Aereon Corporation

Peter Lobner, 15 August 2019

**Background**

Aereon Corporation was founded in 1959 by Monroe Drew and John Fitzpatrick in Princeton, New Jersey. The firm was named in honor of Solomon Andrews' 1863 airship Aereon, which was a three-hulled craft, also built in New Jersey, that propelled itself without an engine by alternately becoming positively or negatively buoyant to generate forward thrust while porpoising through the air. Andrews' second variable buoyancy propulsion airship was the single-hull Aereon II.

Aereon Corporation designed and built the Aereon III hybrid airship. They also developed and patented the design for a large, semi-buoyant aircraft known as the Dynairship. The small Aereon 26 heavier-than-air aircraft was a sub-scale aerodynamic demonstrator for the aerobody shape of the planned larger Dynairship. We'll take a look at these three craft in this section.

**Aereon III**

This was an experimental, rigid, hybrid airship comprised of three side-by-side, streamlined hulls connected by airfoil-shaped truss structures that generated aerodynamic lift during forward flight. Each of the three rigid hulls was 83 ft (25 m) long and 17.5 ft (5.3 m) in maximum diameter. The complete vehicle had a maximum width of 55 ft (16.7m). The helium gas envelopes and the outer skin of the airship are made of DuPont Tedlar™.

The Aereon III’s mooring mast was the telescoping front landing gear. The long strut extends into the center hull, where loads were distributed to the airship structures.

To manage buoyancy without releasing helium gas or ballast, the helium temperature was controlled by a propane-fueled heating system and a series of cool-air blowers. On the ground, with the helium cooled, the airship was designed to be about 400 lb (181 kg) heavy when filled at 85% helium capacity.
Propulsion was provided by a 80 shp Solar gas turbine driving a rear-facing, 21-foot (6.4-meter) diameter, two-bladed helicopter rotor used as a propeller. Maximum speed was expected to be 60 – 70 mph (97 – 113 kph). Like Solomon Andrews' triple-hull Aereon I, Aereon III also was designed for variable buoyancy propulsion without an engine. It was expected to be capable of generating forward speed and porpoising through the air by alternately adjusting buoyancy and pitch between positive buoyancy / positive pitch and negative buoyancy / negative pitch.
Aereon III was constructed between 1959 and 1965 at the Mercer County Airport near Trenton, NJ. It was destroyed during taxi tests in 1966 when it was caught by a sudden gust of wind during a sharp turn. The fragile, lightweight Aereon III was flipped over onto its back and then flipped again onto its undercarriage. The airship was very badly damaged and, after an attempt to re-build it in a new configuration, it finally was dismantled sometime in 1967. Aereon III never flew.

You'll find a more information on Aereon III in Nigel Kaley’s 1962 article, “Modern Airships: A review of 40 years of airship development,” which you can read here:

The Dynairship freighter patent

The Dynairship was a conceptual, large hybrid airship designed by the Aereon Corporation for use as a civilian and military cargo transport. The basic concept for the Dynairship is addressed in US Patent 3,486,719A, “Airship,” which was granted on 30 December 1969 and assigned to Aereon Corporation. The abstract of the patent describes a Dynairship as follows:

“A cargo-carrying air ship comprises a gas-filled, low aspect ratio deltoid wing. Internally, and lengthwise along the underside of the ship, there is provided a cargo space sealed from the gas space, and provided with a pair of parallel track assemblies along the ceiling of the cargo space, on which ride movable cargo hoists. The ceiling of the cargo space is suspended by cables from suspension points within the gas space, and the suspension points are, in turn, suspended by cables from the upper shell of the hull. Adjustable landing gear, mounted from the suspension points, permit variation of the ships angle of attack on the ground, and a rear propulsion system acting against a convex stern arch effectively compensates for drag. The ship, when filled with helium and unloaded, has a dead weight of the order of the weight of the volume of air displaced by the ship.”

The main features of the Dynairship were:

- The hull (2) is a low aspect ratio blended delta wing with vertical stabilizers that form endplates (10 & 12) on the wings.
- The craft is semi-buoyant; the large delta wing contains inflated helium lifting gas cells.
- The cargo compartment (94) and cargo rails (96) are sealed from the helium volume and are suspended within the hull by a web of steel support cables that distribute the concentrated load of the cargo compartment over the large area of the upper shell of the fuselage.
- Cargo is carried in containers suspended from the cargo rails.
- Propulsion system (28) is mounted along the wing trailing edge.
- A Dynalifter can taxi like a fixed-wing airplane.
Dynalifter overhead plan view. Source: Patent 3,486,719
Because of its relatively lightweight for its size, care had to be taken to ensure that a Dynairship was not upset by the wind. Examples of unique operating provisions described in the patent are:

- The landing gear was adjustable so that the ship was maintained in a nose-down attitude while it is on the ground.
- A taxi control station in the stern was provided so that downwind taxiing and turns could be avoided by taxiing the ship in reverse.
- The landing gear was permitted to swivel freely about vertical axes so that the wheel units act as a cross-wind landing gear, which permit takeoff and landing with the aircraft centerline aligned to the wind and not the runway.
• The aircraft may become too light for safe ground operation in windy conditions. The ship needed to be kept partly ballasted by fuel or cargo, or both, particularly when winds were severe.
• A Dynairship could fly when pressurized by air instead of helium, although cargo-carrying capacity would be reduced.


**The Aereon 26 sub-scale demonstrator**

The proof-of-concept aircraft for the Dynairship was the sub-scale Aereon 26, which lacked lifting gas and operated as a heavier-than-aircraft throughout its test program to validate the aerodynamics of the Dynairship. The basic design of the Aereon 26 is described in US Patent 3,684,217A, “Aircraft,” which was awarded and assigned to Aereon Corporation on 15 Aug 1972. The patent abstract describes the aircraft as follows:

“This invention relates to aircraft and particularly to delta-shaped lifting bodies having high sweep angles…….Such lifting bodies possess favorable stall characteristics and are capable of relatively high cruising speeds and relatively low landing speeds. They can be made to carry a large payload efficiently, and may be operated heavier than-air, or, with helium, either lighter-than-air of slightly heavier-than-air.”

The Aereon 26's shape was called an "aerobody," essentially a lifting-body of deltoid planform, elliptical cross-sections, and small stub winglets for added stability. Among the advantages claimed for this hull form were proximity of the aerodynamic center, center of buoyancy, and center of gravity and a minimal need for trim-control devices, thus facilitating the transportation of "a full range of tonnages at various speeds without major trim requirements."

The Aereon 26’s structure was composed of welded aluminum tubes (some salvaged from the wrecked AEREON III), covered with aircraft cloth and aluminum sheet. After completion, the aircraft was transported by road to the National Aviation Facilities Experimental Center (NAFEC) near Atlantic City for flight testing.

![The Aereon 26 at NAFEC. Source: The Atlantic, 8 Mar 2011](image)

The Aereon 26 made its first flight, piloted by John Olcott, at NAFEC on 7 September 1970, but proved to be underpowered and was unable to climb out of ground effect. After a series of modification and brief test flights of new propellers and vortex generators added to the aerobody, testing resumed at NAFEC on 1 March 1971. The aircraft was able to fly and maneuver successfully on several flights before the limited operating life of its used engine expired, ending the test program.

The key finding from the Aereon 26 test program, as reported by William Miller, was that the aerobody was an aerodynamically feasible concept and a basis existed for realistic studies of much larger aircraft. Following the apparent success of the Aereon 26 project, Aereon Corporation’s board voted unanimously to proceed with developing the Dynairship for civilian and commercial purposes.

Aereon 26 during testing.
Source: https://alchetron.com/AEREON-26

Aereon 26 in flight.
William McElwee Miller, Jr. with the Aereon 26.  
Source: flyingmag.com, 2June 2010

Aereon 26 stored in a hanger for 40 years.  
William McElwee Miller, Jr. (r) in June 2011.  
Source: Hal Brown via 
https://searey.us/splash/?Photos&p=SZP1D0000
The Dynairship freigther

In 1974, Aereon Corporation proposed three versions of the semi-buoyant Dynairship:

- A "small patrol aircraft"
  - Length: 50 feet (15 m)
  - Gross weight: 4,000 pounds (1,800 kg)
  - Crew: three persons
  - Cruise speed: 50 mph (80 kph)
  - Endurance: eight hour missions

- A "medium-size cargo aircraft"
  - Length: 200 feet (61 m)
  - Gross weight: 270 tons (245 metric tons)
  - Cargo capacity: 90 tons (81.6 metric tons)
  - Cruise speed: 150 mph (241 kph)
  - Range: 1,000 miles (1,609 km)

- A "logistic carrier"
  - Length: 1,000 feet (300 m)
  - Gross weight: 4,200 tons (3,810 metric tons)
  - Cargo capacity: 3,300 tons (2,995 metric tons)
  - Cruise speed: 150 mph (241 kph)

One later proposal, the semi-buoyant Aereon 340, was to have been 340 feet (100 m) long, with a wingspan of 256 feet (78 m), and total lift of 400,000 pounds (180,000 kg). Powered by four 5,500 horsepower (4,100 kW) Rolls-Royce Tyne turboprop engines, it was designed to carry intermodal containers and semi-trailers.

None of the proposed Dynairships were funded. This lack of funding ended the Dynairship project in 2003.

You'll find more information in the paper, "The Dynairship," by William McElwee Miller, Jr., which is available at the following link:

https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19760007965.pdf

Other Dynairships patents

Another Aereon patent applicable to semi-buoyant and heavier-than-air Dynairships is the following:


Versions of the Dynairship that would, like the Aereon 26, have lacked lifting gas and operated heavier-than-air at all times were proposed by Aereon Corporation. One notable proposal was for the Aereon WASP, which is described in Patent US 4,896,160A. This "airborne surveillance antenna platform" with "long endurance and high altitude flight capability" was to carry a radar antenna comprising "planar or linear phased arrays arranged to scan in a continuous pattern in all azimuthal directions" within its deltoid hull.

Following is a list of several Aereon patents for heavier-than-air versions of the Dynairship. None were ever built.

