Aerotain AG *Skye* drone blimps

Peter Lobner, updated 10 March 2022

1. Introduction

Meier Daniel and Andreas Schaffner founded Aerotain AG in September 2015 in Dubendorf, Zürich, Switzerland as a spin-off from ETH Zürich research university. Aerotain developed, in partnership with ETH Zürich, a small, spherical drone blimp named *Skye* that has been used to entertain and film audiences at concerts and other large indoor venues. *Skye* has other applications, such as advertising and aerial photography. Aerotain AG is expanding their original product line with custom, non-spherical drone blimps.

Aerotain's website is here: http://aerotain.com

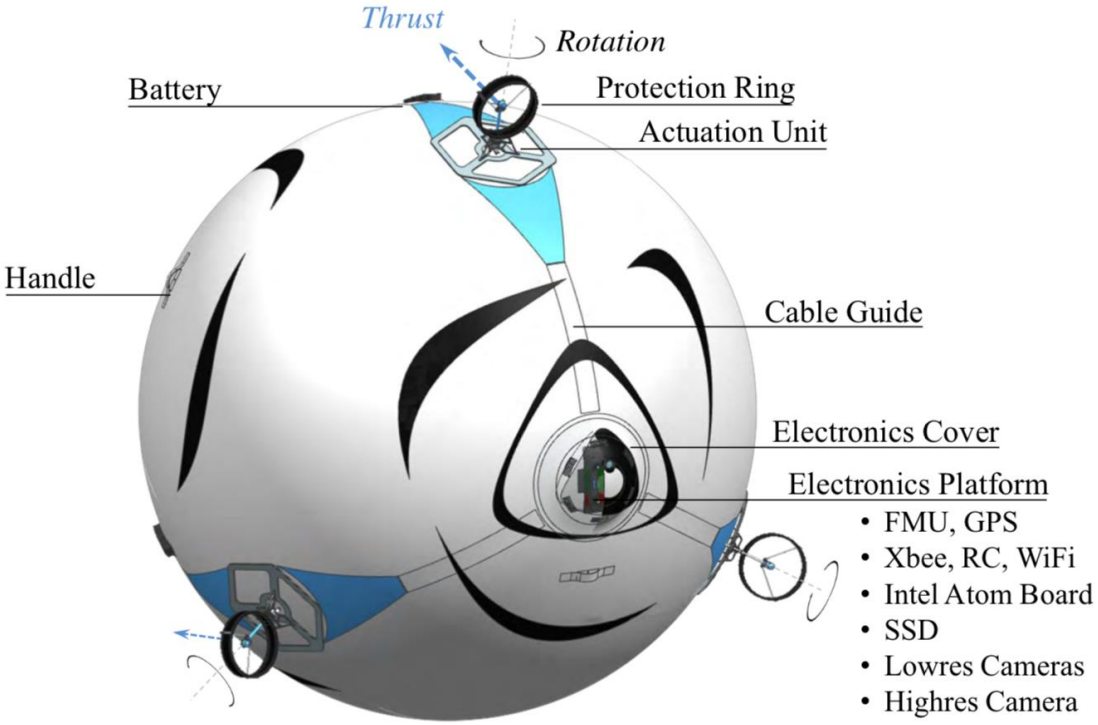
2. The Skye spherical drone blimp

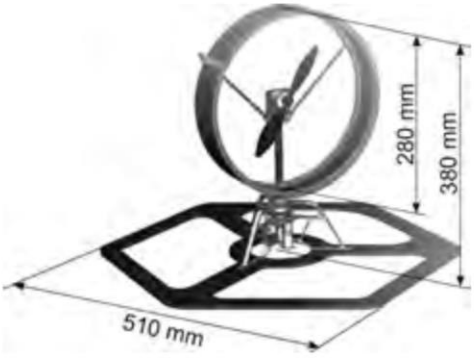
M. Daniel and A. Schaffner describe the novel Skye blimp as follows:

> "Skye is a helium-filled sphere of diameter 2.7m with a strong inelastic outer hull and an impermeable elastic inner hull. Four tetrahedrally-arranged actuation units (AU) are mounted on the hull for locomotion, with each AU having a thruster which can be rotated around a radial axis through the sphere center. This design provides redundant control in the six degrees of freedom of motion, and Skye is able to move omnidirectionally and to rotate around any axis. A multi-camera module is also mounted on the hull for capture of aerial imagery or live video stream according to an 'eyeball' concept - the camera module is not itself actuated, but the whole blimp is rotated in order to obtain a desired camera view."
>
> "Skye is safe for use near people - the double hull minimizes the likelihood of rupture on an unwanted collision; the propellers are covered by grills to prevent accidental contact; and the blimp is near neutral buoyancy so that it makes only a light impact on contact and can be readily nudged away."

“The system is portable and deployable by a single operator - the electronics, AUs, and camera unit are mounted externally and are detachable from the hull during transport; operator control is via an intuitive touchpad interface.”

“The motivating application is in entertainment robotics. Skye has a varied motion vocabulary such as swooping and bobbing, plus internal LEDs for visual effect. Computer vision enables interaction with an audience. Experimental results show dexterous maneuvers in indoor and outdoor environments, and non-dangerous impacts between the blimp and humans.”





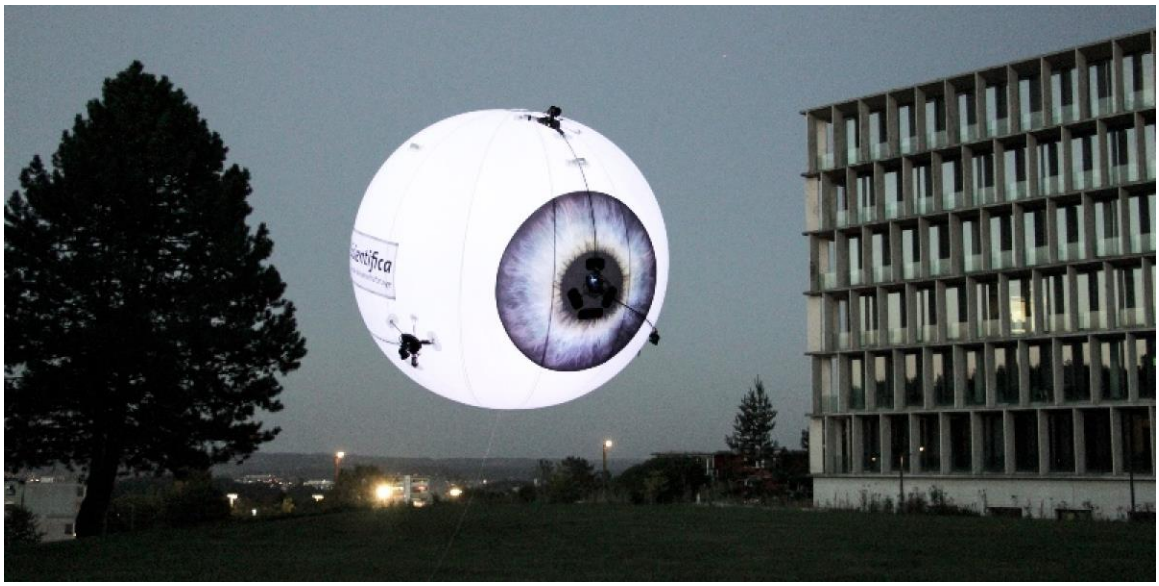
General arrangement of the Skye blimp and a vectoring “actuation unit” (thruster, typ. of 4) Source: M. Daniel, et al., paper

The center of gravity is approximately at the geometric center of the sphere, enabling the blimp to maintain its orientation passively. Tuning weights are attached or removed to each actuation unit to adjust the buoyancy while maintaining the position of the center of gravity. The helium charge for a ready-for-flight Skye is sufficient to provide a slight negative buoyancy, which guarantees automatic return to the ground when the thrusters are stopped.

With six degrees of freedom, Skye is not intuitive to fly manually. A control algorithm was developed to make remote manual piloting feasible and intuitive.

Basic size and performance parameters for Skye are listed below.

- Diameter: 2.7 m (8.6 ft)
- Total mass: 9.5 kg (21 lb)
- Volume: 12 m^3 (424 ft^3)
- Translational speed: 20 kph (12.4 mph)
- Rotational speed: 0.5 rev/sec
- Max wind for operation: about 10 kph (6.2 mph)
- Endurance 3 hours indoors, less outdoors if there is wind



Illuminated with internal LEDs, the blimp provides an attractive nighttime display. Source: Fortune

Multiple blimps can be choreographed in a collision-free aerial display. Source: Aerotain

The blimp can be safely touched in flight.
Source: Digital Trends, 2016

3. Non-spherical done blimps

The Aerotain product line is not limited to spherical shape. Custom designs can be developed.

Aerotain mini-starship Enterprise blimp. Source: Aerotain

4. For more information

- M. Burri, et al., “Design and Control of a Spherical Omnidirectional Blimp,” Autonomous Robots, possibly 2016: https://autonomousrobots.nl/docs/13-skye.pdf
- Kelly Hodgkins, “Aerotain’s blimp-inspired Skye drone won’t injure people if it crash lands,” Digital Trends, 22 April 2016: https://www.digitaltrends.com/cool-tech/aerotain-skye-drone-blimp/

Videos

- “This is Aerotain” (1:01 minutes), Aerotain, 8 February 2018: https://www.youtube.com/watch?v=xxujTYpxtwo&t=1s
- “This Giant Floating Eyeball is 'Crowd Friendly’” (1:02 minutes), Vocatv, 17 March 2016: https://www.youtube.com/watch?v=vp2UXjRvKic

- “Aerotain, airship drone for advertising and events” (9:24 minutes), Charbax, 16 March 2016: https://www.youtube.com/watch?v=0WkMp116pTM

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/