

Juliana Juleva – airship design concepts

Peter Lobner, 17 February 2024

1. Introduction

Juliana Juleva is a graduate industrial design student at Bauman Moscow State Technical University in Moscow, Russia. Her design portfolio on the Behance website (<https://www.behance.net/jjuleva>) includes three airship design concepts. The first is a 2022 design concept for a lenticular airship using cycloidal propellers for propulsion and low-speed maneuvering. The second is a 2022 design concept for an free-flying, uncrewed advertising airship known as aerostatic platform AirOne. The third is a 2023 design concept for a semi-rigid, modular airship with a propulsion / maneuvering system layout similar to the commercial Zeppelin NT semi-rigid airship.

This article takes a look at all three of these design concepts.

2. Lenticular airship with cycloidal propellers (2022)

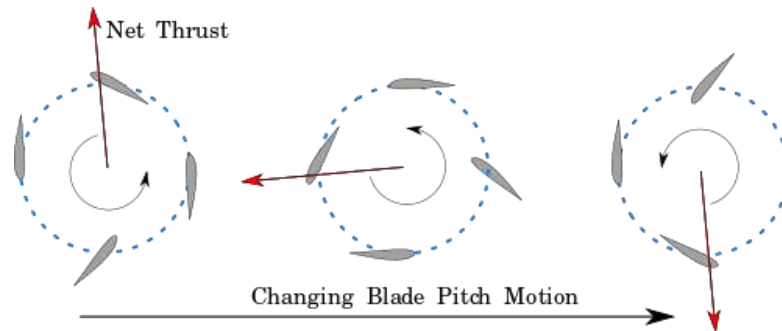


Lenticular airship showing placement of the horizontal axis cycloidal propellers around the periphery of the hull. Source: Juliana Juleva via Behance

This symmetrical lens-shaped, solar-powered airship design concept includes a prominent circular array of photovoltaic cells on its upper surface. Propulsion and maneuvering control is provided by six

horizontal axis cycloidal propellers located 60° apart around the periphery of the hull, just below the equatorial rim. There are no aerodynamic control surfaces.

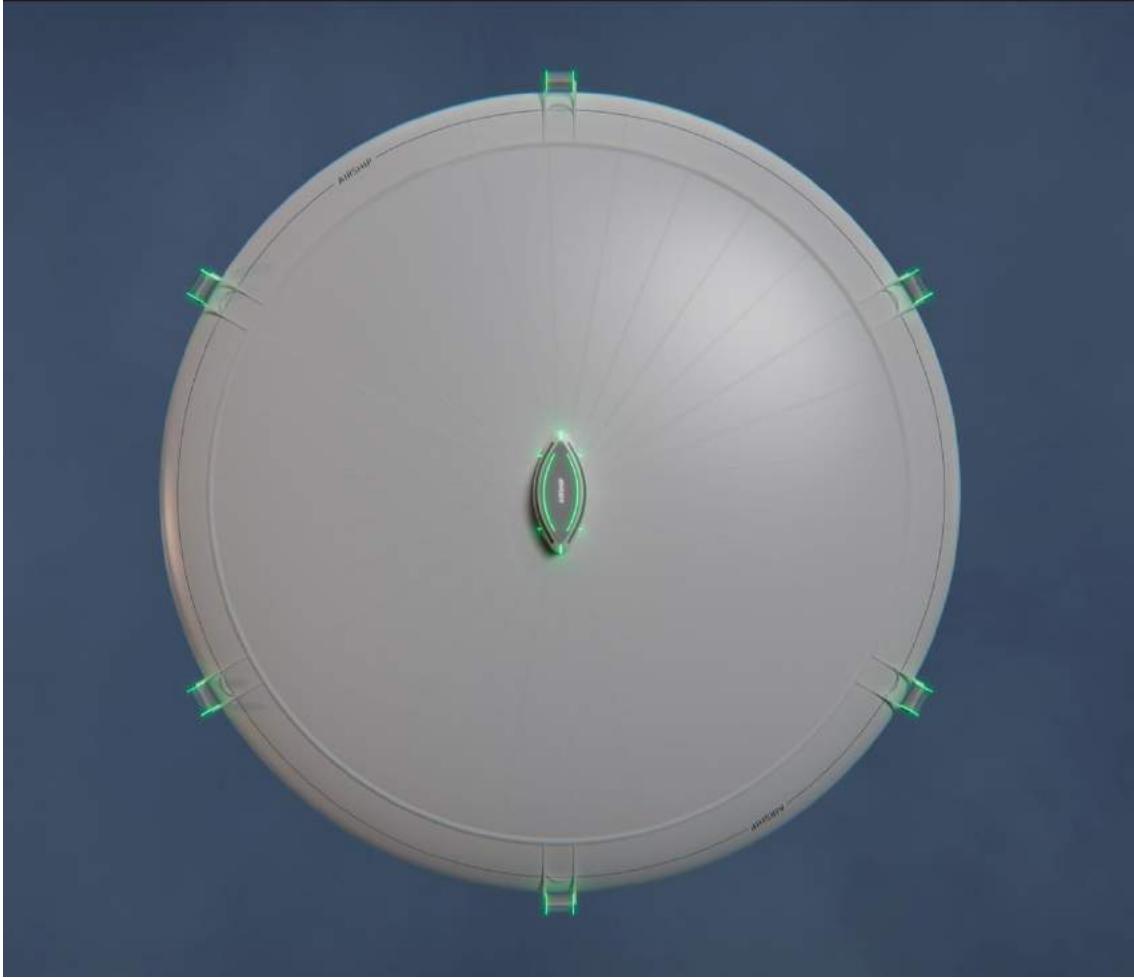
A cycloidal propeller can produce instantaneous thrust in any direction perpendicular to its axis of rotation. This is accomplished by adjusting propeller blade pitch, as shown in the following diagram:



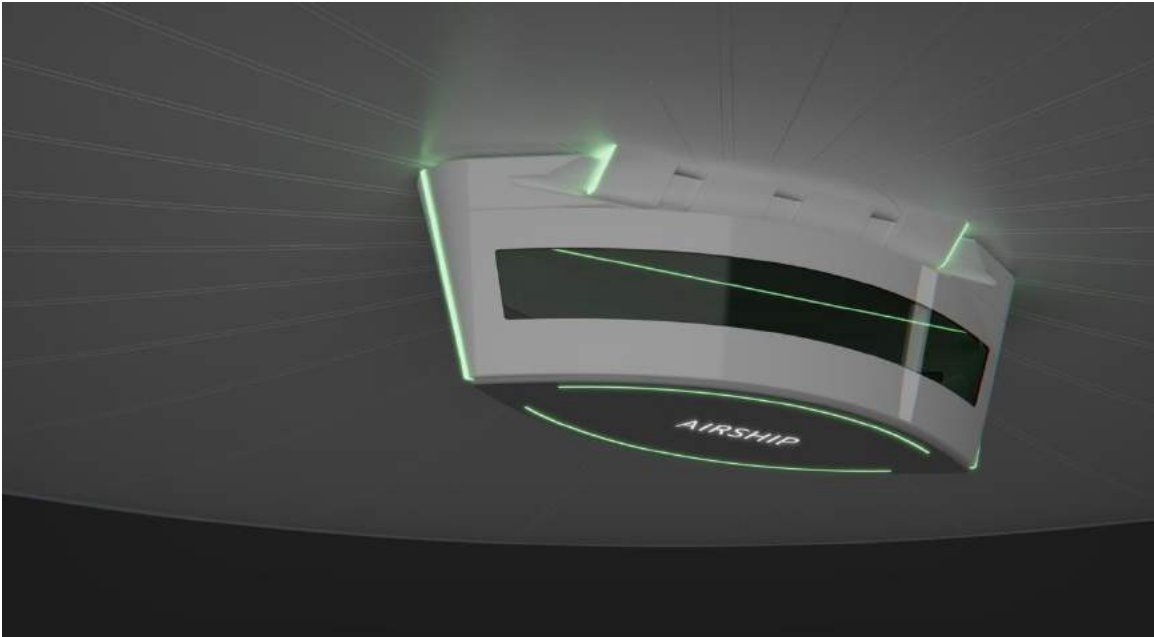
A cycloidal propeller delivers vectored thrust by changing its blade pitch angles. Source: Wikipedia

For Juleva's lenticular airship, the thrust axis of each cycloidal propeller is aligned along a radial axis from the center of the hull. Thrust can be directed up, down or radially outward without interference. However, the cycloidal propeller's thrust would impinge on the hull if the thrust is directed inward, toward the hull. In cruise flight, only one of the six cycloidal propellers (the stern, center propeller) is in the right location for generating propulsive thrust directly aft, along the longitudinal axis of the airship.

In low-speed flight and during hover, the arrangement of cycloidal propellers gives Juleva's lenticular airship the ability to rapidly maneuver in any direction and/or adjust its pitch, roll or altitude. This capability enables precise vertical takeoff and landing (VTOL) and stationkeeping (maintaining geolocation and altitude) while hovering, even in changing wind conditions. When the dynamic thrust from the cycloidal propellers is directed down, the airship can takeoff and fly substantially heavy, carrying a greater payload than would be possible with aerostatic lift alone. Likewise, when the dynamic thrust from the cycloidal propellers is directed up, the airship can takeoff and fly substantially light, enabling it to deliver a heavy payload and then fly off without ballast compensation.



*Two views from beneath the lenticular airship.
Source, both graphics: Juliana Juleva via Behance*



*Lenticular airship showing the location of the gondola under the hull.
Source, both graphics: Juliana Juleva via Behance*

3. Aerostatic platform AirOne (2022)

AirOne is a free-flying, uncrewed advertising blimp that can display advertising conventionally, on the sides of the gas envelope, or via a rotating hologram fan projector under the airship.



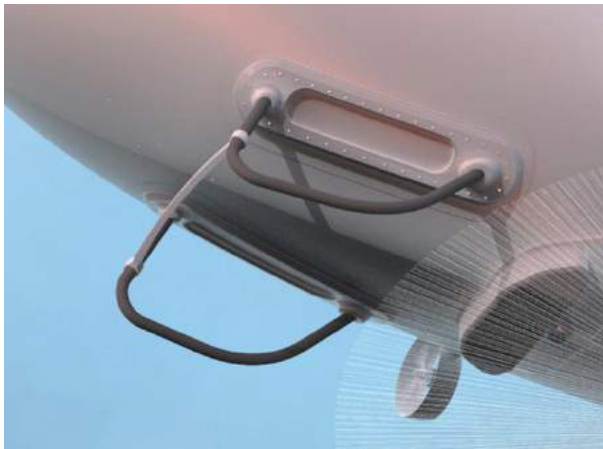
Rendering showing a profile view of the AirOne blimp, with conventional advertising on the gas envelope.



*Rendering showing a concept for advertising displayed using a rotating holographic fan projector under the AirOne blimp.
Source, both graphics: Juliana Juleva via Behance*



A collar around the AirOne blimp's gas envelope supports a propulsion and maneuvering system comprised of four ducted fans (likely thrust vectoring) along the flanks of the envelope. A module containing flight control and airship systems and the mission payload is carried along the centerline, under the envelope.



On the ground, the airship sits on two fixed landing skids forward and the two lower tail fins aft.



Prototype gas envelope. Source, Six graphics: Juliana Juleva via Behance

4. Semi-rigid modular dirigible (2023)

Juliana Juleva developed a design concept in 2023 for a large, modular, semi-rigid “dirigible” airship comprised of two major elements; a standard gas envelope / propulsion module and a customizable gondola module.

The exterior general arrangement of the standard gas envelope / propulsion module is similar to a Zeppelin NT, but three times larger in volume: [25,000 m³ (882,867 ft³) vs. 8,425 m³ (297,526 ft³)].

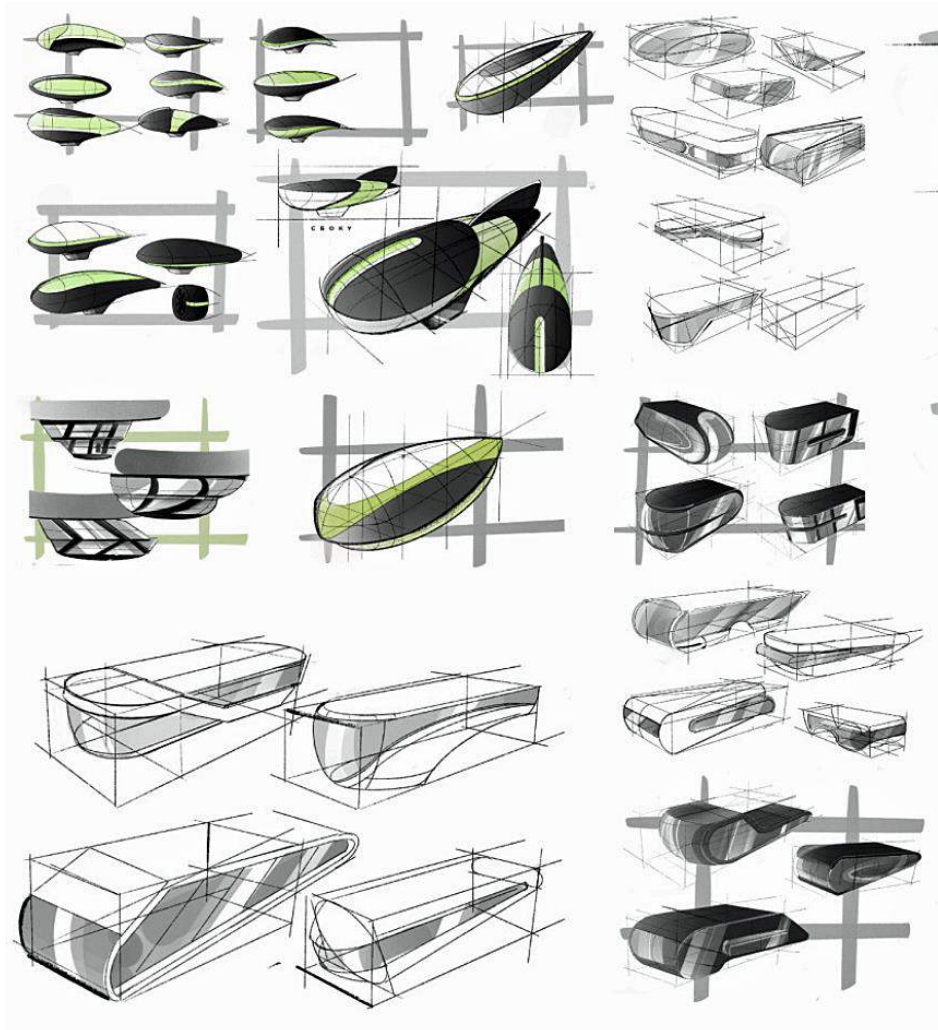
The gondola module can be configured for a wide range of possible applications, such as:

- Cargo transportation, up to 5 metric tons (5.5 tons)
- Passenger transportation
- Rescue operations
- Elite vacations
- Excursion for relatively short day trips to hard-to-reach and undeveloped areas
- Construction
- Advertising & entertainment
- Monitoring / surveillance



*General arrangement of the excursion airship.
Source: Juliana Juleva via Behance*

Juleva's modular dirigible design concept evolved through extensive comparative evaluations reflected in concept artwork and scale model construction of the preferred design.



Source, both graphics: Juliana Juleva via Behance

Modular dirigible design features – Excursion configuration

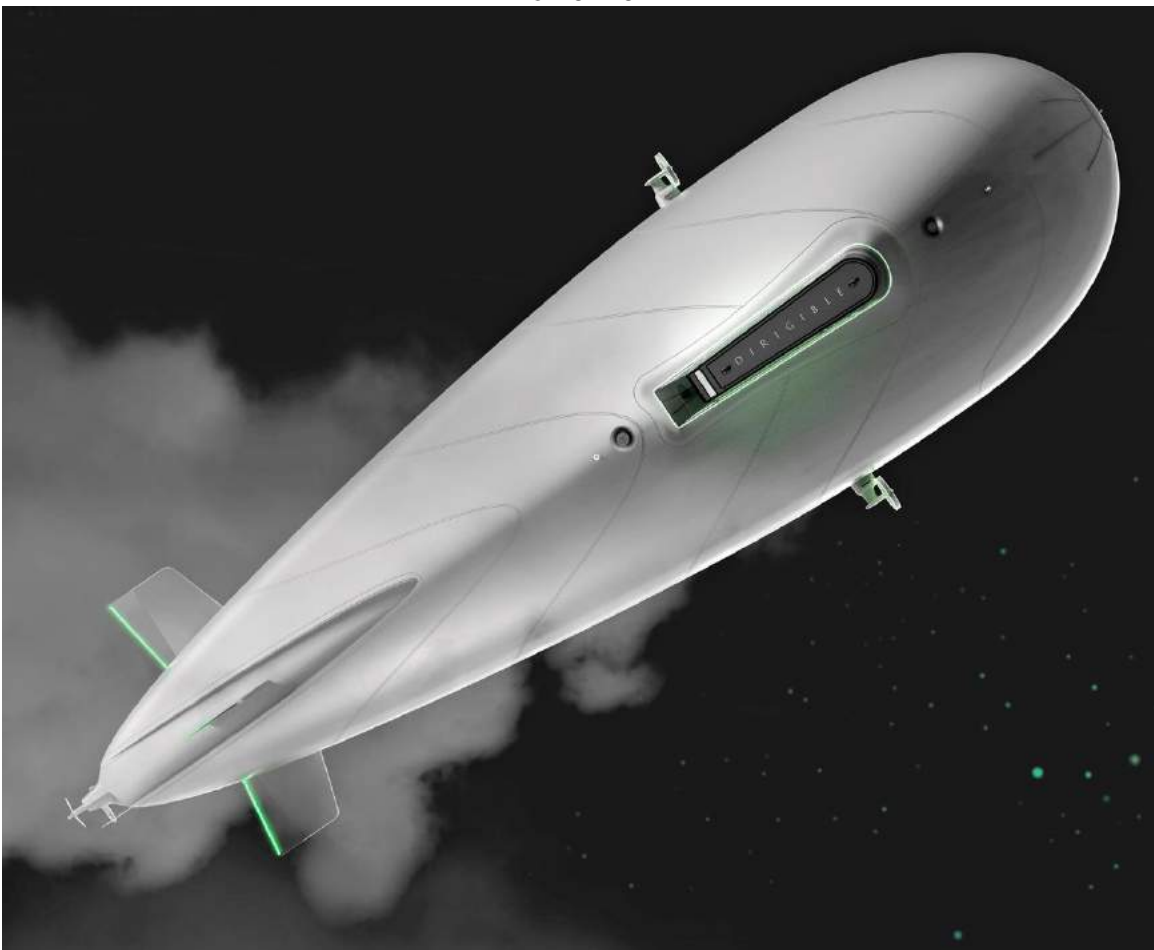
The excursion airship is configured for sightseeing day trips with relatively high-density seating for about 40 passengers in a two-level gondola fabricated from lightweight metals with a fiberglass skin and large polycarbonate windows. All passenger seating is adjacent to large windows that provide panoramic views.

General characteristics of the modular dirigible airship

Parameters	Modular dirigible airship - Excursion configuration
Type	Conventional, semi-rigid
Length	100 m (328 ft)
Width, envelope max	28 m (91.8 ft) not including flank propulsors
Width, overall	About 35 m (114.8 ft) including flank propulsors
Height, top of envelope	22 m (72.2 ft)
Height, overall	About 26 m (85.3 ft) to the top of the tail fin
Lifting gas	Helium
Volume, shell	25,000 m ³ (882,867 ft ³)
Total lift	25,000 kg (55,116 lb) maximum
Load capacity	5,000 kg / 5 metric tons (11,023 lb / 5.5 tons), including passengers, crew, hand luggage @ 10 kg (22 lb) per person, food & water
Propulsion & maneuvering	<ul style="list-style-type: none">• 2 x flank mounted, thrust vectoring, shrouded propellers• 1 x stern-mounted longitudinal propeller providing thrust along the longitudinal axis & possibly vectoring vertically for pitch control.• 1 x stern-mounted fixed propeller providing lateral thrust for yaw control• Capable of vertical takeoff and landing (VTOL)
Crew	5 (pilot, copilot, 2 x cabin stewards & tour guide)
Passenger capacity	About 40 persons
Endurance	Sightseeing trips (hours)



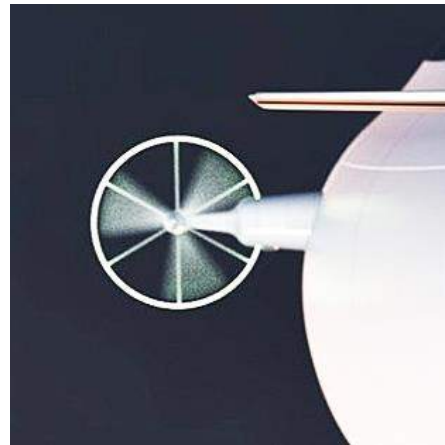
Profile view



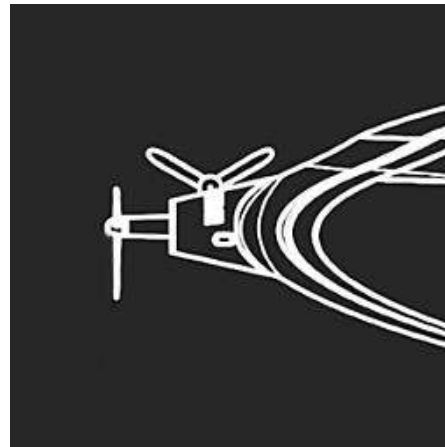
View from directly below the airship showing the placement of the flank-mounted main propellers and the tail-mounted longitudinal and lateral propellers. Source, both graphics: Juliana Juleva via Behance



Views from behind the airship showing the placement of the flank-mounted main propellers and the tail-mounted longitudinal and lateral propellers.

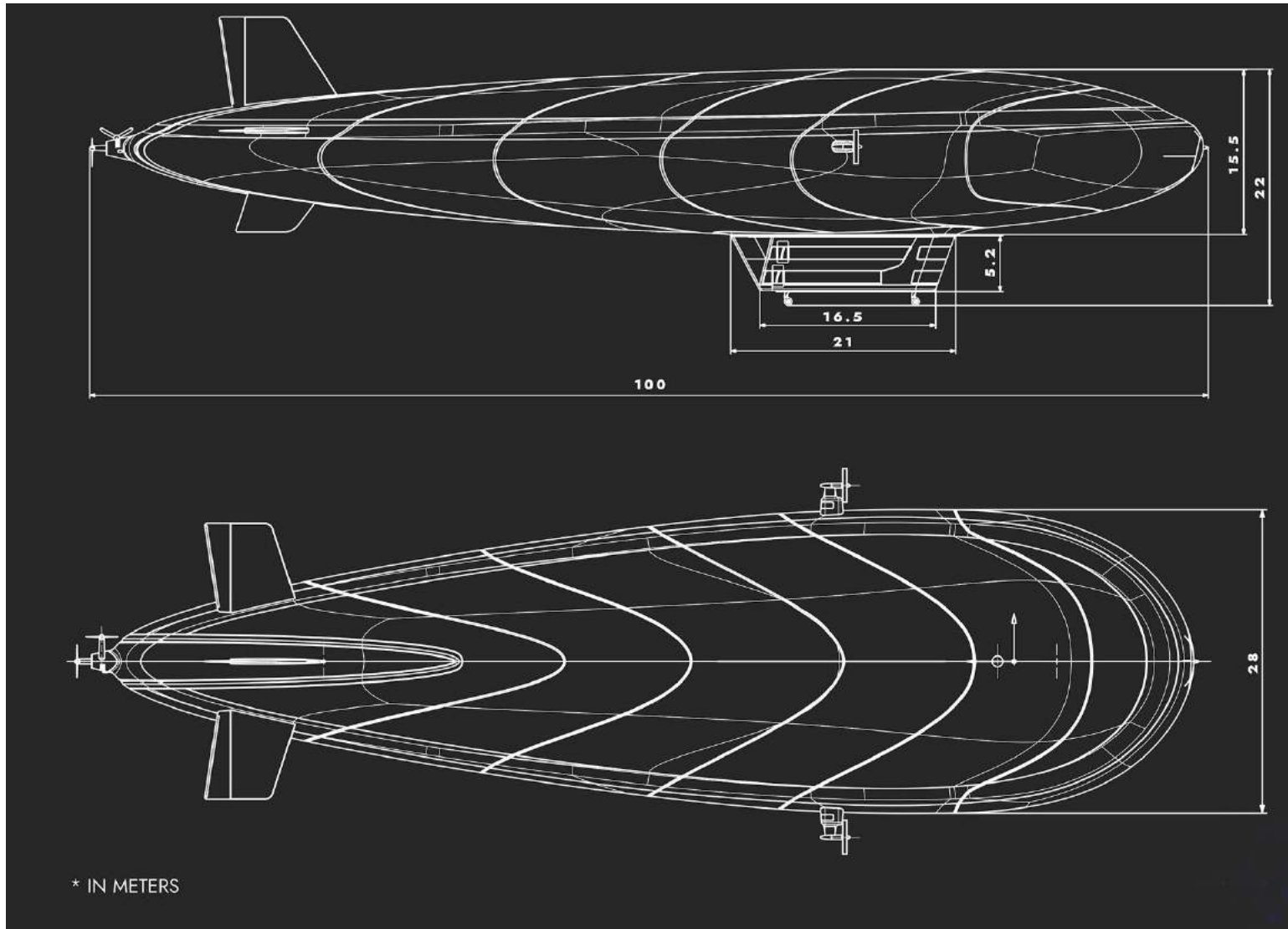


Closeup views of the flank-mounted main propeller.



Closeup views of the longitudinal & lateral thrust propellers.

Source, all graphics: Juliana Juleva via Behance



Excursion airship elevation & plan view drawing. Source: Juliana Juleva via Behance



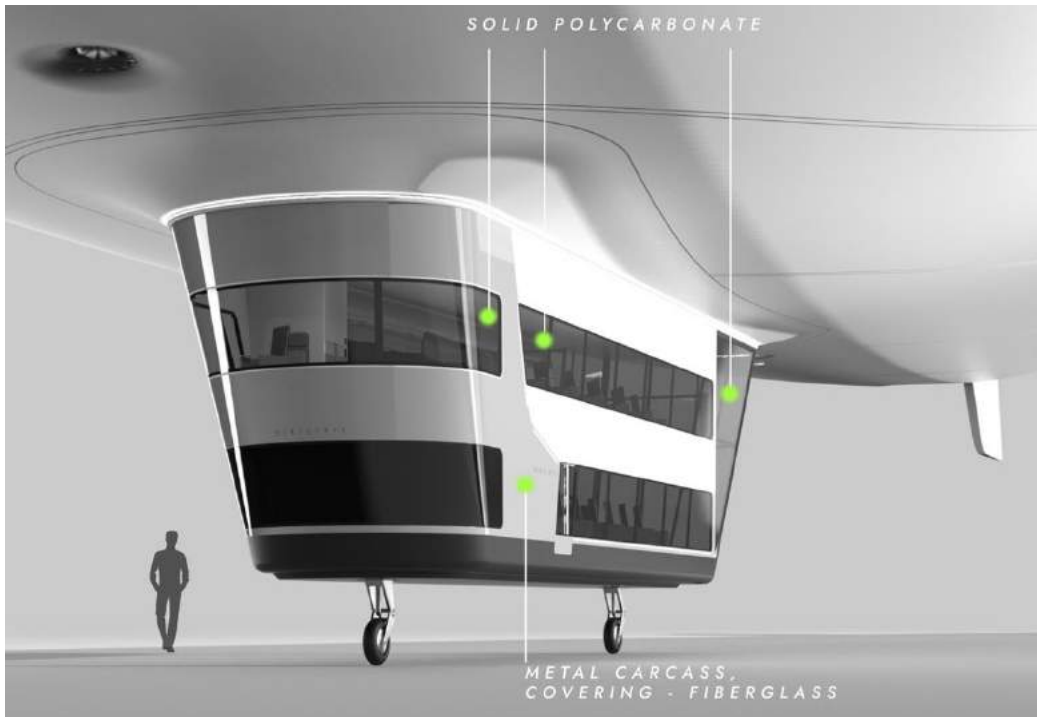
Modular airship configured for four different functions: excursion (top left), cargo (top right), hotel / elite vacations (bottom left), and yacht (bottom right). Source, all graphics: Juliana Juleva via Behance

Excursion gondola module exterior details

The two-level gondola is configured with the cockpit on the lower level and all passenger seating adjacent to floor-to-ceiling windows. On the lower level, there are 15 single seats and a space for a passenger in a wheelchair. The upper level has seating for 26 passengers, 8 in single seats, and 18 in double seats with a panoramic viewing area at the bow. At the stern, two-level glazing provides panoramic views from observation decks on the lower and upper levels. A food service area and toilet are on the lower level.



Gondola exterior side view.

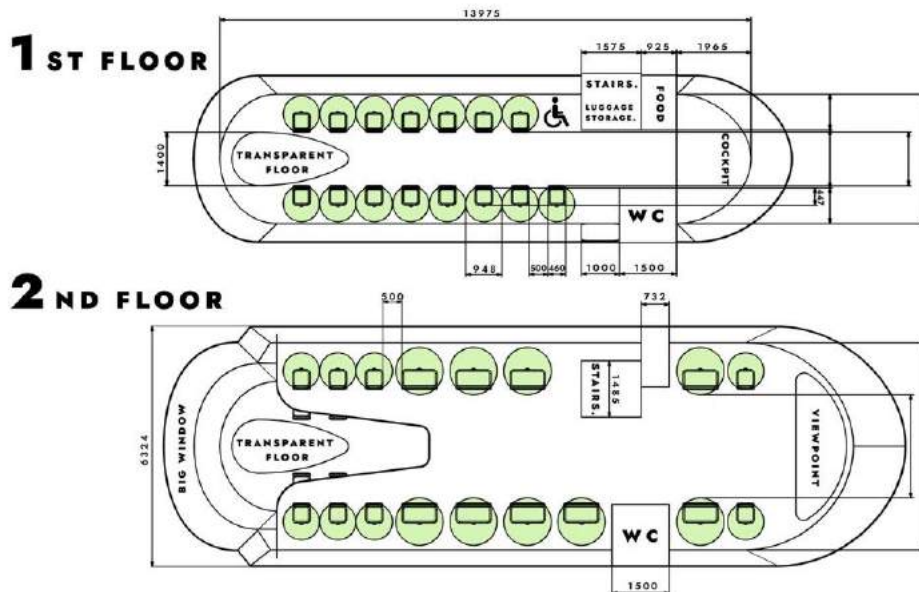


*Gondola exterior bow view. The crew cockpit is on the lower level.
The panoramic overview area is on the upper level.
Source, both graphics: Juliana Juleva via Behance*



Gondola stern view with panoramic two-level lookout.

Excursion gondola module interior details

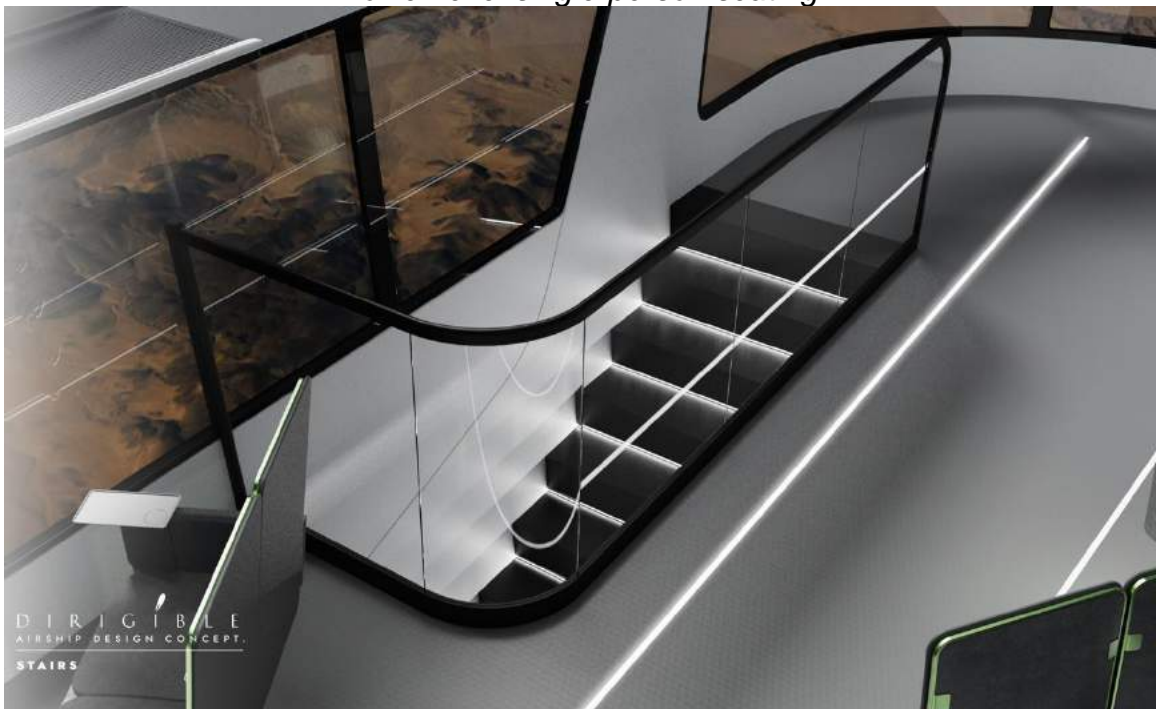


Gondola interior floor plans.

Source, both graphics: Juliana Juleva via Behance



Lower level single-person seating



*Stairs from the lower level.
Source, both graphics: Juliana Juleva via Behance*



Upper level 2-person seating.



*Upper level seating aft, at the panoramic two-level lookout.
Source, both graphics: Juliana Juleva via Behance*

5. For more information

Lenticular airship

- Juliana Juleva, “Lenticular Airship Design Concept,” Behance, published online 12 July 2022:
<https://www.behance.net/gallery/148027779/Lenticular-AIRSHIP>

Aerostatic platform AirOne

- Juliana Juleva, “Airship AirOne Design Concept,” Behance, published online 9 September 2022:
[https://www.behance.net/gallery/152325857/Airship-AIRONE-\(dirigible\)](https://www.behance.net/gallery/152325857/Airship-AIRONE-(dirigible))

Dirigible airship

- Juliana Juleva, “Dirigible Airship Design Concept,” Behance, published online 11 March 2023:
<https://www.behance.net/gallery/165765347/DIRIGIBLE>
- Christian Curmei, “This Dirigible and Airship Design May Be Hinting at a New Way of Flying for All,” Autoevolution, 21 April 2023: <https://www.autoevolution.com/news/this-dirigible-and-airship-design-may-be-hinting-at-a-new-way-of-flying-for-all-213503.html>

Other *Modern Airships* articles

- *Modern Airships - Part 1*: <https://lynceans.org/all-posts/modern-airships-part-1/>
 - American Blimp Corp. - Lightships
 - Walden Aerospace / LTAS - lenticular airships
 - Zeppelin NT
- *Modern Airships - Part 2*: <https://lynceans.org/all-posts/modern-airships-part-2/>
 - Roy P. Gibbens - AirLighter & cycloidal propellers
 - SkyLifter - lenticular airships & cycloidal propellers
- *Modern Airships - Part 3*: <https://lynceans.org/all-posts/modern-airships-part-3/>