

Cloudline – autonomous cargo blimp

Peter Lobner, 5 August 2023

1. Introduction

Cloudline was co-founded in 2017 by Spencer Horne in Cape Town, South Africa with the goal of building a network of zero-carbon emission, lighter-than-air (LTA) unmanned aerial vehicles (UAVs) that would redefine the way essential goods and services are delivered to people without direct access to roads and runways. Their solution is to create a fleet of solar-powered, all-electric, non-rigid, UAV blimps that target the “middle-mile” in logistics supply chains between central distribution points and local distribution points and even the “last mile” to some end-users. On the return journey, the airships can carry products from local vendors for distribution to customers that, until now, have been beyond their reach, thereby providing an entry point to the worldwide market.



*Rendering of an early Cloudline UAV blimp concept.
Source: Cloudline via Airbus Bizlab (2018)*

Cloudline reported, “Prior to the pandemic, we set out to develop a solution that had active cold-chain capabilities, given UNICEF’s needs around vaccine distribution. COVID-19 has raised broader

awareness of the need for universal vaccine access and its associated logistical challenges. The past year (2020) has made us place greater emphasis on our work for unbroken cold-chain delivery. Through our work with UNICEF Innovation Fund's open source advisers, we designed our cooler for broad compatibility and widespread use in aerial delivery.....”

Cloudline first flew a “pre-production” prototype UAV blimp in 2018 and, in 2022, they are flying a larger prototype of what is expected to become their production model.

Their first production UAV blimp will be able to carry cargo weighing up to 20 kg (44 lb). Cloudline projects that these blimps will enable order-of-magnitude cost savings over conventional aerial solutions (i.e., light cargo planes and helicopters) for delivering similar cargo at ranges to about 200 km (124 miles).

In May 2022, Cloudline reported that they have received test flight permissions from three countries and are working with initial customers to begin operations in 2023.

The Cloudline website is here: <https://www.flycloudline.com>

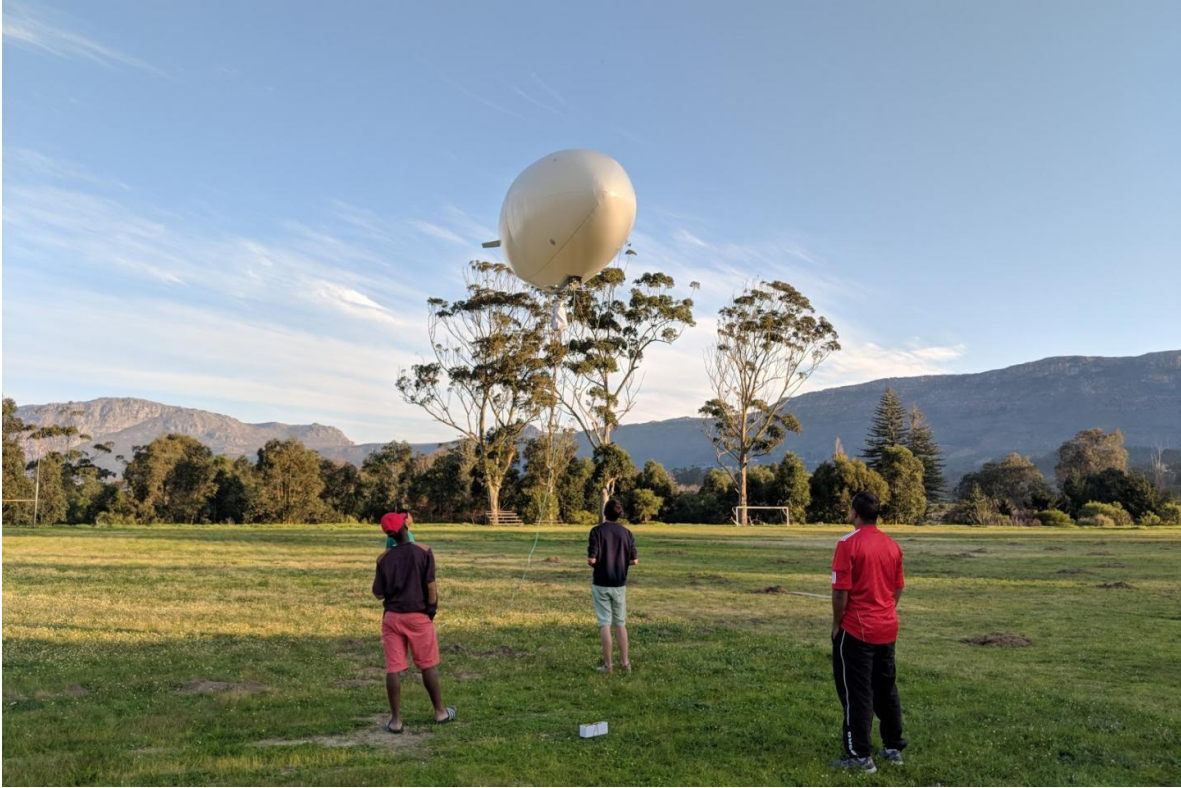
I am grateful to Cloudline for their thoughtful input for this article.

2. The pre-production UAV blimp

Supported in part by the UNICEF Innovation Fund, Cloudline built one “pre-production” UAV blimp, which made its first flight in 2018. The blimp’s elliptical gas envelope has a load-carrying rail along the bottom with attachment points for:

- A small gondola housing electric power, flight control and communications equipment
- Short transverse arms supporting two shrouded, electric motor-driven, thrust vectoring main propellers
- One or more small cargo containers

The cruciform tail fins are fixed and the lower fin houses a small lateral thruster.



*Pre-production Cloudline UAV blimp.
Source, two photos: Cloudline*



Pre-production UAV blimp flying with a cargo container attached.



(L) Bow view showing the two thrust vectoring main shrouded propellers and a suspended cargo container.

(R) Stern view showing the cruciform tail fin configuration and the lateral thruster in the lower fin for high maneuverability at low speed.



*Source, three photos:
Screenshots from Cloudline video
(2019)*

3. The production UAV blimp

A larger and more refined production prototype UAV blimp currently (mid-2022) is featured on the Cloudline website.

This model retains the quiet VTOL operating characteristics demonstrated by the pre-production prototype, making it suitable for operating from small sites, even in an urban or sensitive environment. The airship is highly visible in flight, thereby reducing the risk of UAV airship operations in airspace shared with manned aircraft.

Cloudline reports that their UAV blimp offers the following significant operating advantages:

- Operating costs of the UAV blimp will be an order-of-magnitude lower than for light cargo planes and helicopters.
- One UAV blimp can save up to four metric tons (4.4 tons) of carbon emissions per day compared to helicopter operations.



*Side view of the production prototype showing a shrouded main propeller vectored for cruise propulsion. The inverted-Y tail has movable aerodynamic control surfaces, which provide maneuvering control during cruise flight.
Source: Screenshot from Cloudline video (2022)*

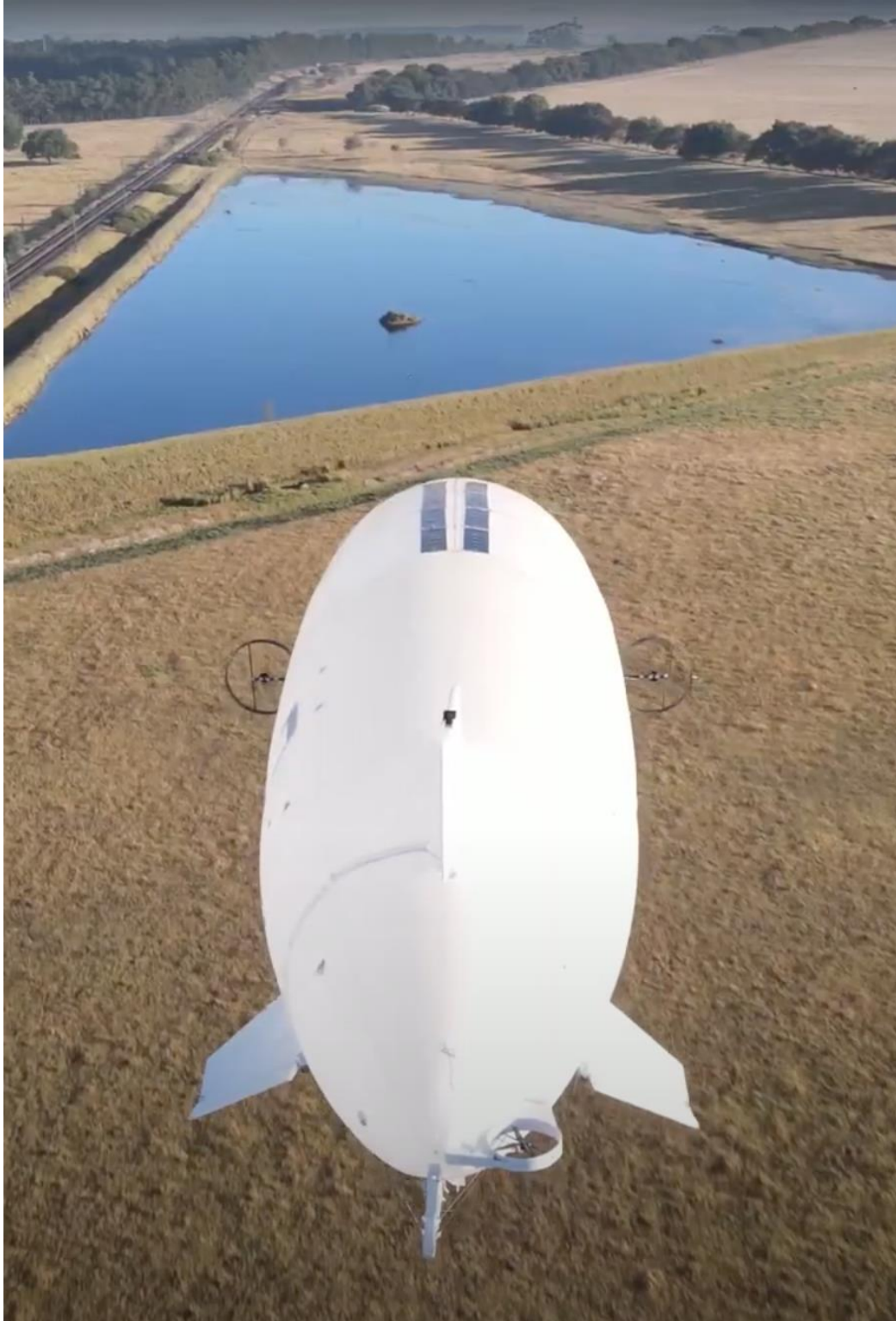
General characteristics of Cloudline's production UAV blimp

Parameter	Production UAV blimp
Type	Non-rigid, with vertical takeoff and landing (VTOL) capability
Lifting gas	Helium
Power system	All-electric power system with zero carbon emissions: <ul style="list-style-type: none">• Batteries• Solar-photovoltaic panels on the top of the gas envelope.
Propulsion system	All electric propulsion & flight control systems: <ul style="list-style-type: none">• 2 x flank-mounted, electric motor driven, thrust vectoring, shrouded propellers provide main propulsion and dynamic lift control in VTOL flight.• 2 x small, tail-mounted, electric motor driven shrouded propellers provide low-speed pitch & yaw (lateral) control.
Payload, max.	Target is up to 100 kg (220 lb)
Range	Over 200 km (124 miles)
Endurance	Up to 12 hours

Source: Cloudline website (Oct 2022)



*The Cloudline production prototype hovering.
Note the shrouded main propeller vectored for lift.
Source: Screenshot from Cloudline video (2022)*



Stern overhead view of the production prototype, showing the placement of the shrouded main propellers and the stern maneuvering thrusters. Note the control surfaces on the inverted Y-tail fins. Source: Screenshot from Cloudline video (2022)

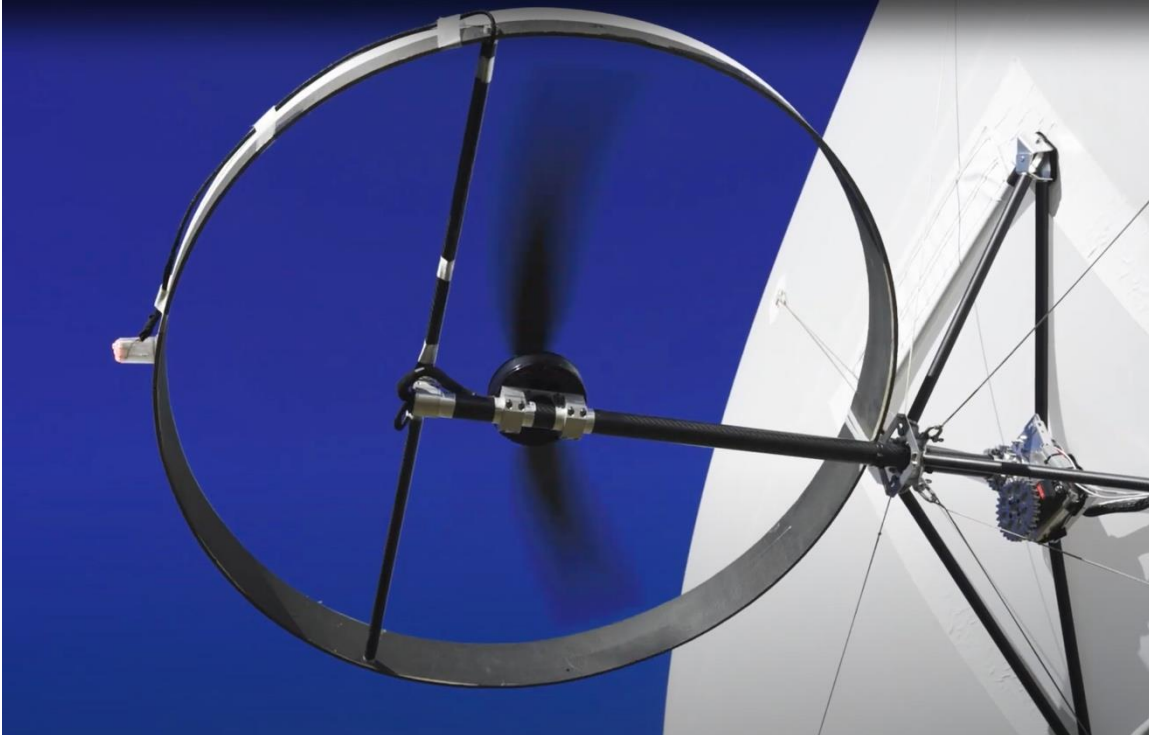


Note the shrouded main propeller vectored for cruise thrust.



Stern views of the production prototype showing the lateral and vertical thrusters used for low speed maneuvering, when the aerodynamic control surfaces lose their effectiveness.

Source: Screenshots from Cloudline video (2022)



*Closeup view of one of the shrouded, thrust vectoring main propellers and its attachments to the gas envelope. Guy wires attached to the envelope provide additional lateral support for the X-framework.
Source: Screenshot from Cloudline video (June 2023)*

The Cloudline UAV can be configured for a wide variety of applications. In 2021, Lakshmi Ajay, writing for Logistics Update Africa, reported that Cloudline is focusing their near-term business development on the following four applications (use cases) of their autonomous cargo airships: health logistics, precision agriculture, infrastructure monitoring, and wildlife management. Cloudline also has had discussions with potential customers on other applications, including security, tree seeding, data transmission (relay), entertainment and emergency response support (i.e., combining communications continuity and damage assessment).

Initial deployments will be in Africa, where national civil aviation regulatory reviews began in 2021 – 2022 in Namibia, Ghana, Côte d'Ivoire, South Africa and Kenya. In July 2023, Cloudline's Chief Operations Officer, Mbali Gushu, reported, "One of our airships has been transported and assembled in Nairobi, Kenya for flight demonstrations. This marks Cloudline's first international flight, first

operational set up and we are overwhelmed with the outreach of potential customers in the region and throughout Africa.”



Cloudline airship in a field hangar in Kenya. Source: Cloudline (June 2023)

Interest also has been expressed by potential customers outside of Africa, including United Arab Emirates, Israel, India, Sri Lanka, Malaysia and the Philippines, where national civil aviation regulatory reviews also began in 2021 – 2022.

With this broad base of interest, the prospects look promising for Cloudline’s autonomous cargo airship to be among the first drone airships to be operated in regular service in shared airspace by governmental, non-governmental organization (NGO) or commercial clients.

4. The Future

On their website, Cloudline has the stated goal of “... building a network of autonomous airships that redefines the way we deliver goods and services to the world.”

In the June 2023 YouTube video, “[Our founding story](#),” Cloudline founder and CEO, Spencer Horn, provides a vision for the future. This includes more capable versions of the Cloudline airship through the introduction of fuel cells that will enable longer range flights with zero carbon emissions, greatly expanding the accessible market for small cargo airship service.



*Rendering of a production Cloudline UAV cargo blimp.
Source: Cloudline.*

5. For additional information

- “Airbus BizLab and Cloudline explore how to improve transport in Africa,” Airbus, 22 February 2018:
<https://www.airbus.com/en/newsroom/news/2018-02-airbus-bizlab-and-cloudline-explore-how-to-improve-transport-in-africa-0>
- Spencer Horne, “Cloudline: Long endurance autonomous airships for medical supply delivery,” UNICEF, 6 December 2019:
<https://www.unicef.org/innovation/venturefund/dronescohort/Cloudline>
- “SA’s Cloudline may have won Fast Company award, but its airships have yet to get flying [Updated],” VentureBurn, 6 March

- 2020: <https://ventureburn.com/2020/03/airships-cloudline-still-not-off-ground-fast-company-award/>
- Spencer Horne, UNICEF Innovation Fund Graduate: Cloudline,” UNICEF, 13 April 2021: <https://www.unicefinnovationfund.org/broadcast/updates/unicef-innovation-fund-graduate-cloudline>
 - Lakshmi Ajay, “We expect to deploy 100 airships in 2022,” Logistics Update Africa, 27 November 2021: <https://www.logupdateafrica.com/we-expect-to-deploy-100-airships-in-2022-aviation>
 - Chanel Retief, “Africa’s Green Economy: ‘AIR IS AN UNDERUTILIZED RESOURCE’,” Forbes Africa, July 2023: <https://www.forbesafrica.com/cover-story/2023/06/09/africas-green-economy-air-is-an-underutilized-resource-spencer-horne/>

Videos

- “Revolutionizing Global Logistics - EHF Fellow Spencer Horne, Cloudline,” (5:37 min), posted by Edmund Hillary Foundation, 10 June 2018: <https://www.youtube.com/watch?v=0QfyPV0dN3Q>
- “Cloudline launches new Autonomous Airship Drone,” (2:29 min), posted by Cloudline, 25 August 2019: <https://www.youtube.com/watch?v=MlldnwmWvIc>
- “Cloudline- Solar powered Autonomous Airships,” (2:23 min), posted by Cloudline, 4 May 2022: https://www.youtube.com/watch?v=VWqyUJ_Y_4M
- “Our founding story,” (5:56 min), posted by Cloudline 27 June 2023: <https://www.youtube.com/watch?v=1MqrPVqxIJY>

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/>
- *Modern Airships - Part 3*: <https://lynceans.org/all-posts/modern-airships-part-3/>