

Buoyant Aero – unmanned hybrid cargo airship

Peter Lobner, 11 February 2022

1. Introduction

Buoyant Aero was founded in San Francisco, CA in 2020 by two MIT hardware engineers, Ben Claman and Joe Figura. The firm's primary goal is to develop unmanned, electrically-powered, semi-rigid cargo airships targeted at the "middle mile cargo logistics" market, which is the part of the supply chain where goods are shipped from a supplier's warehouse to a retailer's warehouse or store.



BUOYANT

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*Buoyant Aero's 20 ft (6.1 m) subscale demonstrator in flight.
Source: Buoyant Aero*

Buoyant Aero explained their market focus: “We started off with a last-mile delivery concept (“Amazon box to the house”). But in conversations with logistics providers, we found a recurring problem transporting 300 - 600 lb (136 – 272 kg) shipments between warehouses or between airports. Using drones to deliver to houses is operationally complex, and the path to doing so at scale is still murky. But with a 650 lb (295 kg) payload, our drone can fit neatly into existing supply chains in the middle mile. This makes our operations much simpler and should allow us to get to market relatively quickly with a few aircraft on a few routes.”

As of late 2021, Buoyant has built and flown four prototype airships. In 2021, the firm successfully flight tested a 20 ft (6.1 m) version of their twin-hull hybrid airship and demonstrated the pickup and delivery of small payloads. Buoyant Aero is designing a full-scale version of their cargo airship, which will have a payload capacity of up to 650 lb (295 kg). The firm plans to build its own airship manufacturing facility and may conduct the first flight of its full-scale airship as early as 2022. They’re developing this airship to eventually be able to operate autonomously.

The company’s website is here: <https://www.buoyant.aero>

2. Buoyant Aero’s 20 ft twin-hull demonstrator

Buoyant Aero is developing electrically-powered, semi-buoyant, hybrid drone airships in which 70% of the lift is aerostatic lift from the helium in the gas envelope. During takeoff, landing and hover, the remaining 30% of the lift is dynamic lift from two tilt-rotor propulsors that are installed under the fabric gas envelopes. In forward flight, aerodynamic lift from the gas envelope replaces the dynamic lift from tilt-rotors, allowing them to be moved to the horizontal position for propulsion. The airship has two small propellers installed in the lower tail stabilizers. These provide lateral force for precisely positioning the airship during low-speed flight and during hovering.

The hybrid design implemented in Buoyant Aero’s airship can eliminate the need to exchange ballast during a load exchange (pickup or delivery of cargo). For example, during a load pickup, the airship can approach the pickup site in a “light” condition, with the tilt-

rotor propulsors positioned to deliver a downforce. The airship can hover in this condition and its sling can be connected to the cargo. Once the cargo is connected, the tilt-rotors can be repositioned to produce an up force and the now “heavy” airship can fly off to the delivery site.

At the delivery site, the “heavy” airship approaches with the tilt-rotors generating an up force that is gradually reduced until the cargo is on the ground and the load is disconnected from the cargo sling. It may be necessary to move the tilt rotors to generate a downforce to release the load. Once released, the cargo sling can be retrieved and the airship can fly off to its next destination, with the tilt-rotors adjusted as needed for controlled flight at the airship’s unloaded weight.

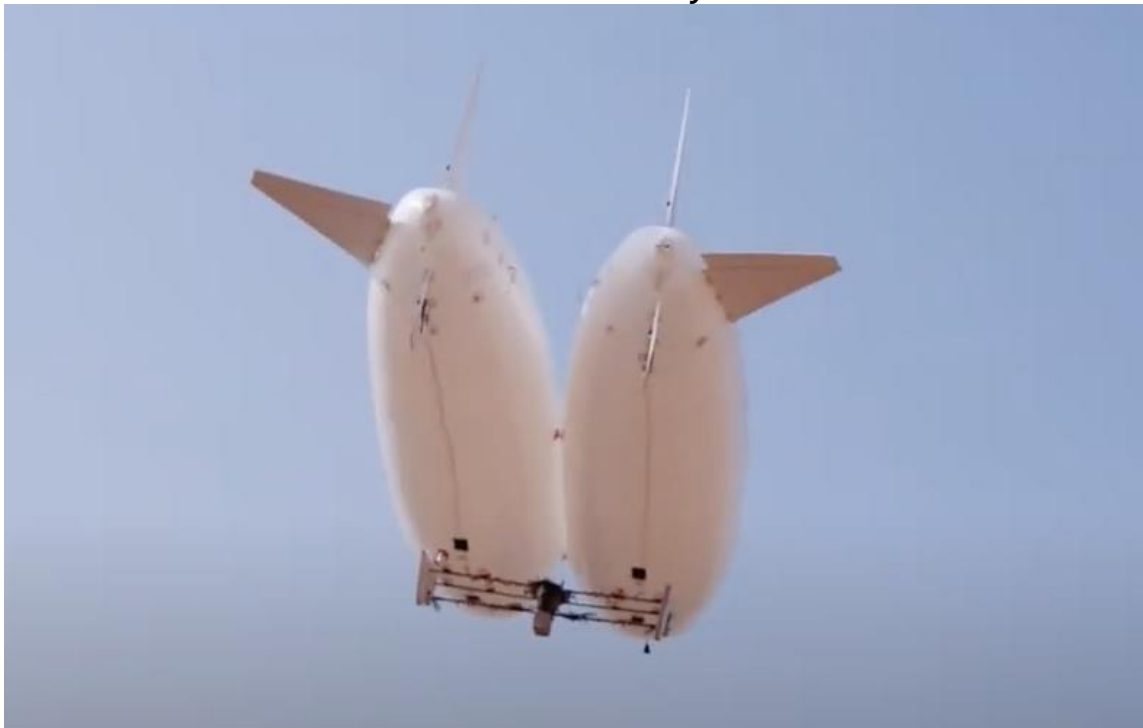
The 20 foot (6.1 m) subscale demonstrator was able to operate at speeds up to 35 mph (56 kph) and handle 10 pound (4.5 kg) payloads.



*Buoyant Aero’s subscale demonstrator on the ground.
Source: Buoyant Aero*



*Buoyant Aero's subscale demonstrator executes a steep departure.
Source: Screenshot from Buoyant Aero video*



Buoyant Aero's subscale demonstrator flying overhead and showing off the twin hull design. Source: Screenshot from Buoyant Aero video



Buoyant Aero's subscale demonstrator approaching and making a cargo delivery. Source: Screenshot from Buoyant Aero video

3. The production airship

The basic design of the larger, electrically-powered, production airship is expected to be similar to the twin-hull subscale demonstrator. The 60 ft (18.3 m) production airship will be designed to operate at higher speeds, about 60 mph (96.6 kph), and carry a much larger payload, up to 650 lb (294 kg). Cargo will be carried externally as a sling load.

Initially, range on battery electric power is expected to be about 250 miles (402 km). Future vehicles will have hydrogen fuel cells, which will support longer-range missions.

The airship will be designed to fly autonomously and can take off and land in inclement weather, using centimeter accuracy global positioning system (GPS) for approaches.

Operating costs are expected to be half the operating cost of a Cessna 182 small fixed-wing aircraft.

4. Plans for FAA licensing

The subscale airship has been operating under an FAA Part 107 license. Before the company can start serving customers, it will need to achieve two certifications: a type certification verifying the airworthiness of the airship and operator certifications for the groups flying them.

Buoyant Aero plans to establish two pilot training programs: one using the subscale prototype and starting in late 2021, and the second using a full-scale ship and starting in late 2022. These training programs are designed for the logistics/parcel delivery companies that will be the airship operators.

5. For more information

- “Launch HN: Buoyant (YC S21) – Blimp drones for air freight,” Y Hacker News, 23 August 2021: <https://news.ycombinator.com/item?id=28278515>
- Aria Alamalhodaie , “YC grad Buoyant wants to solve middle-mile delivery with cargo airships,” TechCrunch, 27 August 2021: <https://techcrunch.com/2021/08/27/yc-grad-buoyant-wants-to-solve-middle-mile-delivery-with-cargo-airships/>
- Ryan Flowers, “Aerodynamic Buoyant Blimp Bidges Into Low Cost Cargo Commerce,” Hackaday, 9 September 2021: <https://hackaday.com/2021/09/09/aerodynamic-buoyant-blimp-bidges-into-low-cost-cargo-commerce/>

Video

- “Buoyant Aero MK4 Test Flights at Byron Airport,” (1:19 minutes), Buoyant Aero, 26 August 2021: <https://www.youtube.com/watch?v=S-eND8-AZFI>

Other *Modern Airships* articles

- *Modern Airships - Part 1*: <https://lynceans.org/all-posts/modern-airships-part-1/>
- *Modern Airships - Part 2*: <https://lynceans.org/all-posts/modern-airships-part-2/>
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