Aérial Concept Group & Transoceans – IRIS Challenger & Lélio

Peter Lobner, 3 September 2022

1. Introduction

The IRIS Challenger was conceived in 2010 by the French firm Aérial Concept Group and built by Airstar to make the first crossing of the English Channel by an electric-powered airship. After an unsuccessful attempt in 2011, the project was revived as the IRIS Challenger II, which was sponsored by the non-profit firm Transoceans, and made a successful channel crossing in 2013. Both Aérial Concept Group and Transoceans had goals to establish additional airship world records. Here's their story.

2. Aérial Concept Group – IRIS Challenger airship

Created in 2005, Aérial Concept was a company specializing in the design of electric airships intended for aerial photography.
In 2010, the company evolved into Aérial Concept Group with two operational departments: Aérial Images and Aérial Production.

In 2010, Aérial Concept Group announced that they had launched a three-year campaign to attempt crossings of three progressively larger bodies of water with their IRIS Challenger electric airship:

- 2011 English Channel crossing from Dover to Calais
- 2012 Mediterranean crossing from the Continent to Corsica
- 2013 Atlantic crossing from Gibraltar to New York

Pierre Chabert, President of Airstar, was one of four members of the IRIS Challenger project management team. The airship was built by Airstar in early 2011, unveiled in September 2011, and flew at the Coupe Icare (Icarus Cup), near Grenoble, France.

In addition to their goal of flying the first electric-powered airship to cross the English Channel, Aérial Concept Group planned to make a documentary film about this project.

Design of the IRIS Challenger

The IRIS Challenger was an ultra-light airship with a large lenticular helium lift gas envelope with a tail fin, a suspended power and propulsion system module, and, hanging below everything else, a spartan, open aluminum gondola for two persons.

Profile view of the IRIS Challenger with tail fin at the right.
Source: IRIS Challenger press dossier (2011)

The power / propulsion module and the pilot's open gondola are suspended beneath the lenticular gas envelope, lowering the center of gravity and providing pendulum stability to counter the pitching tendency of a lenticular airship.

View from below (left) and from above the bow (right).
Source: IRIS Challenger press dossier (2011)

General characteristics of the IRIS Challenger

Parameter	**IRIS Challenger**
Envelope diameter	14 meters (46 feet)
Envelope height	6 meters (19.7 ft)
Envelope volume	560 m^3 (19,776 ft^3)
Total lift	250 kg (551 lb)
Propulsion	2 electric motors of 7 kW (9.38 hp) each, driving two counter-rotating 1.3 meter (51.2 inch) propellers with reverse pitch
Power source	Lithium polymer batteries with 4 hour endurance
Cruise speed	15 kph (9.3 mph)
Accommodations	Aluminum basket supporting 2 people seated side-by-side

IRIS Challenger being flown by pilots Pierre Chabert and Gerard Imburchia. Source, both photos: Christophe Agostinis via le dauphiné (22 Sep 2011)

IRIS Challenger.
Source: Christophe Agostinis
via le dauphiné (22 Sep 2011)

The transparent lower surface provides a view into the interior of the gas envelope. Source: France3-regions, 4 March 2013

In the above photo, the cusp-shaped catenaries connect the upper and lower surfaces of the gas envelope and establish the overall lenticular shape of the inflated envelope. There is no sign of an internal ballonet for pressure control. Author Charles Luffman noted:

> "With the upper and lower aerostat surfaces appearing to be tied together, how it manages volume changes of the contained gas us unclear – could be a problem if temperature and atmospheric pressure varies significantly. Presumably it is intended to be flown at low altitude without ascending or descending very much."

IRIS Challenger - 2011 English Channel crossing attempt

Originally, the team planned to make the English Channel crossing from Dover, UK to Calais, France in October 2011. Prevailing winds delayed that attempt until November, when pilots Pierre Chabert and Gerard Imburchia took off from Dover but were unable to fly all the way to the French coast. The IRIS Challenger completed the journey under tow from a ship and was delivered to the port of Calais.

IRIS Challenger in November 2011 leaving Dover, UK.
Source: Airstar, https://www.pinterest.ru/pin/503418064587198310/

IRIS Challenger in November 2011 over the English Channel.
Source: https://www.pinterest.ru/cbdepassille

Aérial Concept Group's IRIS Challenger was towed to the port of Calais by ship in November 2011.
Source: France3-regions, 4 March 2013

3. Transoceans picks up the mantle from Aérial Concept Group

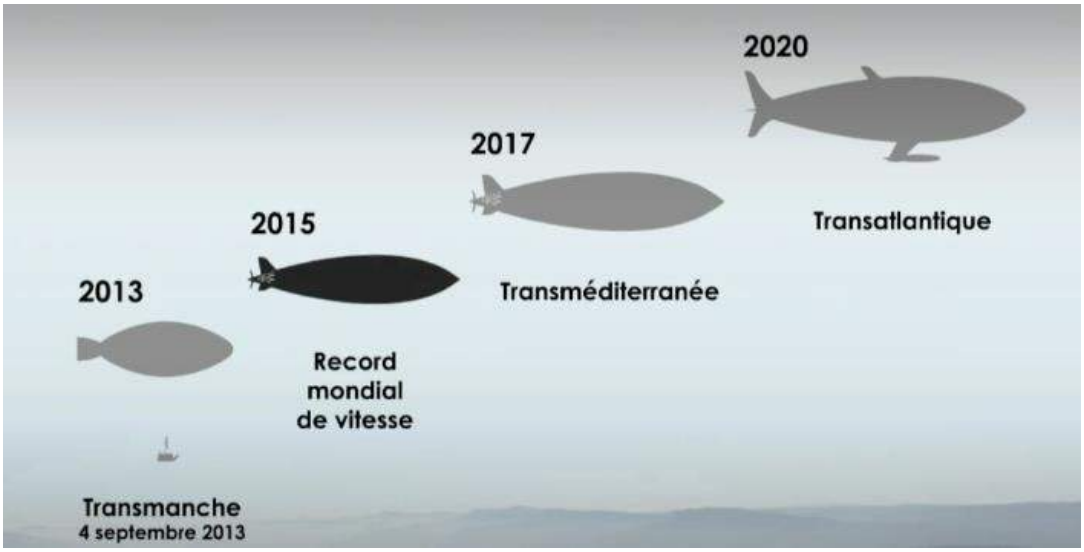
Pierre Chabert, the president of Airstar, founded Transoceans in 2012 as a non-for-profit organization whose objective is "the renewal of the airship incorporating many technological improvements!" Transoceans states: "As (a) laboratory of airship(s), our R&D works are leading us to innovative technologies: new engine power, new propulsion systems, multifunctional textiles, bio-design, bio-based materials, complex joining. We aim to prove that technological advances in aeronautics (will) open the doors of the future for the airships…"

Transoceans are working toward its objectives by developing high-performance, electric-powered airships and they plan to demonstrate their progress by building on the world record goals announced by Aérial Concept Group in 2010. Transoceans announced that was designing airships to establish the following four world records:

- 2013 - English Channel crossing (Transmanche), from France to UK
- 2015 - Airship absolute speed record (Record mondail de vitesse)
- 2017 - Mediterranean Sea crossing (Transméditerranée)
- 2020 - Atlantic Ocean crossing (Transatlantique)

The first record would be attempted with the IRIS Challenger II, which was based on the IRIS Challenger flown by Aérial Concept Group in 2011. The primary external difference appears to be a re-designed open gondola with tandem seating for the two pilots.

The other records will be challenged with manned airships designed especially for each mission.



Original schedule for record flights. Source: Transoceans

These challenges are outlined on the Transoceans website here: https://en.transoceans.net/records

and on their Facebook page here: https://www.facebook.com/Transoceans/

Also see the following video: https://en.transoceans.net
Industrial partners, including Airstar, Air Liquide, Petzl and Dirisolar Research, provide a base of support for the Transoceans airship development program.

4. IRIS Challenger II - 2013 English Channel crossing

The IRIS Challenger II first flew in the spring of 2013 at an Airstar facility in Champ-près-Froges, near Grenoble.

IRIS Challenger II outdoor tethered test.
Source: Transoceans (Mar 2013)

On 4 September 2013, IRIS Challenger II became the first electrically-powered airship to cross the English Channel. After taking off from Cap Gris Nez in the Pas-de-Calais, the airship made the 48.4 km (30.1 miles) trip in two hours and 23 minutes at an average speed of 20 kph (12.4 mph) and landed in Dymchurch, UK.

Leaving Cap Gris Nez. Source: Screenshot from video (Sep 2013)

IRIS Challenger II in flight. Source: Transoceans

IRIS Challenger II approaching the UK coast. Source: Screenshot from video (2013)

IRIS Challenger II lands in Dymchurch, UK.
Source: Robert Halls via LTA Society

IRIS Challenger II landed in a field in Dymchurch, UK.
Source: Transoceans

IRIS Challenger II pilots Pierre Chabert and Gerard Feldzer and ground crew after landing in the UK. Source: Transoceans

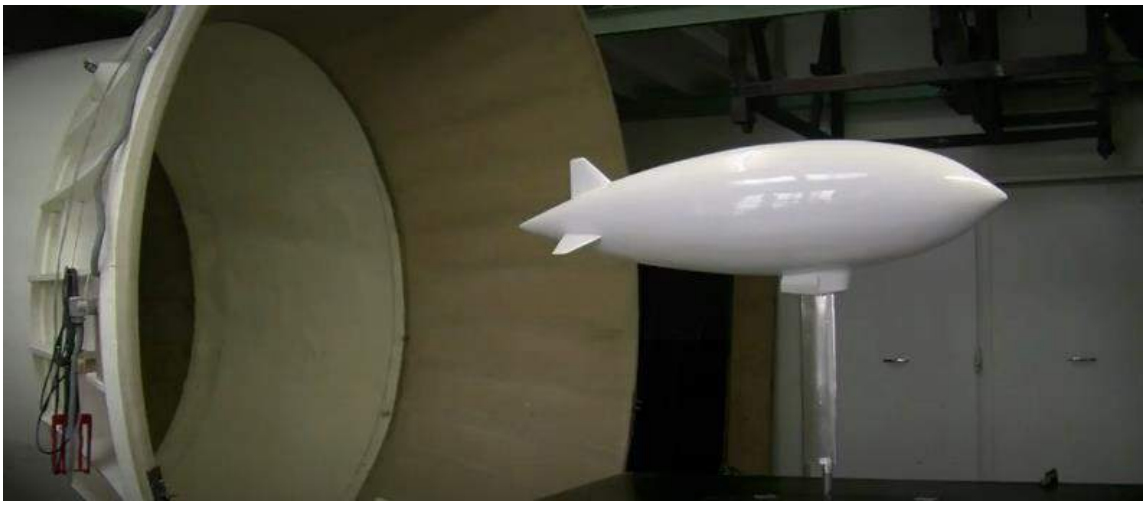
You can watch a short video (in French) on this flight here: https://www.youtube.com/watch?v=uKlqRDBX8Oo

5. Lélio - Airship absolute speed record challenger

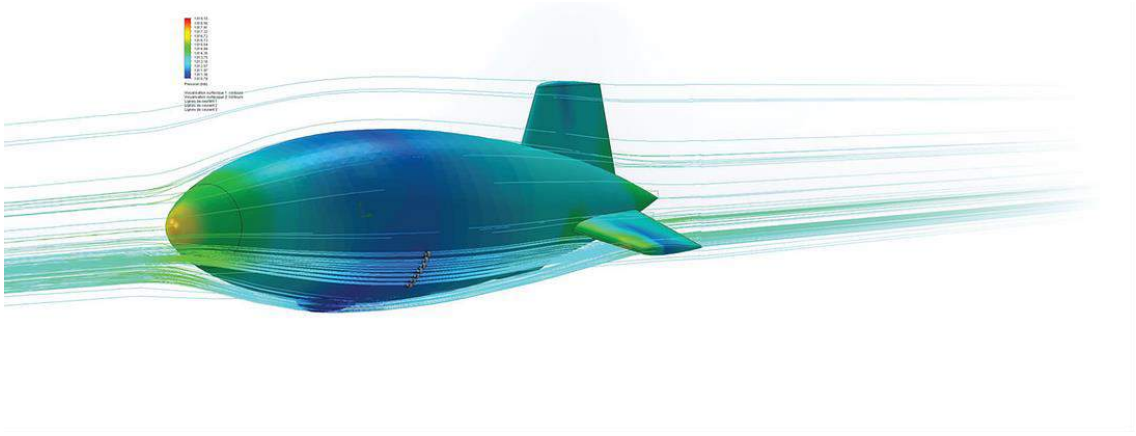
The current airship absolute speed record of 115 kph (71.46 mph) was set on 27 October 2004 by a Zeppelin Luftschifftechnik LZ N07-100 airship flown by Steve Fossett (USA) and co-pilot Hans-Paul Ströhle (Germany). Transocean's Lélio airship is being developed to break this record. The original goal was to make the world speed record attempt in 2015. That record attempt currently is scheduled for late 2022 or early 2023.

Lélio demonstrator

Development work started with the Lélio demonstrator, which is a modest-size, unmanned, electrically-powered drone airship. The profile of the semi-rigid Léilo airship generally corresponds to the very streamlined shape of a large tuna fish with an inverted Y-tail. Flight testing the Lélio demonstrator with flank-mounted propellers began in late 2015 at an Airstar facilities in Champ-près-Froges, near Grenoble.



Lélio wind tunnel test. Source: Screenshot, Transoceans video.



Lélio computational fluid dynamics model. Source: Transoceans

Lélio demonstrator. Source: le dauphiné (17 Nov 2015)

Full-size Lélio world speed record challenger

The full-size Lélio will be a manned, rigid airship that is substantially larger than the demonstrator; measuring about one-half the length of the current world speed record holder, a Zeppelin NT, which is 75 meters (246 ft) long.

Relative size of the full-scale Léilo and a Zeppelin NT.
Source: Transoceans

Transoceans will use helium lifting gas in Lélio. Batteries will provide the electric power for the speed record attempt. The goal is to achieve a maximum speed of 120 kph (74.6 mph).

Rendering showing the general arrangement of the full-size Léilo, which is similar to the demonstrator. Source: Transoceans

Rendering of the full-size Léilo in flight. Source: Transoceans

Transoceans reported: “The overall speed record project budget is € 800,000. Our technical and financial partners already support us for € 400,000. As the technical studies are substantially completed, the remaining budget is now dedicated to the construction of the airship.”

In November 2015, the Transoceans initiated a crowdfunding campaign to raise some of the funding needed for the absolute speed record program using Kocoriko, the Banque Populaire des Alpes crowdfunding platform, as described in detail here: https://www.kocoriko.fr/fr/projects/transoceans.

In August 2022, Transoceans reported that *Léilo* was nearing completion. It is expected to perform a demonstration flight during the Coupe Icare, which will occur between 20 to 25 September 2022 in Saint-Hilaire and Lumbin, in Isère. The 2022 Coupe Icare website is here: https://www.coupe-icare.org/GB_home.html

The speed record attempt that originally was planned to occur in 2015, has been rescheduled for the late 2022 – early 2023 time frame at the Le Versoud Aerodrome, which is located about 10 km (6 miles) northeast of Grenoble.

Léilo nearing completion in an Airstar facility in Champ-près-Froges. Source: Transoceans (Aug 2022)

In August 2022, Pierre Chabert provided the following design details.

- A flush cockpit for the two person crew is located along the bottom of the envelope.
- Propulsion is provided by four electric motors, each weighing 60 kg (132.3 lb) and delivering almost 30 hp (22.4 kW).
- The tail fin has a carbon fiber structure with a stretched fabric skin. It measures 5.5 m (18 ft) long and is 3.5 m (11.5 ft) tall. It weighs 20 kg (44 lb).
- The empty weight of the Léilo airship is 400 kg (882 lb).

6. Transocean's advanced power system for its long-distance world record challengers

Transoceans reported that their long-distance world record airships will use hydrogen as the lifting gas in place of helium.

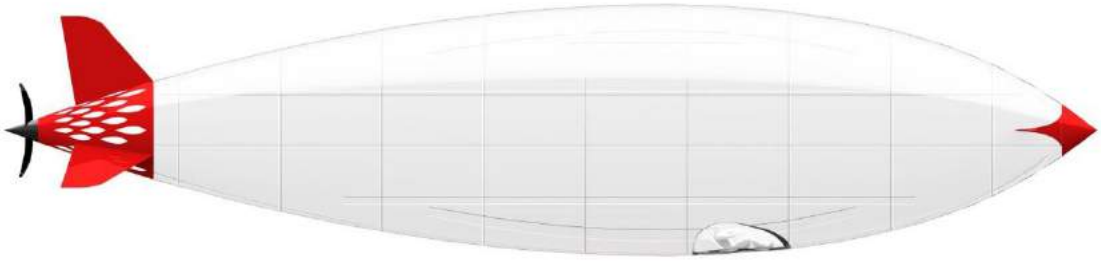
Transoceans is developing an advanced power system to support long distance airship flight with an "eco-responsible" system comprised of the following:

- **Hydrogen fuel cell**: The FC reacts hydrogen and oxygen to produce electrical energy and water. The fuel cell draws hydrogen from an on-board pressurized hydrogen reservoir and oxygen from the ambient atmosphere.
- **Organic solar panels:** These are hull-mounted, lightweight, flexible, thin-film photovoltaic (PV) panels that use carbon-based materials in place of the silicon-based materials commonly used in solar cells, and are recyclable.
- **Solar-powered electrolyzer:** This unit splits the water produced by the fuel cell into hydrogen and oxygen. The hydrogen gas will be reused to continue powering the fuel cell.
- **Salt batteries:** These batteries use common materials (table salt, iron, nickel & ceramics) and are fully recyclable.

7. Crossing the Mediterranean on electric power

The Mediterranean crossing, originally planned for 2017, will require an airship larger than the Léilo. Transocean's conceptual design shown in the following graphics has an envelope profile generally similar to Léilo, with an inverted Y-tail and a small canard at the nose. Propulsion is provided by a single propeller at the tail.

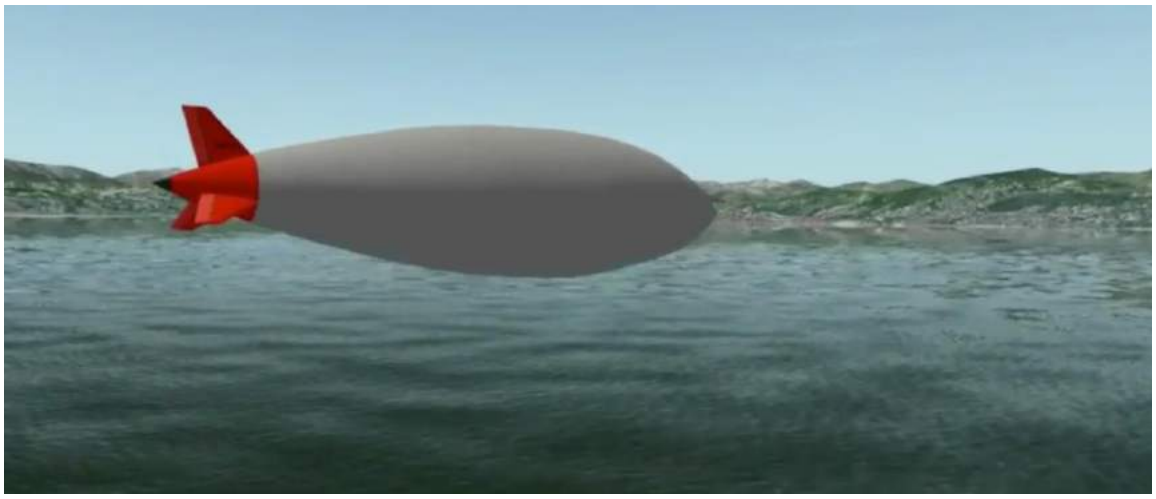
The record flight is expected to start in Monaco and end 220 km (137 miles) away in Calvi, on the north coast of Corsica.



Side view of the trans-Mediterranean airship showing the recessed crew compartment along the bottom of the envelope.

Oblique view of the trans-Mediterranean airship showing the small bow-mounted canards and the recessed crew compartment along the bottom of the envelope. Source, both graphics: Transoceans

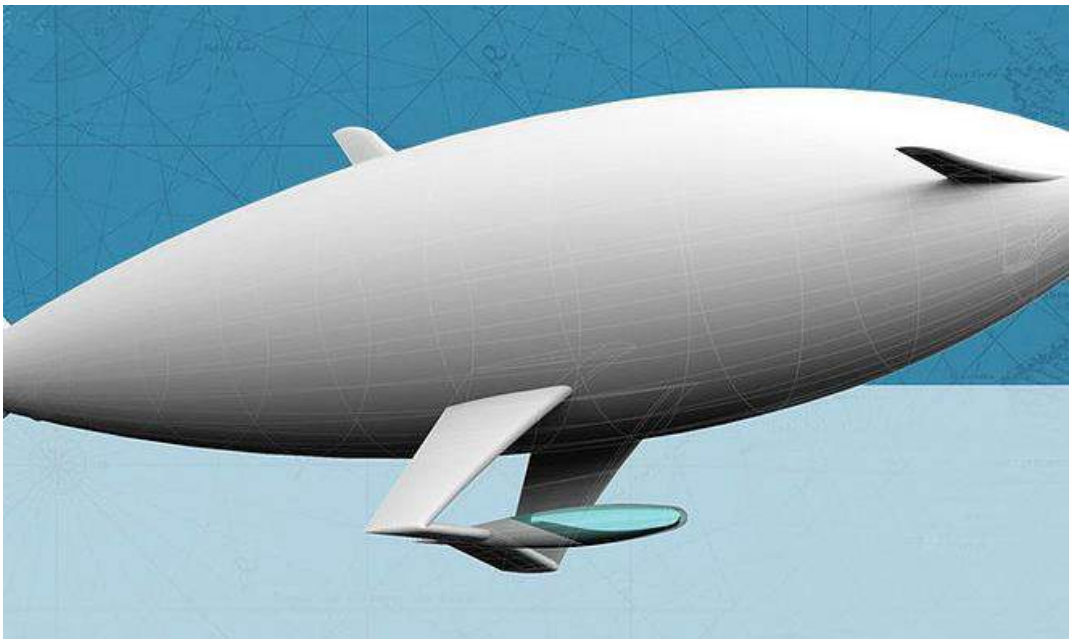
Rendering of the trans-Mediterranean airship. A pilot and copilot are barely visible in a recessed crew compartment along the bottom of the envelope. Source: Transoceans



Rendering showing the trans-Mediterranean airship in low level, over-water flight. Source: Screenshot from Transoceans video

8. Crossing the Atlantic on electric power

Transocean's large, manned, rigid trans-Atlantic airship will have a range of 5,500 km (3,417 miles) and will be designed to make a New York-to-Paris crossing in just a few days on electric power, without any CO_2 emissions. The Atlantic crossing originally was planned to occur in 2020.



Renderings showing a concept for the trans-Atlantic airship. Source, both graphics: Transoceans

9. For more information

IRIS Challenger and IRIS Challenger II

- "Press dossier, Iris Challenger," (in French) Group Aerial Concept, 2011: http://manche.foxoo.com/_internautes/0000006136/photos/traversee%20de%20la%20manche%20en%20dirigeable%20electrique%20101011.pdf
- "The IRIS Challenger airship prepares for another test over the English Channel," (in French) France3-regions, 4 March 2013: https://france3-regions.francetvinfo.fr/auvergne-rhone-alpes/dirigeable-iris-challenger-se-prepare-nouvel-essai-au-dessus-manche-209979.html
- Video: "Iris Challenger - Transmanche 2013 - Full Size Training Month," (3:55 min, indoor inflation & outdoor tethered test), posted by Sébastien Gilliard, 5 March 2013: https://www.youtube.com/watch?v=LM-ky3aKs8o
- Matt Le Clere, "French pilots make aviation history near Folkestone in 'flying saucer'," Lighter-Than-Air Society, 5 September 2013: https://www.blimpinfo.com/uncategorized/french-pilots-make-aviation-history/
- Dean Sigler, "Academy Award Winner, Legion of Honor Recipient Conquer the Channel," CAFÉ Foundation, 4 September 2013: http://cafe.foundation/blog/academy-award-winner-legion-of-honor-recipient-conquer-the-channel/
- Video: "FILM Traversée de la Manche en dirigeable électrique - IRIS CHALLENGER II – 04 Sept 2013," (7:05 minutes), posted by La Mimi, 27 September 2013: https://www.youtube.com/watch?v=uKlqRDBX8Oo
- Charles Luffman, "Lenticular Airships – An Exposition," Section 12, "Iris Challenger, 2 man Electric Airship, France 2011," LTA Solutions, 7 May 2015 (amended): https://docplayer.net/64482432-Lta-solutions-a-lighter-than-air-aircraft-design-engineering-practice-page-1-of-16-lenticular-airships-an-exposition.html

Leiló

- Video: **“**Transoceans - Record du monde de vitesse en dirigeable" (1:22 minutes), Transoceans, 5 November 2015: https://www.youtube.com/watch?v=dhiWecWEyKY&t=78s
- Olivier Pentier, “Lélio wants to beat the world speed record,” Le dauphine, 17 November 2015: https://www.ledauphine.com/isere-sud/2015/11/16/lelio-veut-battre-le-record-du-monde-de-vitesse
- Tammy Sewell, “‘Lélio’, the Isère airship that wants to break speed records,” Oicanadian, August 2022: https://oicanadian.com/lelio-the-isere-airship-that-wants-to-break-speed-records/
- “’It’s a childhood dream’, Pierre Chabert wants to break all records aboard his electric airship,” France Detail Zero, 24 August 2022: https://france.detailzero.com/news/amp/52730

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    - Airstar Aerospace – small manned & unmanned airships
    - CNIM Air Space - Diridrone
- *Modern Airships - Part 3*: https://lynceans.org/all-posts/modern-airships-part-3/