

## Avalon Airships, Ltd.

Peter Lobner, updated 8 February 2022

### 1. Introduction

Avalon Airships is a small airship design firm that was incorporated in 2017 in Manchester, UK. In partnership with the University of Manchester, Avalon has developed three very advanced airship conceptual designs for a range of applications.



Their website is here: <https://www.avalon-airships.com>

The three airship concepts are named EOS, Hemera, and Aether.

- All are designed for very low environmental impact.
- All have electric propulsion systems.
- EOS and Hemera are hybrid airships designed to operate from water. They both have water ballast systems. These airships are semi-buoyant, with aerostatic lift from helium providing a large fraction of the lift required for flight. These airships are designed for short takeoffs and landings (STOL) using vectored thrust and then transitioning to aerodynamic lift in flight.
- Aether is a variable buoyancy airship designed to operate from land. External ballast is not required. It is designed for vertical takeoffs and landings (VTOL) and is capable of hovering.

This article addresses all three of these Avalon Airships concepts.

### 2. EOS

EOS is a broad, three-lobe, hybrid airship intended as an unmanned autonomous platform that can be configured for a wide range of applications, including police, freight, search and rescue, and entertainment. This electrically-propelled airship generates zero carbon emission during operation. There are two generations of the EOS airship; Generation 1, circa 2017, and Generation 2, circa 2020.

Both generations of EOS incorporate the following design features:

- **All-electric, zero carbon emission propulsion system:**  
Four powerful, thrust-vectoring, electric-powered, propulsors provide thrust for cruise propulsion and for maneuvering at slow speed. Two are mounted forward on small wings and two are mounted at the tail.
- **Hybrid, semi-buoyant:**  
Aerostatic lift from helium provides a large fraction of the lift, with the balance generated by vectored thrust from the propulsion system and aerodynamic lift from the fuselage and small wings during forward flight.
- **Short takeoff and landing (STOL):**  
Since EOS is semi-buoyant, it needs a short takeoff run to become airborne using vectored thrust and then aerodynamic lift as airspeed increases. For landing, aerodynamic lift decreases as the airship slows and vectored-thrust provides the needed lift prior to touchdown.
- **Water takeoff and landing:**  
EOS is designed primarily for taking off and landings from a body of water. This airship can moor at a wide range of sites, including city center rivers, quays and ports. This would increase the siting flexibility for operating bases and terminals.
- **Water ballast system:**  
A high speed water ballast system rapidly increases the weight of the airship immediately as it lands in the water. This improves controllability and safety after landing. The water ballast is discharged during the subsequent takeoff sequence.
- **Likely semi-rigid construction:**  
While not stated by Avalon Airships, the tri-lobe gas envelope is likely to be a non-rigid, pressure-stabilized, multi-layer envelope with a lightweight internal rigid structure to carry the loads from the wings, propulsors, mission equipment and cargo. Lockheed Martin's tri-lobe Aerocraft (circa 1998) had this design feature.

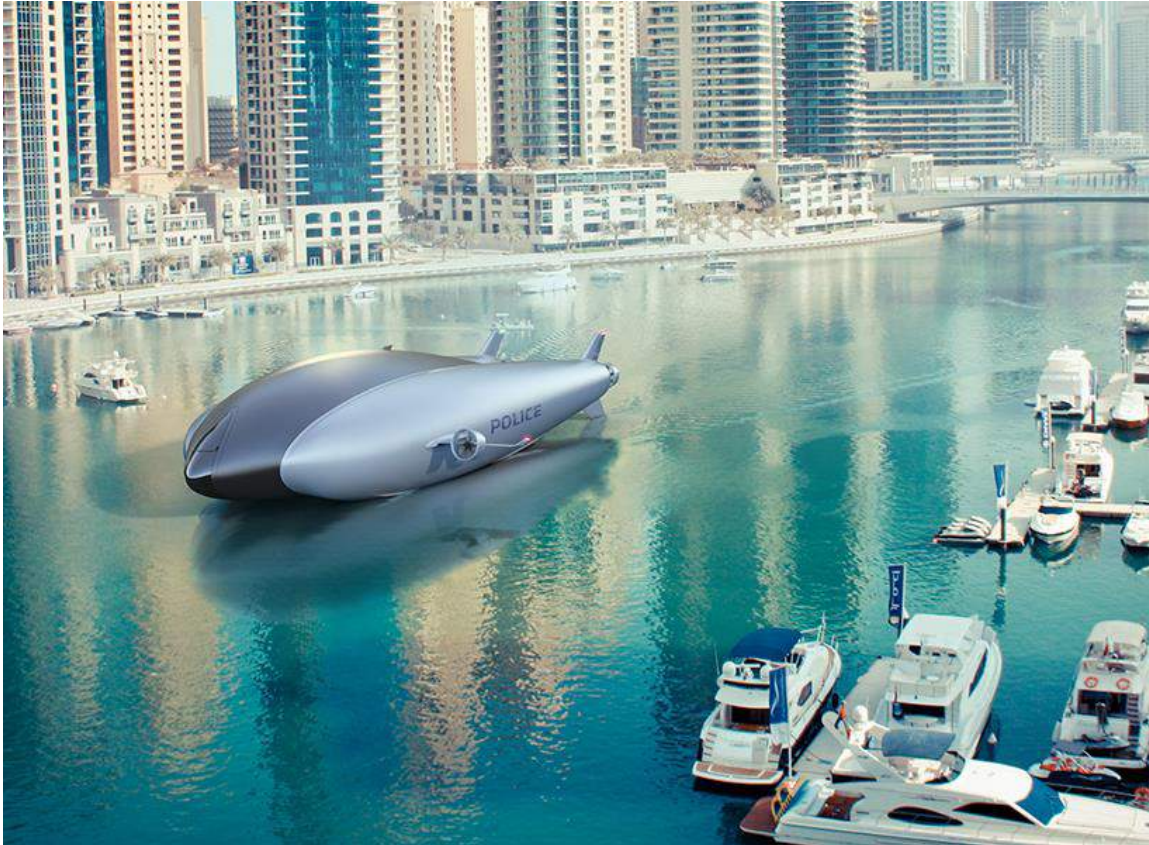
## EOS Generation 1

Avalon Airships introduced this graceful airship in 2017. It was designed for a range of over 300 miles (482 km) and long airborne endurance.

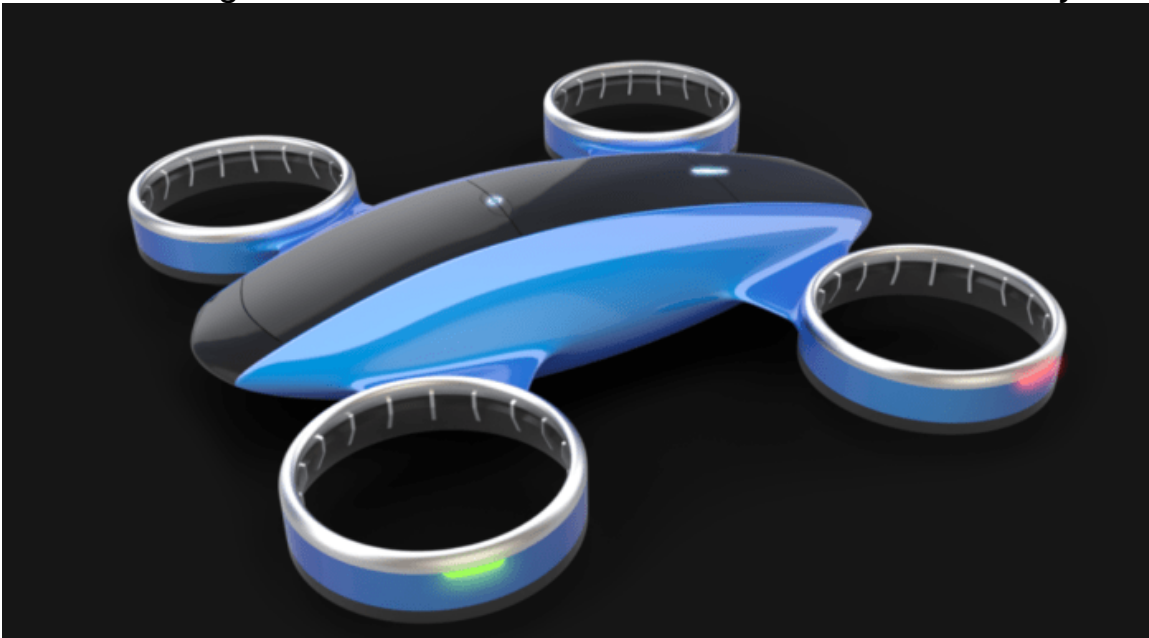


*Renderings of the EOS Generation 1. Note the fore and aft shrouded propellers. Source, both graphics: Avalon Airships.*





*Rendering of an EOS Generation 1 on a downtown waterway.*



*The EOS police version can be equipped to launch a small, remotely-piloted drone that can deliver supplies and equipment for direct aid in emergencies. Source, both graphics: Avalon Airships*



## EOS Generation 2

Avalon Airships introduced the EOS Generation 2 in January 2020 as a more refined and scalable airship.



*Rendering of the EOS Generation 2 in flight.  
Note the slender forward wings and the wingtip-mounted propellers.*



*Rendering of the EOS Generation 2 just before landing  
on a downtown waterway. Source, both graphics: Avalon Airships*



*The above search-and-rescue graphic clearly shows that a tilt-wing is used to vector the forward propellers.*



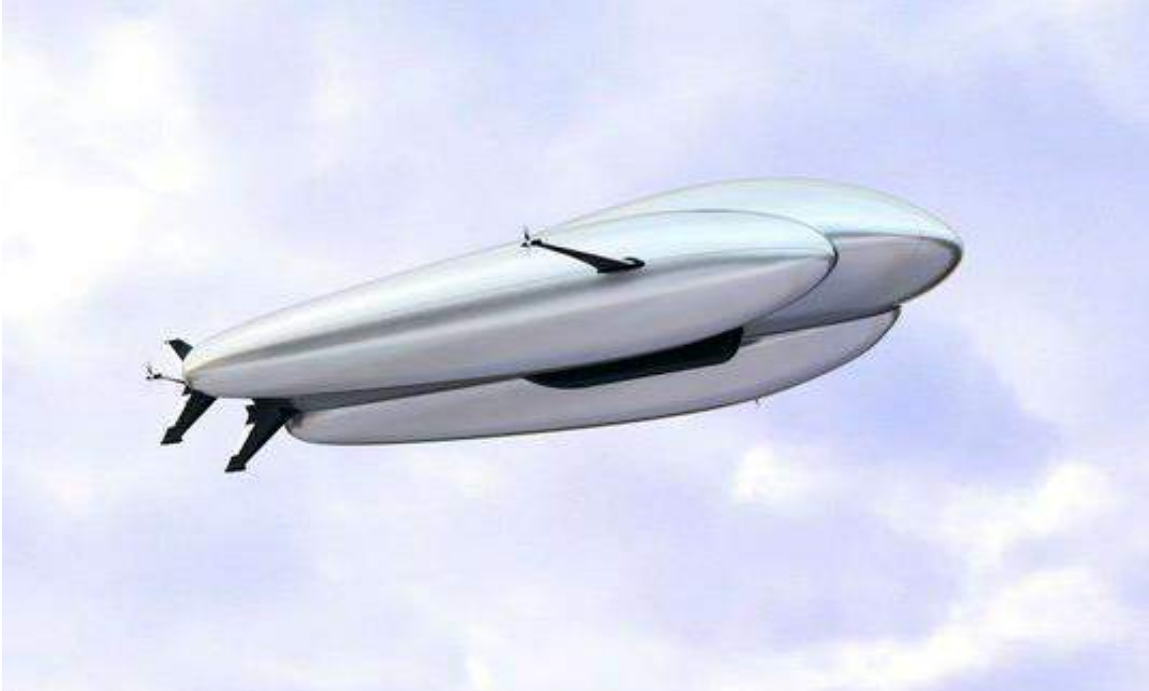
*Rendering of an EOS Generation 2 after landing at a remote site.  
Source, both graphics: Avalon Airships*





*Concept for EOS airships operating from a waterfront terminal.  
A representative dock configuration is shown in the graphic below.  
Source, both graphics: Avalon Airships*





*Rendering of an EOS Generation 2 in flight showing the fore and aft wingtip-mounted thrust-vectoring (via tilt-wing) propellers and a payload pod under the center lobe of the gas envelope.*



*This rendering shows an EOS airship after it landed on a rooftop. It appears that the EOS Generation 2 is not restricted to STOL water landings. Under lightly-loaded conditions, a VTOL roof-top landing (or a landing on the ground) may be possible.*

*Source, both graphics: Avalon Airships*



### 3. Hemera

This large hybrid airship concept is designed to operate as a luxury tourist ferry, providing passengers with an indulgent yet sustainable way to travel. Helium provides a large fraction of the lift, with the balance generated by vectored thrust electric propulsion and aerodynamic lift from the fuselage during forward flight. A water ballast system increases the weight of the airship as soon as it lands on the surface of the water. Range is over 600 miles (966 km) at more than 80 mph (129 kph).



*Hemera concept in flight. Source, both graphics: Avalon Airships*





*Hemera concept after water landing (above) and dockside (below).  
Compare the relative scales of the dockside Hemera and the  
dockside EOS is a previous graphic.  
Source, both graphics: Avalon Airships*



## 4. Aether

This large, luxury airship was designed in the UK in 2013 by Mac (Telemachus) Byers as his final year university project for his Transport Design BA (Hons) degree at the University of Huddersfield, in West Yorkshire, UK. Avalon Airships explained that the mission of the Aether airship design exercise was to demonstrate the “sky cruise” concept and “capture the imagination of the public and kindle excitement and energy for the next generation of airship technology.”

The Aether airship incorporates the following design features:

- **Rigid hull:**  
The angular hull is designed for operating from the land and sits on four large fins (two forward and two aft) that carry the weight of the airship on the ground. Each fin houses two thrust-vectoring ducted fans. Aether is designed to operate without ground infrastructure.
- **All-electric, zero carbon emission propulsion system:**  
Eight powerful, thrust-vectoring, electric-powered, ducted fans provide thrust for cruise propulsion and for maneuvering at slow speed and hover. These fans can pivot in all directions, making this large airship highly maneuverable. The use of a distributed electric propulsion system and extensive sound insulation is expected to provide an almost silent flight experience for the passengers
- **Variable buoyancy ballast control system:**  
Aether implements a variable buoyancy system that allows the pilot to increase or decrease the weight to vehicle on demand to provide greater control and safety when landing and taking off. Weight is increased by compressing outside air and storing it in an onboard pressurized air ballast tank. Weight is decreased by venting the air ballast tank to the atmosphere. On the ground, the airship can be ballasted so it is heavier-than-air and stable on a windy day. For takeoff, the airship can be ballasted for nearly neutral buoyancy. During flight, buoyancy can be adjusted in coordination with aerodynamic lift to sustain flight at the desired altitude and speed.



- **Vertical takeoff and landing (VTOL):**  
With the variable buoyancy ballast control system and the eight thrust-vectoring ducted fans, Aether is capable of VTOL operations and hovering. The total dynamic propulsion power of the ducted fans will determine how light or heavy (relative to neutral buoyancy) Aether can be during VTOL operations.
- **Pressurized passenger volume:**  
A rather unique feature of this airship is the open design of the large passenger decks. This open design is enabled by pressurizing the passenger volume (main deck and upper deck) to maintain structural integrity. An airlock likely would be required to enter or exit the passenger volume. A similar design feature was employed in Hakan Colting's 2012 design of the Flying-Yacht.

You can watch the short video, “*Aether Cruise Experience*,” which provides an impressive animated view of a short walkthrough and cruise on the Aether airship here:

<https://www.youtube.com/watch?v=7LKgtdNFi-g>



*Rendering of Aether in flight. Source: Avalon Airships*



*Rendering of Aether in flight. The cockpit and crew compartment is at the nose of the hull.  
The two-level, glass-enclosed passenger compartment is under the hull.  
Source: <http://www.ifitshipitshere.com/>*



*Two views of the Aether about to land. Dust is rising from operation of the thrust-vectoring fans. Source, above & below: Avalon Airships*



*Aether on the ground, sitting on its four fins. The passengers have direct access from the main deck to the outside world.*

*Source: <http://www.ifitshipitshere.com/>*





*Bow view of Aether on the ground. Note that the two forward thrust-vectoring ducted fans have been rotated out. Source: Avalon Airships*



*Stern quarter view of Aether on the ground.  
Note that the aft thrust-vectoring ducted fans have been  
rotated in, flush with the aft fins.  
Source: <http://www.ifitshipitshere.com/>*

## **Main deck**

Floor to ceiling windows on the main deck and the upper deck give the maximum viewing experience to all passengers. While cruising at a low altitude all passengers will have incredible views of the scenery below.



*Large open area on the main deck encourages social interactions among guests.*



*View from the bow seating area.  
Source, both graphics: Avalon Airships*





*A large bar (above) & restaurant (below) are on the main deck.*



## Upper deck



*Upper deck walkway provides access to staterooms.  
Source, three graphics: Avalon Airships*



## Staterooms

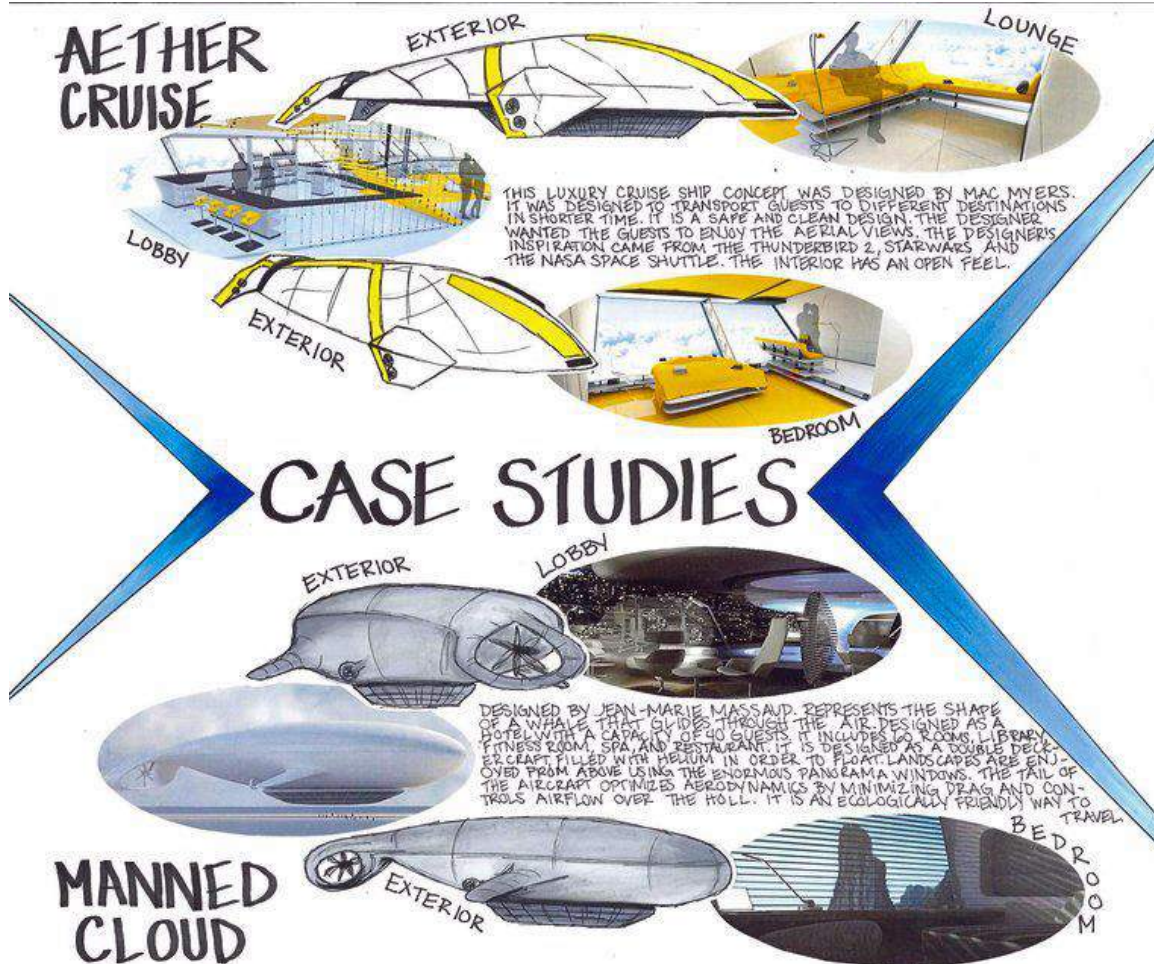


*Two views of a concept for a private stateroom with ensuite bathroom with shower. Source, both graphics: Avalon Airships*



The firm K+ Development and Design (KEYMAN + DESIGN), in Erie, PA, was founded in 2015 by Keyman Asefi to promote the concept of emotional interior architecture, which focuses on developing the most innovative environment for the occupants. The firm's website is here: <http://www.keyman-asefi.com/about#aboutkeymanasefi>

Among the case studies presented on this website is one for “future living,” which developed the following graphic that focuses on the design aesthetics of the Aether airship concept designed by Mac Byers and the Manned Cloud airship concept designed by Jean-Marie Massaud. Clearly, both of these airship concepts and their interior designs are in a class by themselves, not to be confused with most other modern, but utilitarian, heavy-lift airship designs.



Source: adapted from <http://www.keyman-asefi.com/mercyhurst-university>

## **The future of Aether**

Regarding the Aether design concept, Avalon Airships notes, “This is a concept designed to capture the public’s imagination, therefore the engineering and aerodynamics do not reflect a realistic proposition. However, this grand and exciting use case could be brought to life using a scaled version of the EOS platform capable of (flying) over 4,000 kilometers (2,485 miles).”

## **5. For more information**

### **EOS**

- Avalon’s EOS is a zero-emission, unmanned airship designed to cater to multiple industries,” designboom, 27 August 2018: <https://www.designboom.com/technology/avalon-eos-zero-emission-unmanned-airship-08-27-2018/>
- Tom Fish, “Airship POLICE CARS: Autonomous drones the future of emergency services,” Daily Star, 30 August 2018: <https://www.dailystar.co.uk/news/world-news/avalon-airships-autonomous-drones-future-16881530>

### **Aether**

- “The All-Electric Aether Luxury Airship by Mac Byers Could Usher In A New Era Of Air Travel,” If it’s hip, it’s here, September 2013: <https://ifitshipitshere.blogspot.com/2013/09/the-all-electric-aether-luxury-airship.html>
- “Aether Airship Concept Design,” Tomorrow’s World Today, 28 October 2020: <https://www.tomorrowstoday.com/2020/10/28/aether-airship-concept-design/>

### **Videos**

- “Aether cruise experience,” (2:12 minutes), Mac Byers, 19 June 2013: <https://www.youtube.com/watch?v=7LKgtdNFi-g>



- “Return of the Airships - Aether rotate” (a 360° horizontal rotation of a CAD model of the Aether airship), Facebook Watch, 4 December 2016:  
<https://m.facebook.com/ReturnoftheAirships/videos/aether-rotate/227500674353104/>

### **Other *Modern Airships* articles**

- *Modern Airships - Part 1*: <https://lynceans.org/all-posts/modern-airships-part-1/>
  - Lockheed Martin Aerocraft
- *Modern Airships - Part 2*: <https://lynceans.org/all-posts/modern-airships-part-2/>
  - Flying-Yacht (Hokan Colting)
- *Modern Airships - Part 3*: <https://lynceans.org/all-posts/modern-airships-part-3/>
  - Manned Cloud (Jean-Marie Massaud)