AeroVehicles, Inc. (AVI) Aerocat

Peter Lobner, Updated 3 April 2021

1. Introduction

AeroVehicles Inc. (AVI) originally started in California in 2002. In 2014, AVI registered AeroVehicles Inc. Sucursal Extranjera in San Luis, Argentina and then Aerovehicles Paraguay S.A. was opened in 2019 with manufacturing and product support to be located in Oviedo, Paraguay.

AeroVehicles currently offers a range of aviation-related products and services. Their products include light, fixed-wing intelligence, surveillance and reconnaissance (ISR) aircraft and aerostats. Their services are focused on remote sensing applications (LIDAR, geomagnetic mapping, multi- and hyper-spectral imaging, infrared imaging, and synthetic aperture radar imaging) and related systems integration services.

AeroVehicles also is developing a family of large, rigid, hybrid airships that are capable of vertical takeoff and landing (VTOL), can operate from small sites, and can be configured to perform a variety of civilian or military missions, such as:

- Cargo transport
- Passenger transport
- Tourism / advertising
- Border patrol
- Long-endurance ISR platform
- Search & rescue
- Disaster relief / humanitarian aid / mobile medical facility
- Pipeline patrol
- Land survey and exploration
- Combating and controlling wild fires

The AeroVehicles website is here: http://www.aerovehicles.net

2. AVI's rigid airships

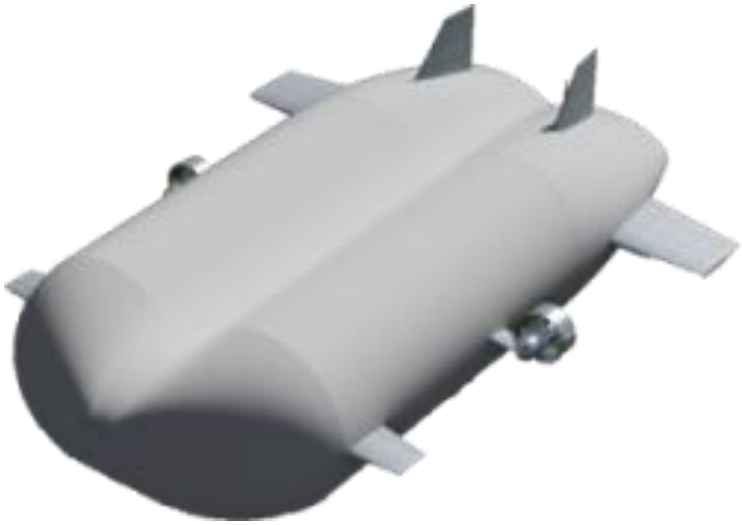
AeroVehicles began its airship development program with a sub-scale concept demonstrator that could carry a 500 kg (1,102 lb) payload. Their planned airship product line includes the unmanned Minicat and the much larger R12 and R40 airships. Basic characteristics of these airships are summarized in the following table. The airships are described in more detail in the following sections.

Dimensions	**Minicat**	**R12**	**R40**
Length	43 m / 141 ft	90 m / 295 ft	116 m / 381 ft
Width		45 m / 148 ft	61 m / 200 ft
Height		21 m / 69 ft	29.5 m / 97 ft
Payload bay volume		1,028 m^3 / 36,303 ft^3	1,888 m^3 / 66,674 ft^3
Payload	6 - 10 metric tons 6.6 - 11 tons	20 metric tons / 22 tons	40 metric tons / 44 tons
Range @ max payload		3,000 km / 1,864 miles	3,000 km / 1,864 miles
Max altitude @ max payload		2,500 m / 8,202 ft	2,500 m / 8,202 ft
Cruise speed @ max payload		150 kph / 93 mph	160 kph / 99 mph
Features	**Minicat**	**R12**	**R40**
VTOL	Yes	Yes	Yes
STOL		Yes	Yes
Variable buoyancy	Yes	Yes	Yes
Carry external sling load		Yes	Yes
Retractable ACLS		Yes, 4 pads	Yes, 3 pads
Anti- & de-ice systems	Yes	Yes	Yes
Full glass cockpit	Unmanned	Yes	Yes
IFR capable	Unmanned	Yes	Yes
Fly-by-wire		Yes	Yes
Roll-on / roll-off cargo capability		Yes	Yes
Endurance	35 – 48 hours	3 – 5 days	

You can view a 2010 AeroVehicles video with an overview of their Aerocat airships here:
https://www.youtube.com/watch?v=tdXeGSjibFw

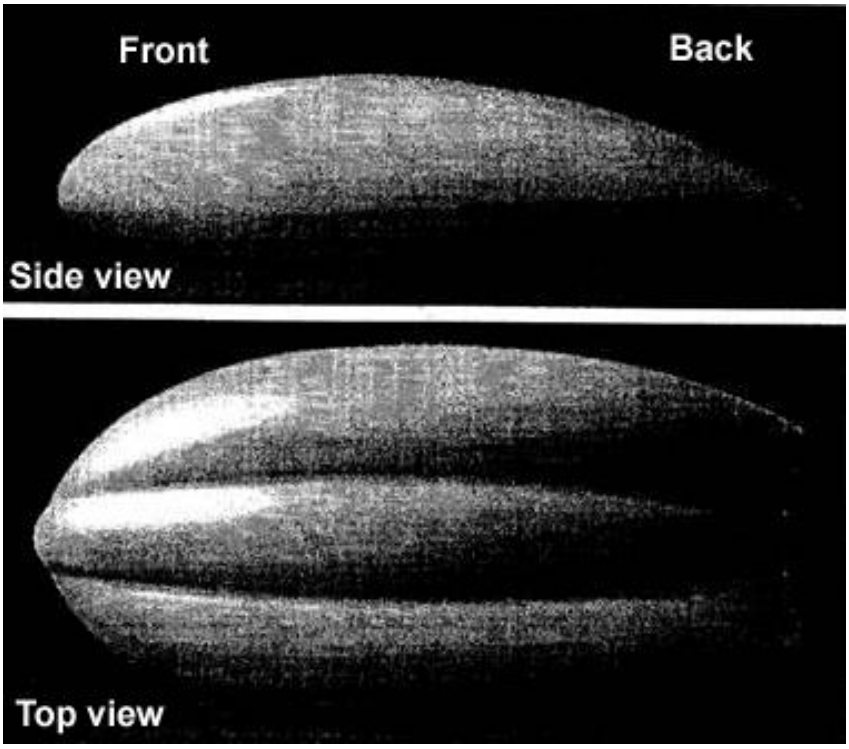
3. The Minicat

AeroVehicles is developing a 43 meter (141 ft) long, rigid, hybrid unmanned airship named Minicat, which is intended to serve as a prototype of the larger Aerocat-series of airships. The Minicat also can be configured for a variety of operational missions and is particularly well-suited for long-duration ISR missions. Early concept drawings of the Minicat are shown below.



Early Minicat configuration. Source: AeroVehicles

The design for the Minicat's hull has evolved and it now has a lifting-body hull shape similar to larger R12 and R40 Aerocats, as shown in the following figures.



Minicat & Aerocat hull shape, side view (top) and top view (below). Source: AeroVehicles, "ModelCenter™Model for the MiniCat 2002"

Minicat has the same type of variable buoyancy control system found on the larger AeroCat airships. Buoyancy inflight and on the ground is managed with a helium compression system. Buoyancy is decreased by pumping some helium from the atmospheric pressure lifting gas cells into small high-pressure storage vessels onboard the airship. When more buoyancy is required, stored helium is vented from the high-pressure storage vessels back into the lifting gas cells. With this system, the Minicat is capable of vertical takeoff and landing (VTOL). This buoyancy control process is similar to the Control of Static Heaviness (COSH) process adopted by Worldwide Aeros Corp. (Aeros) on their variable buoyancy Aeroscraft airships.

The Minicat airship is being designed to carry a payload of 6 to 10 metric tons (6.6 to 11 short tons) and conduct long-duration (35 to 48 hour) autonomous missions.

You'll find more information on Minicat here:
http://www.aerovehicles.net/product/minicat/

4. The R12 airship

As a hybrid airship, the Aerocat's total lift is the sum of the aerostatic lift from buoyant helium plus the dynamic lift from the vectored thrust propulsion system and the aerodynamic lift from the shaped fuselage moving through the air. Helium provides about 60% of total lift with 40% coming from dynamic lift.

The Aerocat R12 is designed to carry 20 metric tons (44,092 pounds) of cargo 3,000 km (1,862 miles) at a maximum altitude of 2,500 meters (8,202 feet). Cruise speed will be 150 kph (84 knots).

Aerocat R12 concept shown in flight, with ACLS retracted. Source: AeroVehicles.

When fully loaded the Aerocat R12 is heavier than air. AeroVehicles reports that the Aerocat R12 will have both short takeoff and landing (STOL) and vertical takeoff and landing (VTOL) capabilities. Aerocat has the same variable buoyancy control system described previously for the Minicat. This helium compression system is used to manage buoyancy inflight and on the ground.

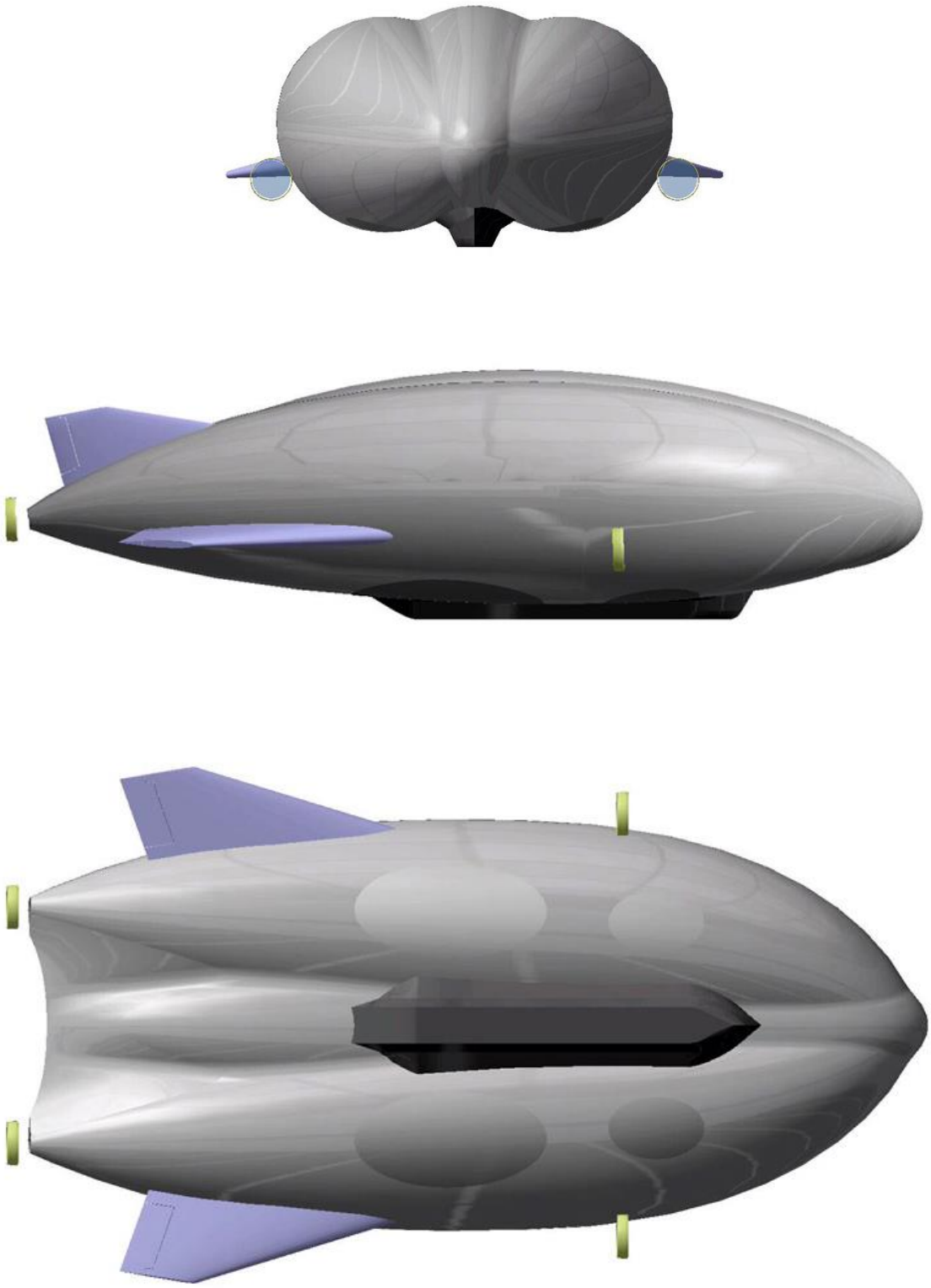
The VTOL capability likely is available only when the airship is lightly loaded and the combination of helium lift and vectored thrust is sufficient to lift the airship vertically. After a vertical takeoff, the vectored thrust system transitions the airship to horizontal flight where aerodynamic lift comes into play as airspeed builds. In cruise flight, the vectored thrust system is delivering thrust for propulsion and fuselage and wings are providing aerodynamic lift.

The Aerocat makes its short takeoff and landing (STOL) runs on an air cushion landing system (ACLS). Functionally, this system should be quite similar to the ALCS demonstrated on the Lockheed Martin P-971 and Aeroscraft Dragon Dream airships. In the “lift” mode, the ALCS enables the airship to move on a cushion of air over uneven terrain, ice and water. In the “suction” mode, the ALCS holds the airship to the ground, which can be an important feature for stabilizing the hybrid airship during a load exchange on the ground (i.e., off-loading heavy cargo) or in strong winds.

For example, after heavy cargo has been unloaded on the ground, ALCS suction may be needed to temporarily stabilize the airship while the helium pressurization system adjusts for buoyancy or new cargo and/or additional ballast is loaded to restore airship gross weight and maintain net buoyancy in a prescribed range.

Managing net lift during a load exchange from a hovering airship with a sling load (i.e., cargo suspended under the airship) is a more difficult proposition. AeroVehicles claims that the Aerocat R12 is capable of handling a sling load, but due to the known handling characteristics of lighter-than-air aircraft, AVI does not recommend this type of operation except in perfect conditions and where precision is not required. Buoyancy management during this type of load exchange is difficult as helium compression takes time based on the weight of the sling load released or picked up.

Rendering of an R12 in flight, rear quarter view.
Source: AeroVehicles



Bow view (top), profile view (middle) and plan view from below showing the centerline gondola (below). Source: AeroVehicles

Aerocat R12 concept shown in flight, with ACLS retracted. Source: AeroVehicles

Rear quarter view of the Aerocat R12 concept shown on the ground, with ACLS extended. Source: AeroVehicles.

The payload bay can be configured to carry up to 105 passengers in 5-abreast seating.

Above: Cabin configured for high-density seating.
Below: Lower density seating alternative.

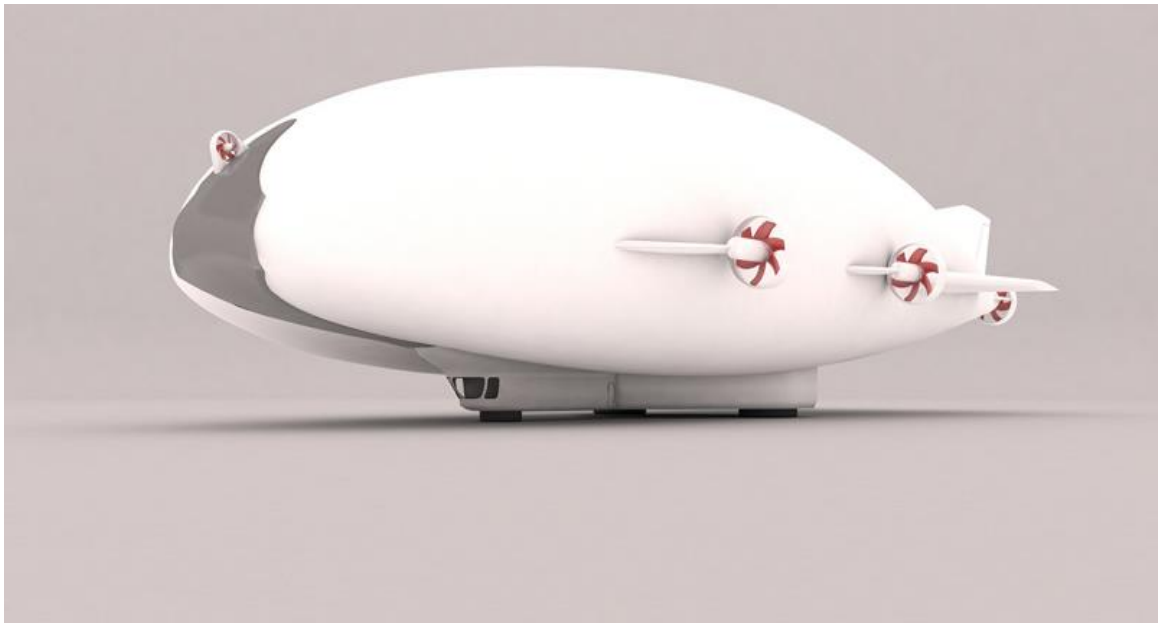
Source, three graphics: AeroVehicles

R12 water landing, configured for marine search & rescue. Source, both graphics: AeroVehicles

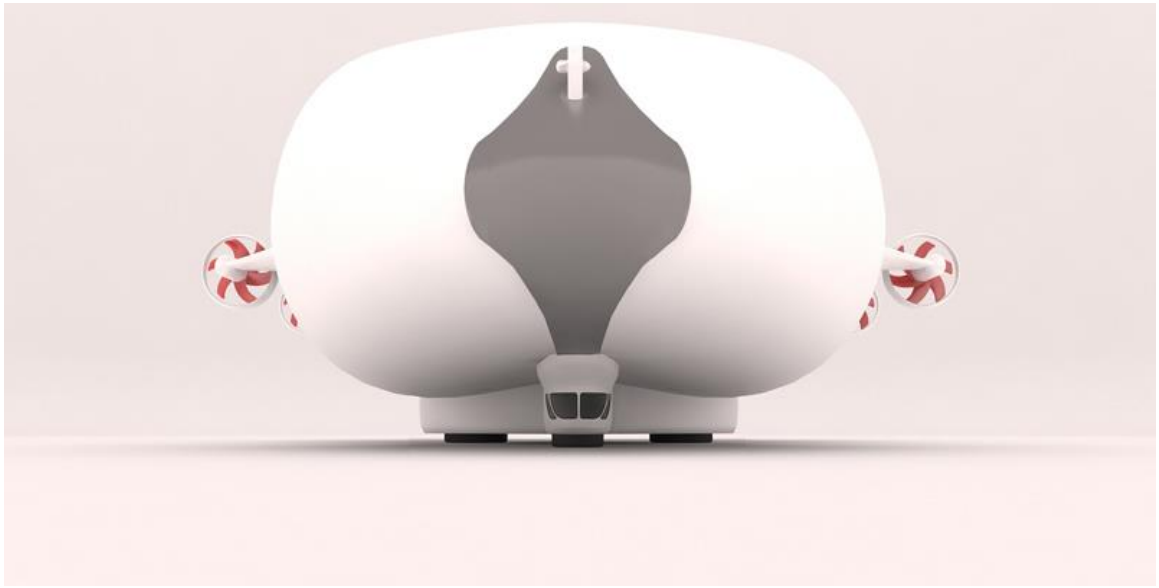
R12 configured for disaster relief / humanitarian aid / mobile medical facility. Source, both graphics: AeroVehicles

5. The R40 airship

The R40 is the largest airship in the AeroVehicles product line. Major external distinguishing features are the two flank-mounted propulsors on each side plus the stern propulsors (R12 has one flank-mounted propulsor on each side plus the stern propulsors), the larger triangular cargo bay (R12 has a linear cargo bay along the centerline), and three retractable ACLS pads (R12 has four).

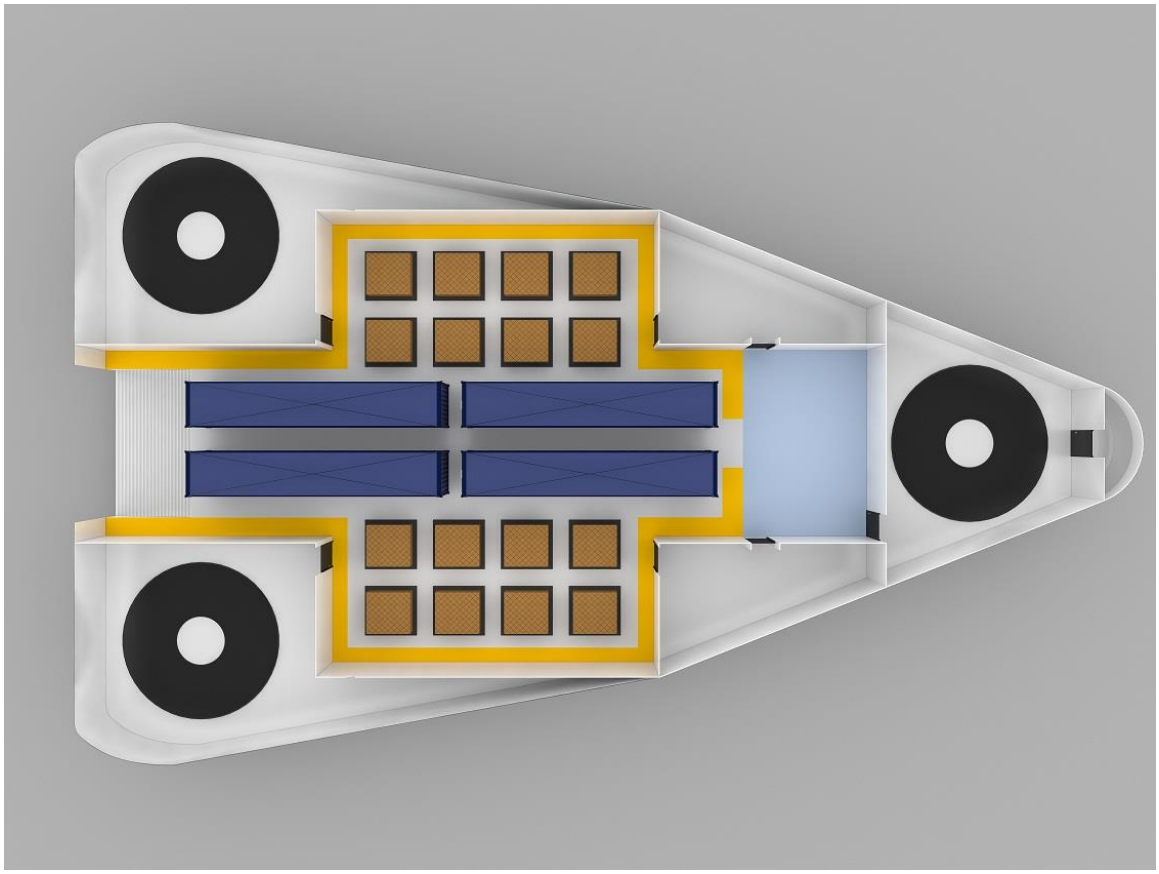


Aerocat R40, bow quarter view. Source: AeroVehicles



Aerocat R40, bow view. Source: AeroVehicles

AeroVehicles describes their R40 airship as follows: “Per client requests, the Aerocat R40 has been designed to operate in all environments from arctic regions to arid deserts. The envelope structure includes a composite nosecone and an internal ‘rigid’ structure to give strength to the envelope. This rigid structure also removes the upper surface lobes where ice and snow accumulate and the nosecone protects the hull material from blowing sand or ice particles. Aerocat’s design includes three separate anti- and de-icing systems necessary to operate in arctic regions. Without these features a cargo airship’s ability to operate in hostile environments is greatly reduced. Additionally, the Aerocat R40’s payload bay has 1,888 cubic meters of clear area with a 4 meter overhead clearance for cargo. Combined with the ability to transport 55 metric tons 900 nautical miles and the R40 is an extremely efficient and versatile transport aircraft.”



Aerocat R40 cargo bay design. The three black circles are the housings for the retractable ACLS pads. The cockpit is at the extreme right. Source: AeroVehicles

6. Beyond the R12 and R40

The Aerocat R12 and R40 designs can be scaled up to meet emerging customer needs. AeroVehicles anticipates that airships capable of handling 350 – 500 tons of cargo will be requested by some future customers.