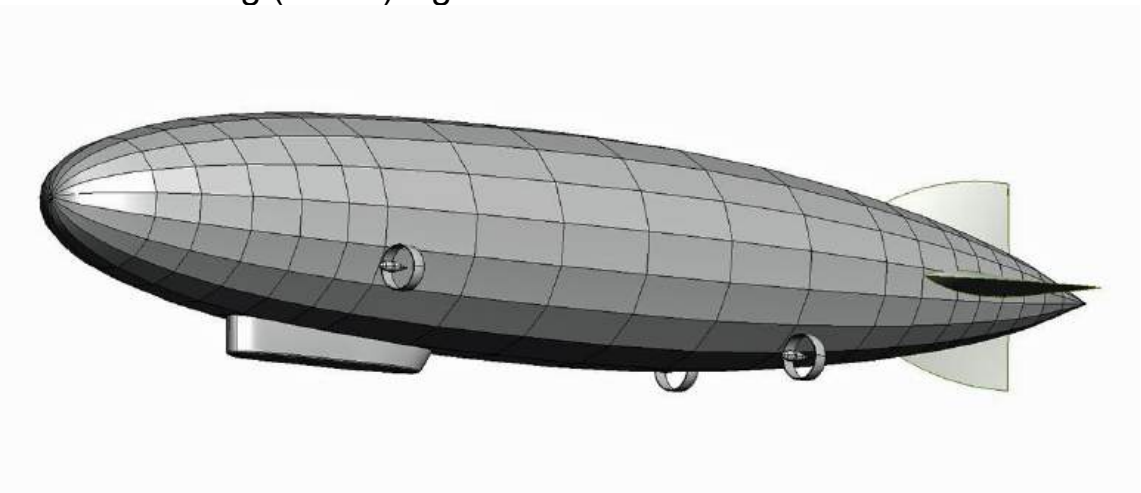
Troponaut – rigid airships

Peter Lobner, 23 February 2026

1. Introduction

Troponaut was founded in Hamburg, Germany, in 2025 by Lead Architect & CEO Johannes Eissing. The firm's near-term goal is to develop a "next-generation," efficient, quiet and sustainable rigid airship in the "commuter" category to meet a growing demand for airship tourism. This conventional rigid airship incorporates a novel "QuadroPod" propulsion and maneuvering system that Eissing and others have been developing for more than a decade as a means to significantly improve airship low speed maneuverability, particularly during hover and vertical takeoff and landing (VTOL) flight.



General arrangement of the 2022 DELEG commuter airship and Troponaut T-15. Source: J. Eissing, 2022 Aviation Innovations Conference presentation

Longer-term goals include developing a larger luxury passenger airship and a heavy-lift cargo airship.

Gregory Gottlieb and Dr. Andreas Burkart serve as Advisory Board members. This team is characterized as having, "A unique combination of experience from Zeppelin, CargoLifter, and DLR (the German Aerospace Center)." Troponaut's corporate website is here: https://troponaut.aero

The author wishes to thank Johannes Eissing for his review and input for this article.

2. Business model

The German non-profit association Aerarium Luftschifftechnik e.V. was established in about 1997 with the goal of "familiarizing interested students and scientists, as well as people outside of the university framework, with balloon and airship technology. In addition to possible financial support for aerostatic research projects, contacts and know-how in the field of aerostatics are primarily conveyed. The association acts as an initiator of projects as well as an active link between individual projects." Within Aerarium, an interest group in model airships was established and became a crucible for testing and evolving advanced airship design and operating concepts with the aid of sub-scale flying models. Since 2017, competitions for remote-controlled model airships (CIAM Class 7B) have been held under FAI / CIAM (FAI Aeromodelling Commission) auspices. Design features, such as the novel "QuadroPod" propulsion and maneuvering system, have been tested and validated by Johannes Eissing and others through their participation in this Aerarium interest group.

Also within Aerarium, the Interest Group DELEG (Deutsche Luftschiff Eigner Genossenschaft) was formed to refine the baseline design concept for a "commuter" category passenger airship and develop a solid business model, using a Technical Readiness Level (TRL) process, for the development, certification and operation of the commuter category airship. Johannes Eissing reported the following outcomes from this effort at the October 2022 Aviation Innovations Conference in Toronto, Canada:

- A baseline design concept was developed for a relatively conservative, but highly-maneuverable,15-tonne (16.5 ton), conventional, rigid commuter airship. See Section 3 for details.
- A basic business model was developed, specifying the respective roles of DELEG and partners:
    - Airships are ordered by DELEG from a qualified aeronautical design and manufacturing organization.
    - The delivered airships are owned by DELEG and are leased to qualified airship operators.
    - The airships are maintained and repaired by qualified maintenance, repair and overhaul (MRO) organizations.

- A business entity, Airship Owner Cooperative DELEG, was formed to execute the business model, with the goal of delivering a commuter airship prototype by 2032.

In 2026, the firm Troponaut was formed, replacing the Airship Owner Cooperative DELEG in a refined business model that provides more details on the roles of the participating parties.

Troponaut's roles are to provide the airship preliminary design and project financing, and to manage the leasing of type-certified airships.

Detailed design, certification, production, and maintenance are to be executed by established Design Organization Approval (DOA) and Production Organization Approval (POA) partners.

- These are entities collaborating under EASA Part 21 regulations to design, certify, and manufacture aircraft, components, or modifications for Supplemental Type Certificates (STCs).
- They ensure strict regulatory compliance, quality control, and airworthiness, often involving Original Equipment Manufacturers (OEMs) or MRO organizations, with one party holding the primary design responsibility.

Troponaut would own the type-certified airships that are produced and would dry-lease the airships to qualified operators.

- In a dry-lease arrangement, Troponaut will deliver airships to qualified operating organizations (the lessees) without crew, insurance or maintenance.
- The lessee takes full operational control, meaning they provide their own flight crews and make arrangements for insurance and maintenance. The lessee may register their airships under their own Air Operator Certificate (AOC).
- The lessee would contract with qualified MROs to maintain and repair their airships throughout the term of their lease.

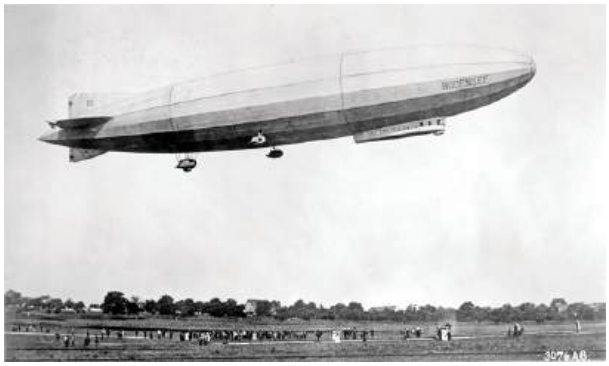
At the end of its lease, an airship is returned to Troponaut.

3. The Troponaut T-15

In 2022, the Interest Group DELEG, described in the previous section, developed the baseline design concept for a “commuter” category passenger airship, which, per EASA CS-30N regulations, “is limited to propeller-driven, multi-engine airships that have a seating configuration, excluding pilot seats, of 19 or less.” Commuter category airships can carry more passengers than a “Normal” category airship, which is limited to nine passengers, but less than the larger “Transport” category airships. DELEG targeted their first airship for the commuter category because it represented a significant capability increase over normal category airships, but it did not introduce the large increase in acquisition cost and additional airworthiness certifications risk of a transport category airship.

The 2022 DELEG design concept for a commuter category airship had the following features:

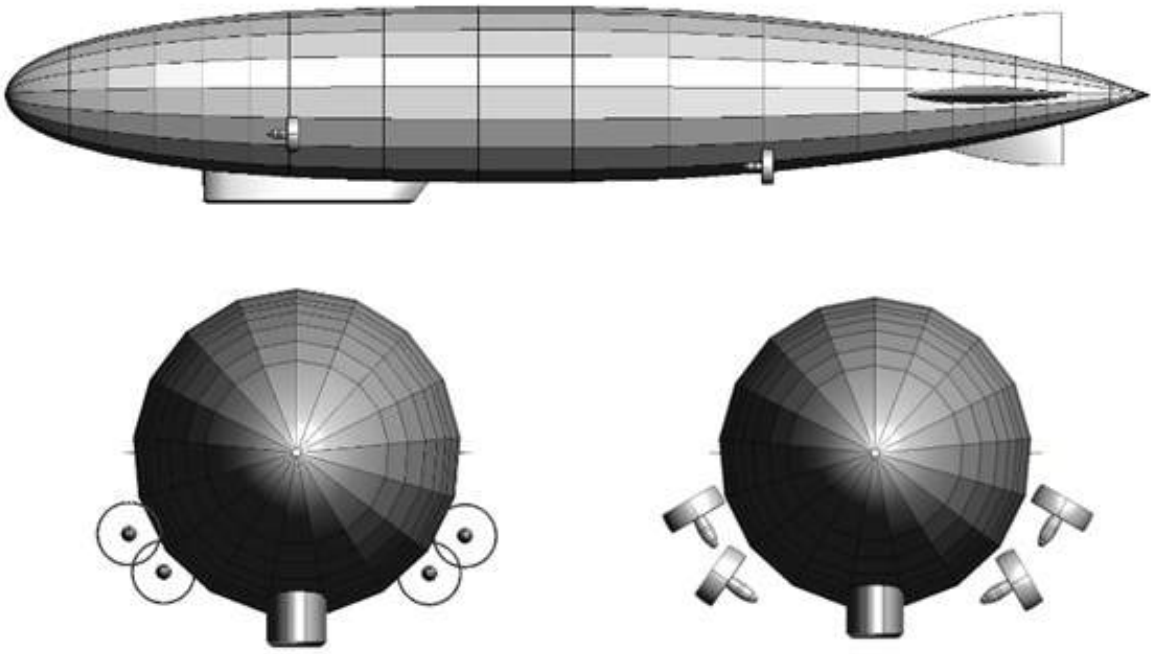
- Benchmark airship: Zeppelin LZ-120 Bodensee (built in 1919).



LZ-120 Bodensee, October 2019. Source: Library of Congress via Wikipedia

- Keep the LZ-120 Bodensee rigid airframe structural concept:
  - The Bodensee’s teardrop-shaped airframe was formed from 11 transverse main rings, with an auxiliary ring between each pair of rings. Each transverse main ring was a 17-sided polygon.
  - The transverse rings were connected by longitudinal girders (longerons) with a rigid keel that started 20 meters (65.6 ft.) from the bow and ended 10 meters (32.8 ft.) from the stern.
  - The forward-mounted control car was combined with the passenger accommodation and was constructed as an integral part of the hull structure rather than being suspended beneath it.

- Downsize to a maximum takeoff weight (MTOW) of 15 tonnes (16.5 tons).
    - The original LZ-120 had an MTOW of about 20 tonnes (22 tons).
- Use contemporary airworthy materials and commercial off-the-shelf (COTS) equipment.
- Implement an improve propulsion concept for maneuverability (by incorporating the “QuadroPod” system demonstrated in Aerarium model flight tests).



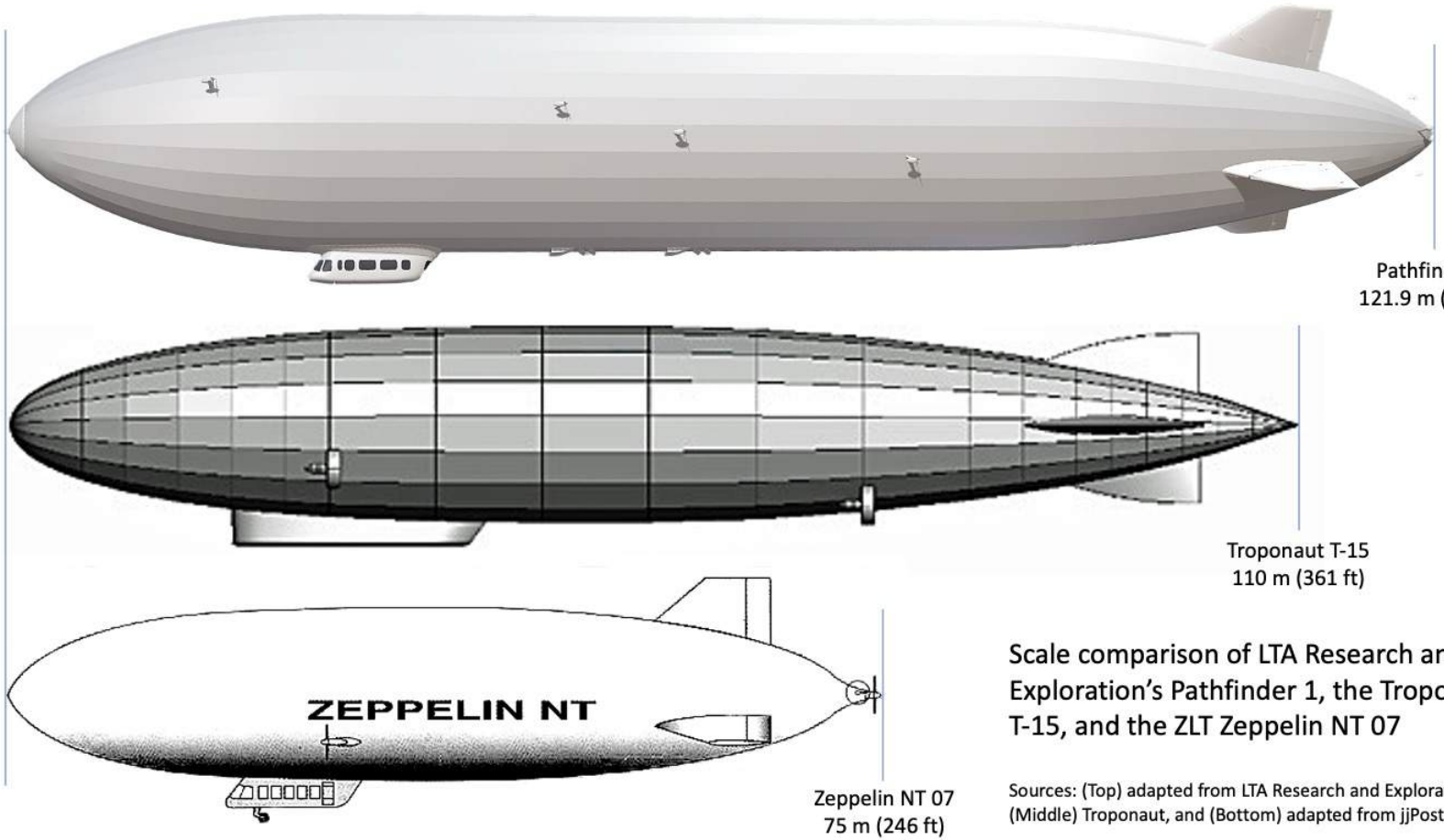
General arrangement of the 2022 DELEG commuter airship and Troponaut T-15. In lower right, note the angles of the vectored QuadroPod propulsors. Source: J. Eissing, 2022 Aviation Innovations Conference presentation

In 2026, Troponaut's initial offering is the 110 m (361 ft) T-15 conventional (near-equilibrium) rigid passenger airship with the novel "QuadroPod" propulsion and maneuvering system that enables precise low-speed, hover and vertical takeoff and landing (VTOL) flight. With a 15,000 kg (33,069 lb) MTOW and 19 passenger capacity, the T-15 is designed to comply with EASA CS-30N regulations.

Troponaut T-15 General Characteristics

Parameter	**T-15**
Type	Conventional, rigid
Airframe structure	Rigid "skin-on-frame" design
Applications	• Primary: "Commuter," per CS-30N • Other: Long-duration surveillance & scientific research missions.
Lifting gas	• Helium • Multiple lifting gas cells within the airframe provide redundancy & damage tolerance
Length	110 m (361 ft)
Width, max	18 m (59 ft)
Fineness ratio	6.1
Volume	• 14,700 m^3 (519,126 ft^3) of helium at ISA, sea level • 15,789 m^3 (557,600 ft^3) gross volume
Maximum takeoff weight (MTOW)	14,700 kg (32,407 lb)
Payload	5,000 kg (11,023 lb)
Accommodations	• Crew • 19 passengers
Propulsion & maneuvering	• 4 x flank-mounted "QuadroPod" ducted propellers with thrust vectoring. Propeller swivel axis is angled down. The prime mover is not defined. • Fine control for low-speed maneuvering, VTOL flight and station-keeping (hovering).
Aerodynamic control surfaces	Cruciform tail fins with conventional rudder and elevator control surfaces
Speed, cruise	100 kph (62 mph)
Range	10,000 km (6,214 miles)

A comparison of the scale of the Troponaut T-15 with two other contemporary passenger airships, LTA Research and Exploration's Pathfinder 1 and ZLT's Zeppelin NT 07, is shown in the following graphic.



Scale comparison of LTA Research and Exploration's Pathfinder 1, the Troponaut T-15, and the ZLT Zeppelin NT 07

Sources: (Top) adapted from LTA Research and Exploration, (Middle) Troponaut, and (Bottom) adapted from jjPostcards

Classic streamlined airframe

The profile of the Troponaut T-15 is a classic teardrop shape similar to the profiles of several other large rigid airships. As noted previously, the German LZ-120 Bodensee Zeppelin built in 1919 was selected as the benchmark for the basic design of the T-15.

In 2016, Eissing reported on the use in airship hull design of Series 58 Gertler shapes, which are mathematically-defined teardrop shapes developed in 1950 and originally applied to the design and evaluation of hydrodynamically efficient teardrop-shaped submarine hulls. More recently, Series 58 Gertler shapes have been used in the design of aerodynamically efficient airship hulls, including the Cargolifter CL-160, Eissing's 2013 "Ellie" QuadroPod model airship, and several other small airships. With significant experimental and numerical data available, Series 58 hull shapes are reported to be easy to generate from a modest set of parametric inputs.

The initial T-15 hull profile is a Series 58, 91% scale, fit to the LZ-120 Bodensee shape, showing the same geometric parameters.

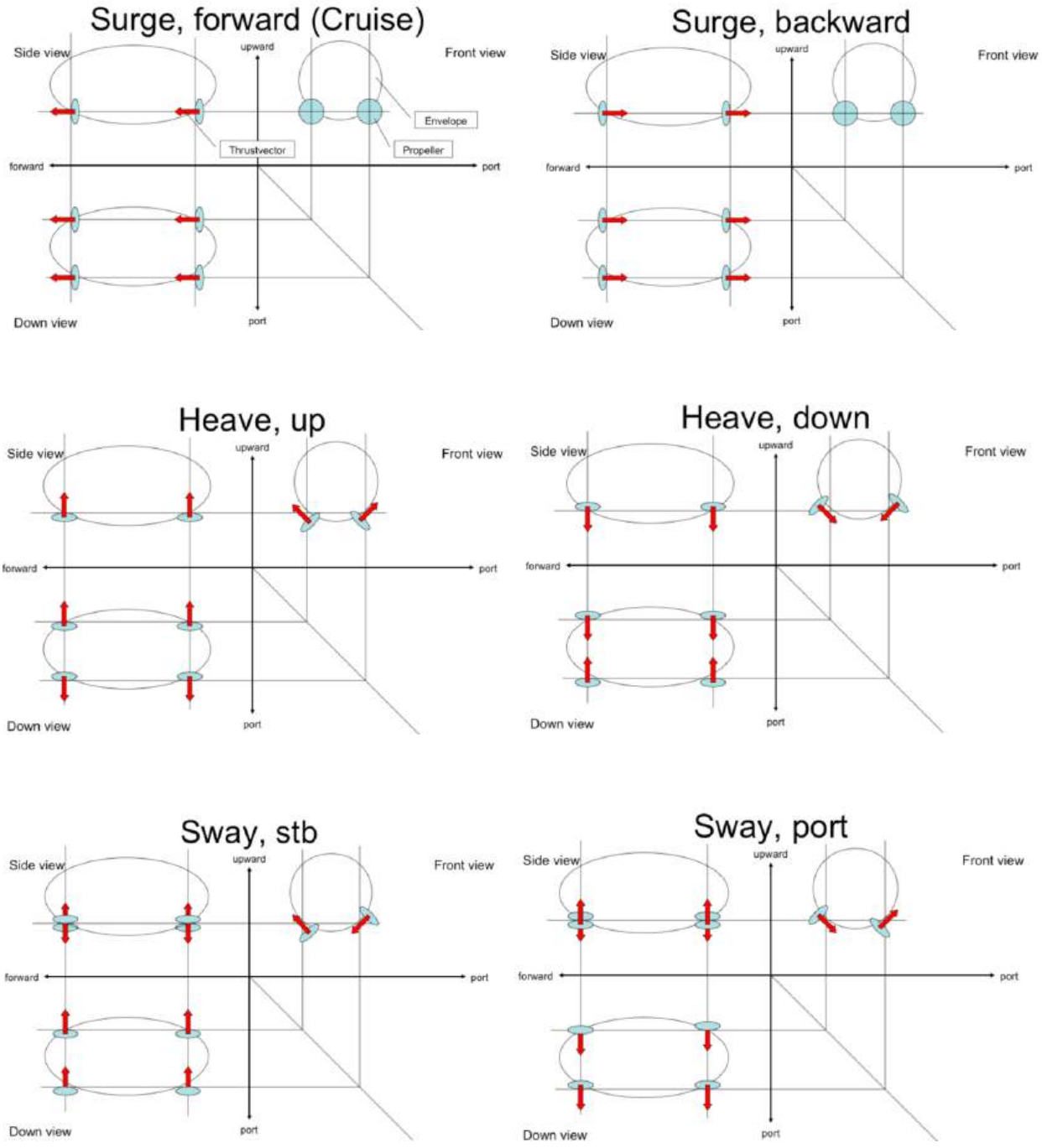
Novel "QuadroPod" propulsion and maneuvering system

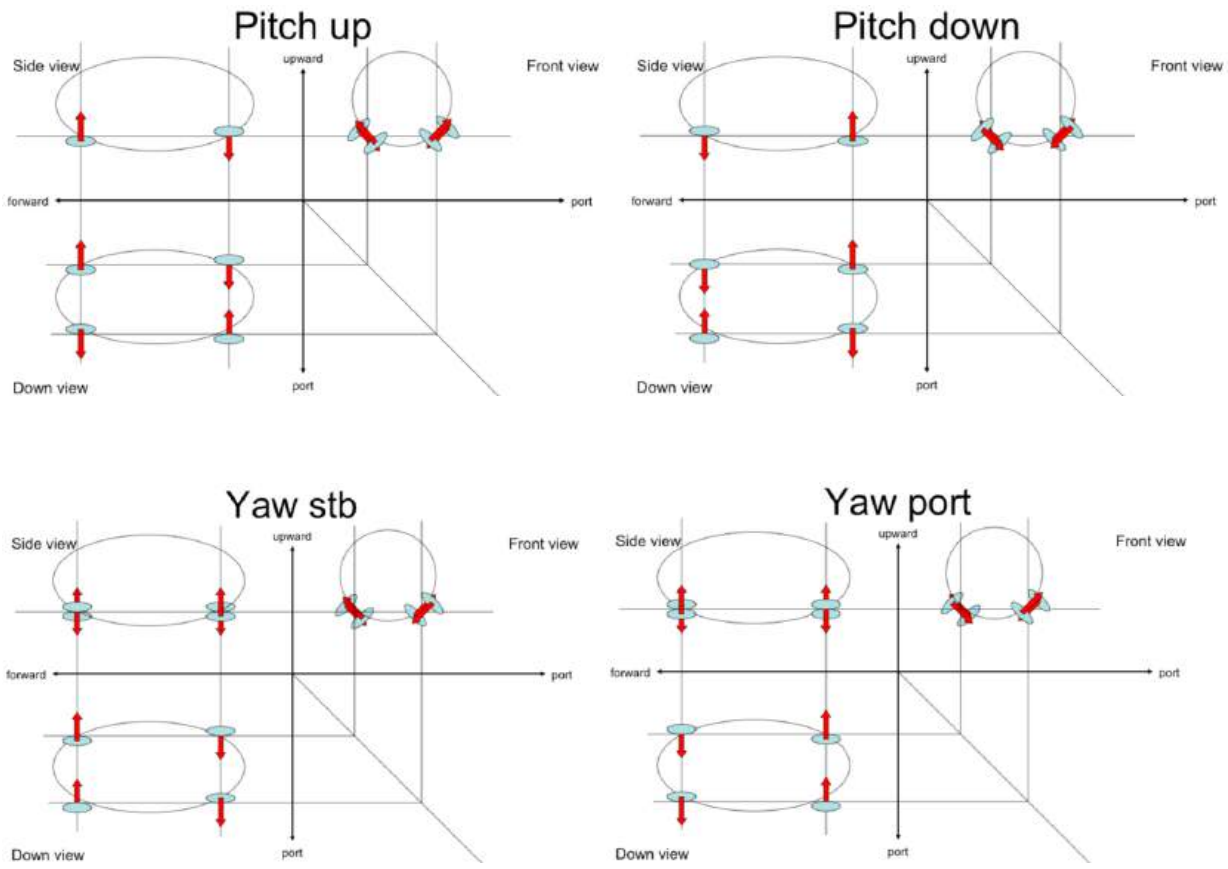
The "QuadroPod" system has four thrust vectoring propulsors installed, with two on each of the hull. On many airships with thrust vectoring propulsors, the propulsors rotate vertically around a horizontal axis (axis parallel to the ground plane) and can provide dynamic thrust in two dimensions (longitudinal & vertical). Supplementary control can be provided by smaller transverse bow or stern thrusters (i.e., Zeppelin NT, CargoLifter CL160). In contrast, the QuadroPod propulsors rotate around an axis at an anhedral angle (angled down) and can provide dynamic thrust in three dimensions (longitudinal, vertical, and transverse). Supplementary bow and/or stern thrusters are not needed.

While working for Airship Ventures, Johannes Eissing developed and flew the *Ellie* proof-of-concept model airship with an early "QuadroPod" propulsor configuration. A demonstration flight of this remotely-controlled model airship was conducted in the lobby of the UAA ConocoPhillips Integrated Science Building on 22 August 2012 during the 2nd Cargo Airships for Northern Operations Workshop. You can watch a video of this demonstration flight here. The "QuadroPod" propulsor configuration also

has been successfully tested on other airship models, including Martin Zobel's "StaroCore" and the TUHH "Outdoor Airship."

The control laws for a "QuadroPod" are quite different in cases where three-dimensional maneuvering is involved. In 2017, Johannes Eissing characterized this control behavior in the following series of diagrams.





QuadroPod control diagrams.
Source: J. Eissing, "The Most Maneuverable Airship" (2017)

4. The Troponaut T-60 and T-240

Building on experience that will be gained in developing, manufacturing, certifying and operating the T-15 airship, Troponaut has a longer-range plan to develop two larger airships with their DOA / POA partners.

The T-60 is a concept for a scaled-up passenger airship targeted for higher price markets such as luxury expeditions and transatlantic "air cruises." Vehicle maximum takeoff weight would be about 60 metric tons (66 tons).

The much larger T-240, with an MTOW of 240 metric tons (264 tons), is a concept for a heavy-lift cargo airship. Troponaut sees this vehicle as a means for revolutionizing logistics for remote areas.

5. Load exchange

Conducting a load exchange from a near equilibrium airship is a problem that has vexed cargo airship designers for decades and has led to complex solutions that have not yet been demonstrated in realistic operational environments. A possible solutions identified by CargoLifter entailed tethering their CL-160 heavy-lift airship to the ground during a load transfer using a specially-designed transfer rig that also included space for the ballast being exchanged. Canada's Buoyant Aircraft Systems Inc. (BASI) prefers fixed-base operations, with their heavy-lift airship being secured to a rotating turntable at each fixed base during a load transfer. Flying Whales plans to take on or discharge ballast from a hovering airship during a load transfer.

In 2022, Johannes Eissing was a co-author on an article on how to perform a load exchange with a near equilibrium airship using a method called Airship External Sling-Load Operation (AESLO). This method was adapted from helicopter operations and appears to show promise for enabling safe load transfers from a near equilibrium airship.

6. For more information

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- Johannes Eissing, et al., “Airship Sling-Load Operations: A Model Flight-Test Approach,” Section in “Lighter Than Air Systems - Proceedings of the International Conference on Design and Engineering of Lighter-Than-Air Systems 2022 (DELTAs-2022),” Springer, November 2022: https://www.springerprofessional.de/en/airship-sling-load-operations-a-model-flight-test-approach/23765828

EASA Regulations

- CS 30N Book 1, “Certification Specification for Normal and Commuter Airships,” (aka “Final Special Condition ‘SC GAS’ Gas Airships - Issue 01”), EASA, 14 March 2021: https://www.easa.europa.eu/en/document-library/product-certification-consultations/final-special-condition-sc-gas-gas-airships
- CS 30N Book 2, “Acceptable Means of Compliance,” EASA, draft, February 2023: https://www.easa.europa.eu/en/downloads/139572/en
- Part 21J, “Design Organisations Approvals,” EASA: https://www.easa.europa.eu/en/domains/aircraft-products/design-organisations/design-organisations-approvals#group-easa-downloads

- Part 21G, “Production Organisations Approvals,” EASA: https://www.easa.europa.eu/en/domains/aircraft-products/production-organisations-approvals

LZ-120 Bodensee

- “Zeppelin’s LZ-120 – Bodensee,” The Lighter-Than-Air Society, circa 2014 : https://www.blimpinfo.com/wp-content/uploads/2012/08/Zeppelin’s-LZ-120-–-“Bodensee”.pdf
- “LZ-120 – Bodensee,” Aviation in Germany 1919 – 1945: https://www.histaviation.com/lz-120-bodensee.html

Videos

- “Model Airship Tests Engine Configuration,” (1:17 min), posted on Vimeo by Anchorage Daily News, 23 August 2012: https://vimeo.com/48123189?fl=pl&fe=vl
- “Airships to the Arctic Conference (2022) - Johannes Eissing, “How Green are Airships?” (23:00 min), posted on YouTube by Asper School of Business, 18 January 2023: https://www.youtube.com/watch?v=AmjbvAKusjU

Other Modern Airships articles

- Modern Airships - Part 1: https://lynceans.org/all-posts/modern-airships-part-1/
  - Airship Advertising & Laws Corp. - rigid airship
  - Airship Industries – R40 / R130 & R150 rigid airships
  - Airship Industries (USA) – Rigid cargo airships
  - CargoLifter AG –CL160 semi-rigid heavy-lift airship
  - CL CargoLifter GmbH & Co. KGaA - rigid heavy-lift airships
  - LTA Research and Exploration – Pathfinder 1 rigid airship
  - ZLT Zeppelin Luftschifftechnik GmbH & Co. KG (ZLT) - Zeppelin NT (NT 07 and NT 14) semi-rigid airships
- Modern Airships - Part 2: https://lynceans.org/all-posts/modern-airships-part-2/
  - Augur RosAeroSystems – DZ-N1 rigid airship
  - Aviation Industry Corporation of China (AVIC) – AS700 blimp
  - Lightspeed USA – LS-12 & -60 rigid airships
- Modern Airships - Part 3: https://lynceans.org/all-posts/modern-airships-part-3/