

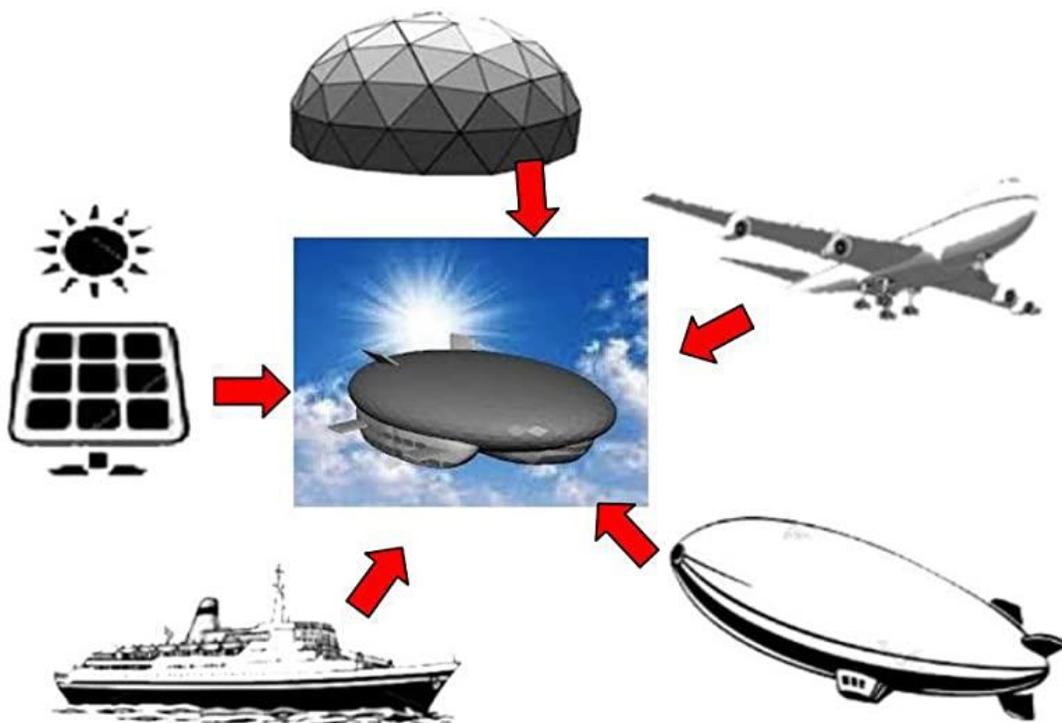
Turtle Airships

Peter Lobner, 3 April 2021

1. Introduction

Turtle Airships was founded in Silla, Spain by Darrell Campbell in about 1980. Campbell viewed his Turtle airship design concept as a coalescence of several diverse technologies:

- Blimps / airships: lighter-than-air
- Geodesic structures: rigid, lightweight airframe
- Aircraft: significantly higher maximum speed than conventional airships using bio-diesel fueled engines
- Ships: able to operate from any body of water; amphibious
- Solar cells: the top surface of the hull is a massive photovoltaic array; enables operation at reduced speeds on solar power alone; reduces carbon footprint from airship operations



Source: Turtle Airships

Turtle Airships initial focus was on creating smaller airships meant to do simple tasks, and building them in large numbers. Turtle Airships wanted to work with national and local economic development agencies and communities to bring affordable, efficient, and versatile air transport to developing nations. Turtle Airships saw their greatest market potential in hybrid airship sizes comparable to a flying bus or flying truck that would be about the length of a common blimp, but would be much wider. These airships would be able to economically carry passengers and cargo and serve a wide range of businesses. The firm hoped to generate revenues from a large production volume of these modest size hybrid airships before moving on to more ambitious projects involving larger airships.

The Turtle hybrid airship was well suited for humanitarian missions requiring timely delivery of emergency supplies and related emergency medical and other services as well as evacuation of large numbers of people. Their airships also could be configured for regional security surveillance and interdiction missions, such as dealing with pirates in the waters off of Somalia, Indonesia, and Nigeria.

After the inception of the Defense Advanced Research Projects Agency's (DARPA) Project Walrus in mid-2003, Turtle Airships initially was considered by the Pentagon as a potential prime contractor. However, the WALRUS funding went to other competitors: Lockheed Martin, Aeros, Millennium Airship, Inc. and Advanced Technologies Group (ATG) / SkyCat.

There has been speculation that the design of the Millennium Airship SkyFreighter hybrid airship was inspired by the Turtle airship. However, in August 2008, Darrell Campbell acknowledged on Airshipworld Blog that Turtle Airships has no connections of any kind with Millennium Airship or their SkyFreighter.

A prototype was designed in Spain and USA and was to be constructed in Singapore. In 2008, there was a report that construction of the prototype had begun at an estimated cost of about \$1 million.

The company's goals evolved to include making a demonstration around-the-world flight of a solar powered airship in 2011. Turtle Airships plans to invest over \$200 Million in airship manufacturing plants and airship operations by 2012, with an expected public offering to raise over \$3 billion scheduled for 2015.

In spite of these lofty aspirations, Turtle Airships never built an prototype or production airship. In 2021, the company's website is offline, but the blog is still online here:

<http://turtleairships.blogspot.com>

2. Description of the Turtle hybrid airship



Source: Turtle Airships

- **Lift gas:** Initially all-helium. Later, Turtle Airships intended to use ammonia as a lifting gas, and promote gradual acceptance for use of hydrogen for some applications.
- **Hull construction:** A strong geodesic frame with rigid metal (aluminum, titanium, or stainless steel) and carbon fiber panels forming the hull's exterior surface, creating the faceted look of a giant turtle shell.
- **Hybrid electric power system:**
 - The entire upper surface of the hull is a thin-film Cadmium-Indium-Germanium (CIG) photovoltaic array. The solar panels are deposited or printed directly upon the surface of the rigid panels that make up a Turtle

airship hull. Campbell stated: "While less efficient than the traditional silicon wafers, the expanse of the hull is large enough to use an amount of thin films that can make up the difference.....The cells should have enough power for (generating) 45 kW..."

- Bio-diesel engines provide supplementary power during the day and provide all power at night.
- **Propulsion:** Multiple vectored thrust engines
 - Maximum 45 kW from solar power alone delivers 60 horsepower. Campbell remarked that this should be able to drive the airship at 40 mph (64 kph) in average conditions.
 - Campbell remarked on the short-term goal: "Depending upon the amount of money we have to work with, we'll either adapt a hybrid electric [or] diesel automobile engine for this first craft, or use a small jet such as those used on Very Light Jets which has been adapted to burning diesel."
 - The long-term goal was to have a propulsion system that could achieve a top speed as high 200 mph, which should be feasible with the airship's strong, rigid hull and efficient aerodynamic design.
- **Flight control system:** Sensors measure the airship's real-time heading, orientation, speed and external forces acting on the airship and apply compensating thrust in order to maintain stability during flight.
- **VTOL operations:** Enables operation from small sites.
- **Long range:** Capable of unrefueled trans-Atlantic flight.
- **All-weather operations:** Enabled by the strong, rigid hull.
- **Amphibious:** The airship can land directly on water and take on water ballast for stability like a boat. The airships can land in harbors, rivers, mountain lakes, or the middle of the ocean.
- **Minimal or no ground infrastructure:**
 - Can land on any empty field or at airports
 - No mooring mast needed
 - Has built in systems to anchor to the surface without ground crew assistance
 - Hangar not required

- **Scaleable design:** The basic design of the airship can be scaled up to carry very large payloads and/or large numbers of passengers.



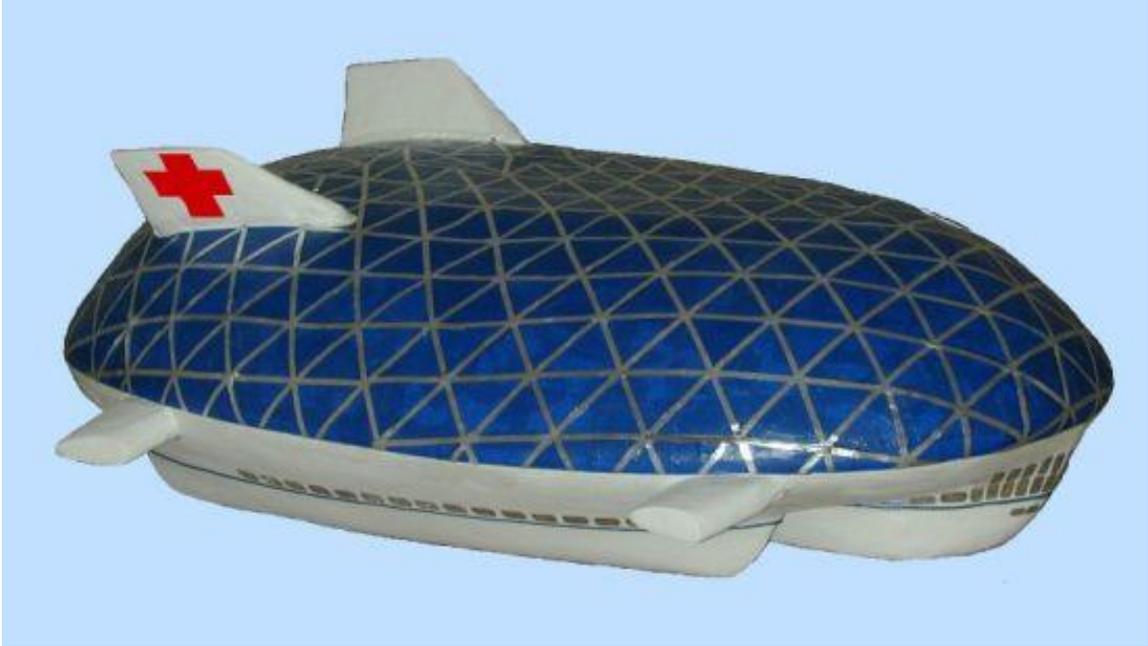
The Turtle airship. Source: Popular Science, July 2001

3. TurtleDove Airships

One of the humanitarian roles of the Turtle airship was that of a flying hospital that could rapidly deploy to disaster sites around the world. To make this happen, a non-profit organization named TurtleDove Airships will proposed to operate the Turtle airship flying hospitals.

The flying hospital airships would be made available via charter to the United Nations, International Red Cross, Red Crescent and similar non-profit relief organizations. These organizations would provide the doctors, medicines, food, water systems, and other emergency aid equipment to be delivered to the disaster site. Once loaded, the versatile airships would be able to deliver people, supplies and services rapidly and more cost effectively than other forms of transport.

The airships also could be used to evacuate large numbers of people for the disaster area.



A Turtle airship flying hospital.
Sources: (Above) Turtle Airships via Airshipworld Blog, 2008
(Below) Turtle Airships via Wired.com, 2009

4. For more information

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