

# Hybrid Air Vehicles (HAV) - Airlander 10 & 50

Peter Lobner, updated 8 March 2022

## 1. Introduction

Development of commercial versions of the Airlander hybrid airship have been underway since 1999, when HAV acquired the rights to hybrid airship and blimp technologies from its predecessor firms, Advanced Technologies Group (ATG) and SkyCat Group Ltd.

The Airlander 10 prototype was the commercial reincarnation of the HAV-304 LEMV (Long Endurance Multi-Intelligence Vehicle) airship, which was delivered by the HAV / Northrop Grumman team to the US Army in 2012. After only one flight, the Army retired the HAV-304 and HAV purchased it back in 2015. After being refurbished, it served as the Airlander 10 prototype in a flight test program from 2016 to 2017, before it was damaged in a storm and retired in 2018.

This article addresses HAV's Airlander 10 and 50 hybrid airships that are under development and slated to enter service within the next decade. The HAV website is here:

<https://www.hybridairvehicles.com/about-us>

HAV's Facebook page here:

<https://www.facebook.com/pg/HybridAirVehicles/posts/>

Details on the ATG SkyCat, HAV-304 LEMV and the Airlander 10 prototype are provided in separate *Modern Airships* articles.

## 2. The production Airlander 10 design

The production Airlander 10 design has been refined over the past decade. The production design announced by HAV in January 2020 incorporated the following improvements over earlier designs:

- **Reduced drag:** Computational fluid dynamics (CFD) analysis has produced a refined aerodynamic shape. One recognizable feature is a rounder nose and an updated tail section.

- **Improved handling and reduced pilot workload:** A bow thruster improved low speed maneuverability. Lessons learned from the prototype flight test program and flight simulator have helped refine operating procedures and flight operating limits.
- **Improved forward propulsion:** Unducted flank propellers provide greater thrust at lower weight and drag than the ducted flank propellers on the prototype and earlier designs.
- **Larger cabin:** Configurable for various types of missions.
- **Improved maintainability:** Careful attention was given to the placement and design of airship equipment and systems to reduce the need for maintenance and simplify required maintenance.
- **Updated landing gear:** Fully-retractable air cushion landing system (ACLS) has lower drag in flight and increased ground clearance and stability after landing.



*Airlander 10, still with ducted flank propellers.  
Source: HAV (pre-2020)*



*Streamlined Airlander 10 in flight. Note the bow thruster, the unducted flank propeller supported from the gas envelope, the revised tail configuration and the fully-retracted ACLS. Source: HAV (2020)*

## General design characteristics of the production Airlander 10

Parameter	Production Airlander 10
Type	Semi-rigid, hybrid
Length, overall	98 m (320 ft) long, 5% longer than the prototype
Length, main cabin	46 m (151 ft) long, larger than most single-aisle commercial airliners. Main cabin is configurable and available in different lengths.
Width, overall	43.5 m (143 ft)
Height, overall	26 m (85 ft)
Gas envelope material	Vectran™, a high-performance multifilament yarn spun from liquid crystal polymer (LCP)
Gas envelope volume	38,000 m <sup>3</sup> (1,342,000 ft <sup>3</sup> )
Payload	Up to 10 metric tons (22 tons)
Propulsion	<ul style="list-style-type: none"> <li>• Base configuration: 4 x diesel engines, similar to the prototype</li> <li>• Hybrid intermediate (circa 2025): 2 x electric motors (flank propulsors) and 2 x diesel engines (stern propulsors)</li> <li>• All-electric (circa 2030): 4 x electric motors, zero carbon emissions</li> </ul>
Takeoff & landing distance	550 m (1,804 ft)
Air cushion landing system	Six air cushion landing “feet” extend for landing and are fully retracted in flight
Cruise speed	20 – 60 knots (37 - 111 kph)
Maximum altitude	6,096 m (20,000 ft)
Range	3,704 - 7,408 km (2,000 - 4,000 nautical miles) depending on mission
Maximum mission duration	5 days



*Airlander 10 with unducted flank propellers & six ACLS “legs” extended, two forward and four aft. Source: HAV (2020)*

The Airlander 10 can be configured for a variety of missions, including:

- Defense & security
- Maritime patrol & Coast Guard
- Logistics
- Luxury travel
- Corporate and private clients

The Airlander 10 will be able to accept new equipment and systems needed to transition to a future all-electric airship within the same basic airframe. HAV is working with Collins Aerospace and the University of Nottingham to transition an all-electric design by 2030.

The UK Aerospace Research and Technology Programme awarded HAV a £1 million grant for a project, named E-HAV1, to develop a prototype 500 kW (670.5 hp) electric propulsor to replace its diesel-powered forward engines. These electric propulsors will have twice the power of the 242 kW (325 hp) diesel engine-driven propulsors on the Airlander 10 prototype. The prototype electric motor built by Collins Aerospace in the UK completed its critical design review in July 2021 and is expected to be qualified for flight in 2023.

In August 2020, Tom Grundy, the firm's chief executive, announced that a GoFundMe campaign had raised £1.6 million, £630,000 more than it originally sought, to support completion of the first production Airlander 10. The company says it has letters of intent for 15 commercial airships and also is working to sell a military version.





*Renderings of an Airlander 10, still with ducted flank propellers, carrying a large external load (above) and cruising to a remote destination (below). Source, both graphics: HAV (pre-2020)*



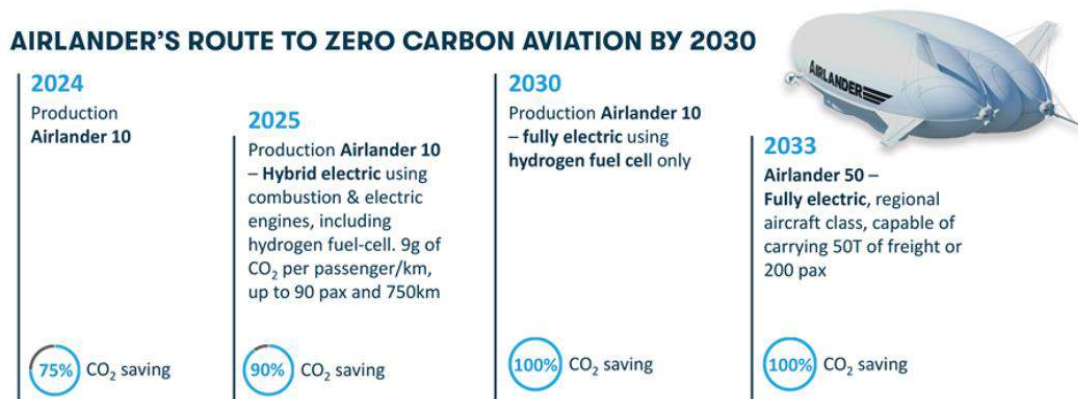
### 3. Airlander 10 type certification and production schedule

Type certification of the production Airlander 10 is being done with the European Aviation Safety Agency (EASA). HAV also intends to have the Airlander 10 type certified by the US Federal Aviation Administration (FAA), with the goal of having the Type Certified airship able to operated worldwide. Key certification milestones achieved with European civil aviation authorities are:

- Design Organization Approval from EASA was received in October 2018
- Production Organization Approval from the Civil Aviation Authority (CAA) also has been received

HAV reported that, “the prototype served its purpose as the world's first full-sized hybrid aircraft, providing us with the data we needed to move forward from prototype to production standard..... The full commercial model is expected to take to the skies with its first paying passengers in the early 2020s.”

On their Facebook page, HAV posted the following schedule for development and production of their Airlander hybrid airships. The initial production Airlander 10 will be diesel powered, with production transitioning to all-electric airships by 2030.



*Source: HAV*

After Type Certification, HAV expects that production will gradually increase to their factory capacity of 12 aircraft per year.

## 4. Customized Airlander 10 interior design concepts

At the July 2018 Farnborough Air Show, HAV unveiled the basic design of the passenger cabin for Airlander 10, which is capable of carrying up to 16 passengers with overnight accommodations on three-day, 2,000 nautical mile (3,704 km) “expeditions”.

In this section, we’ll take a look at three luxury interior design concepts that have been developed for the production Airlander 10.

### **Design Q interior design concept**

The UK firm Design Q has developed an interior concept for the Airlander 10 that tailors the airship for “luxury expeditionary tourism.” The passenger accommodations are described as follows:

“Passengers on Airlander will have luxurious private en-suite bedrooms and will be able to enjoy horizon-to-horizon views in the aircraft’s extensive Infinity Lounge. The Altitude Bar will offer drinks with the ultimate view, while 18 guests can enjoy fine dining in the skies.”

“Airlander 10’s interior is unusually spacious – the (46 m long) cabin is larger than most single-aisle aircraft, such as the A320. This space allowed the team at Design Q to use their extensive experience of luxury spaces to create something full of unique features that will set new standards for excellence in air travel.”

The following Design Q graphics will give you an idea of what is possible in a “luxury expedition airship” that could be certified for commercial operations in the mid-2020s.

You’ll find more information, including a short video tour of the Airlander 10 passenger cabin, on the Design Q website here:

<https://www.designq.co.uk/airlander-10>









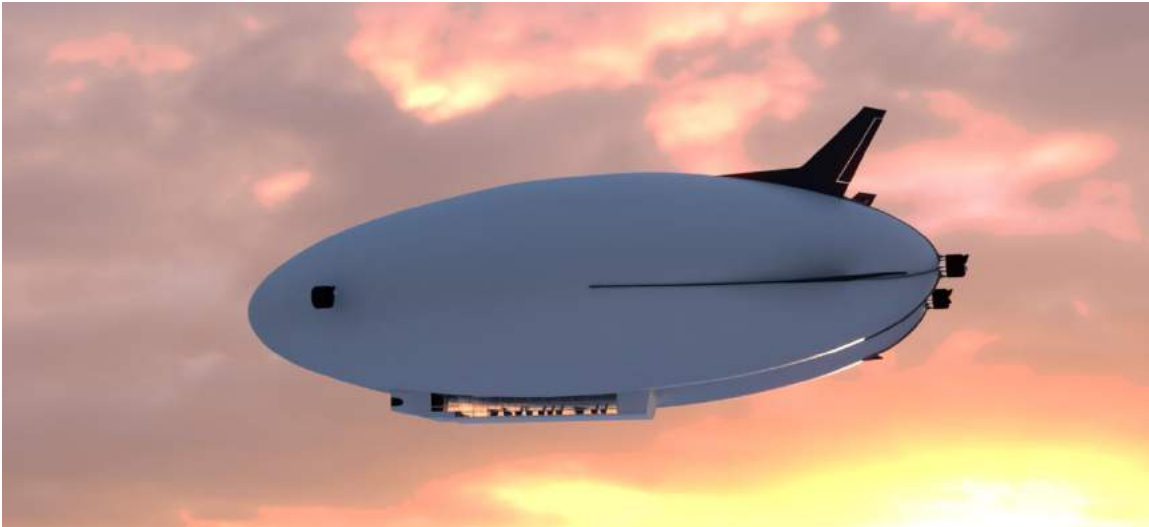
## Vesper Rising interior design concept

In 2017, the firm Vesper Rising announced plans to use an Airlander 10 for tourist flights in Las Vegas, NV and over the Grand Canyon. The general configuration of their planned day-tourist version of the Airlander 10, including views of the proposed interior are shown in the following graphics from the Vesper Rising website here: <https://vesperrising.com/about-us>





Vesper Rising is seeking capital for this venture and likely has not placed a firm order for an Airlander 10.



*Rendering of the Vesper Rising Airlander 10 configured for day tours.  
Source, three renderings: Vesper Rising (2017)*

### **HAV interior design concept**

In May 2021, HAV released the following renderings of a cabin interior that appears to be configured for luxury day tours.

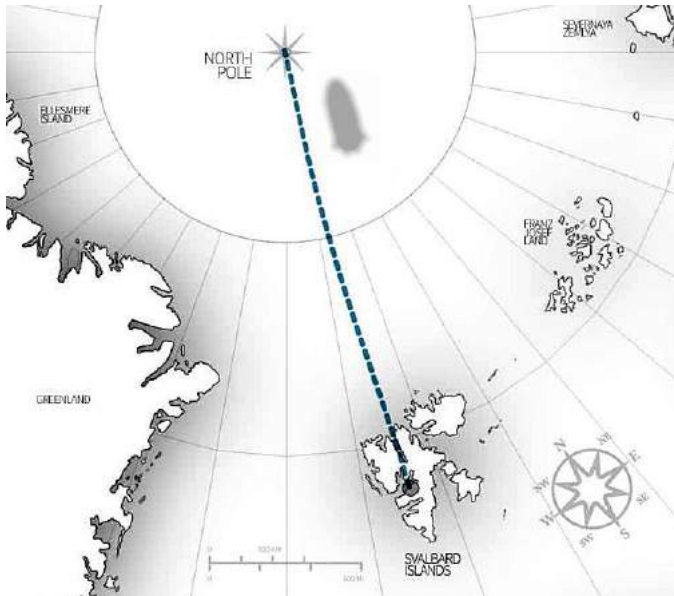




*Source, three renderings: HAV via CNN Travel (May 2021)*



## 5. OceanSky Cruises “expedition” to the North Pole



One expedition already being offered by Swedish company OceanSky Cruises is a 38-hour luxury round-trip airship cruise to the North Pole from Svalbard Island, with lunch on the ice at the pole. They advertise this trip as, “An expedition to the North Pole without a footprint.” The airship will be outfitted with the DesignQ interior with eight cabins.

*Source: OceanSky Cruises*

Details are available on the OceanSky Cruises website here:  
<https://www.oceanskycruises.com/north-pole-expedition/>



*Source: OceanSky Cruises*



*Source, both graphics: OceanSky Cruises*



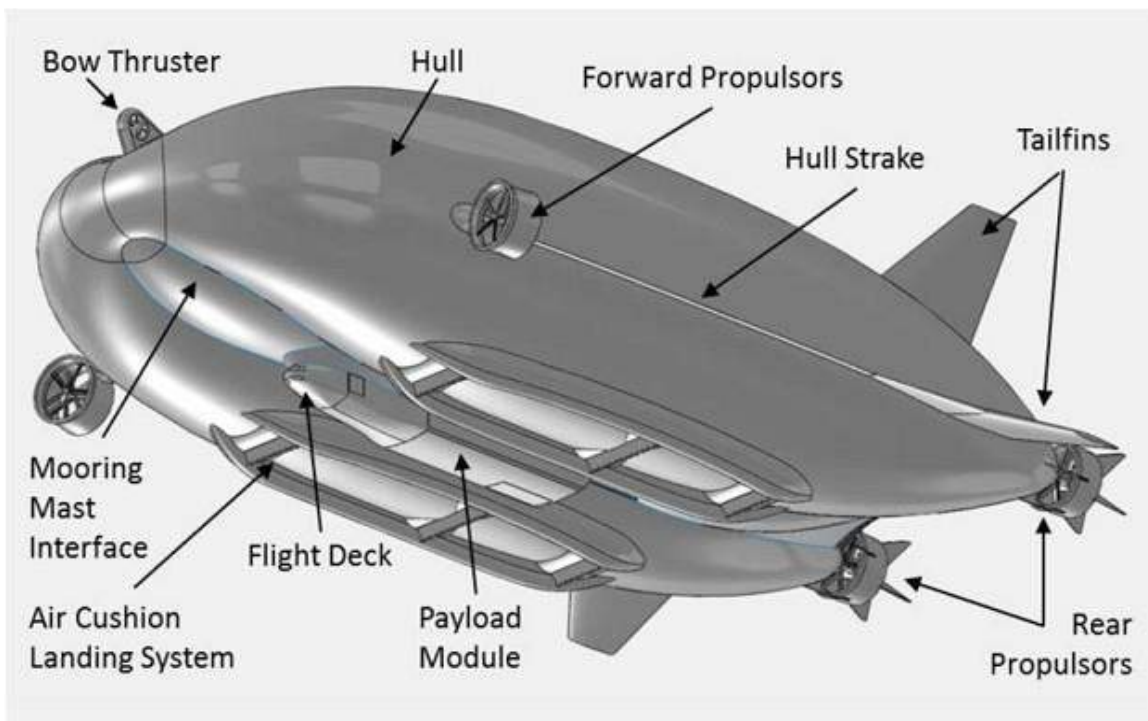


## 6. The Airlander 50 airship

HAV is developing a larger hybrid airship known as Airlander 50. The earliest version is expected to be diesel-powered, like the Airlander 10 prototype and the initial production Airlander 10. HAV plans to certify an all-electric Airlander 50 by 2033.

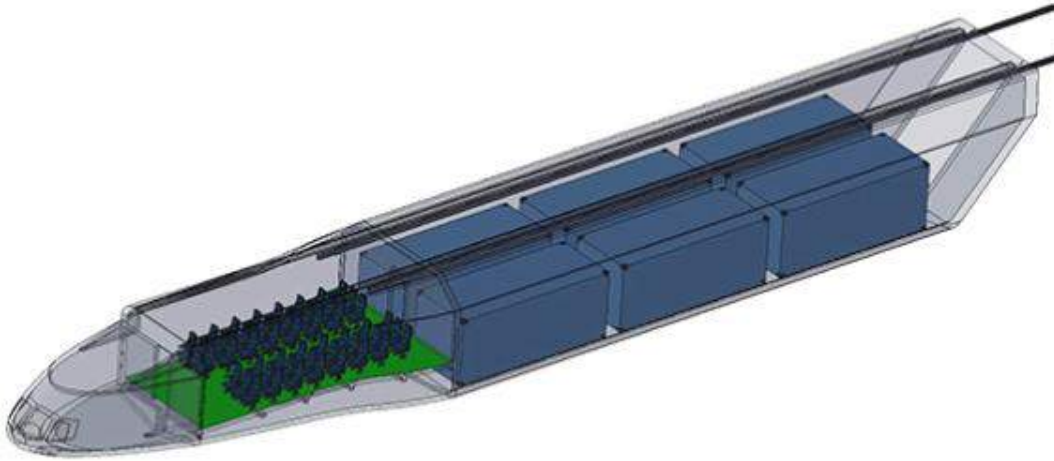


*Early Airlander 50 concept drawing. Source: HAV*



*Early Airlander 50 general arrangement drawing. Source: HAV*

The central payload module has a 30 m (98 ft) internal payload bay capable of carrying up to 50 metric tons (55 tons) of cargo in six 20-foot ISO containers, as shown in the following graphic.



*Airlander 50 central payload module design concept configured to carry six 20-foot ISO containers and 48 passengers. Source: HAV*

The payload module can carry up to 200 passengers in an all-passenger configuration. Range with maximum payload will be 2,200 km (1,367 miles).

## **7. Beyond the Airlander 50**

The basic Airlander hybrid airship design is scaled to larger sizes than the current Airlander 10 and 50 designs. HAV reports that “The future will see an Airlander 200, with the ability to fly 200 (metric) tons of freight long distances.”

## **8. For more information**

- Sitara Maruf, “Largest Airship Gets Production Approval,” LTA Flight Magazine, 17 January 2019: <http://www.ltaflightmagazine.com/largest-airship-gets-production-approval/>
- “Airlander 10: £1m grant for craft to go 'all-electric',” BBC News, 25 April 2019: <https://www.bbc.com/news/uk-england-beds-bucks-herts-48049536>

- “Farnborough Airshow: Airlander to offer 'luxury expeditions',” BBC News, 18 July 2019: <https://www.bbc.com/news/uk-england-beds-bucks-herts-44872208>
- Henty Mance, “Boarding soon: the five-star airship bound for the North Pole,” Financial Times, 11 October 2019: <https://www.ft.com/content/f34a3a56-e8fd-11e9-a240-3b065ef5fc55>
- “Airlander 10: World's longest aircraft to get longer,” BBC News, 11 January 2020: <https://www.bbc.com/news/uk-england-beds-bucks-herts-51032891>
- Rima Sabina Aouf, “Refined Airlander 10 design set to go into production,” de zeen, 24 January 2020: <https://www.dezeen.com/2020/01/24/airlander-10-design/>
- Rupert Neate, “UK firm flying high as eco-friendly airship project gathers pace,” The Guardian, 29 August 2020: <https://www.theguardian.com/business/2020/aug/29/uk-firm-flying-high-as-eco-friendly-airship-project-gathers-pace>
- Andrea Steffen, “Airlander 10: An Airship That Produces 75% Fewer Emissions,” Intelligent Living, 4 September 2020: <https://www.intelligentliving.co/airlander-10-airship/>
- Jack Guy, “Airship to offer low-carbon flights with floor-to-ceiling windows,” CNN Travel, 27 May 2021: <https://www.cnn.com/travel/article/hybrid-air-vehicles-airship-scli-intl-gbr/index.html>
- Ben Sampson, “Electric motor for Airlander 10 airship passes design review,” Aerospace Testing International, 6 July 2021: <https://www.aerospacetestinginternational.com/news/electric-hybrid/electric-motor-for-airlander-10-airship-passes-design-review.html>

## **Video**

- “How Airships Could Overcome a Century of Failure,” Bloomberg, 2 March 2022: <https://www.bloomberg.com/news/videos/2022-03-02/how-airships-could-overcome-a-century-of-failure-video>



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

- *Modern Airships - Part 1:* <https://lynceans.org/all-posts/modern-airships-part-1/>
  - Hybrid Air Vehicles (HAV) - Airlander 10 prototype
- *Modern Airships - Part 2:* <https://lynceans.org/all-posts/modern-airships-part-2/>
- *Modern Airships - Part 3:* <https://lynceans.org/all-posts/modern-airships-part-3/>