inventors Pierre Balaskovic & Pierre Chabert, filed 12 October 2001, granted 1 September 2004, assigned to Airstar SAS: https://patents.google.com/patent/FR2830838A1/en
- US7866601B2, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 18 October 2007 as application US2008/0179454A1, granted 11 January 2011, assigned to LTA Corp.: https://patents.google.com/patent/US7866601B2/en
- US8297550B2, “Lenticular Airship and associated controls,” Inventor Pierre Balaskovic, filed 7 August 2008 as application US2010/0320314A1, granted 30 October 2012, assigned to LTA Corp.: https://patents.google.com/patent/US8297550B2/en
- US8109462B2, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 1 December 2010 as application US2011/0163200A1,

granted 7 February 2012, assigned to LTA Corp.: https://patents.google.com/patent/US8109462B2/en

- US8418952B2, “Lenticular Airship,” Inventor Pierre Balaskovic, filed 3 January 2012, granted 16 April 2013, assigned to LTA Corp.: https://patents.google.com/patent/US8418952B2/en
- US8616503B2, “Lenticular Airship and associated controls,” Inventor Pierre Balaskovic, filed 11 October 2012 as application US2013/0043353A1, granted 31 December 2013, assigned to LTA Corp.: https://patents.google.com/patent/US8616503B2/en
- US9840318B2, “Lenticular Airship and associated controls,” Inventor Pierre Balaskovic, filed 14 November 2013 as application US2014/0070050A1, granted 12 December 2017, assigned to LTA Corp.: https://patents.google.com/patent/US9840318B2/en

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- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
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    - Airstar – small airships & drones
    - LTA Aerostructures (LTAA) – lenticular airships
- *Modern Airships - Part 3*: https://lynceans.org/all-posts/modern-airships-part-3/