The Hamilton Airship Company (THAC) airships

Peter Lobner, 3 April 2021

1. Introduction

The Hamilton Airship Company (THAC) was founded in 1995 by Jonathan Hamilton in Bryanston, South Africa, north of Johannesburg. Their business goal was to develop airships to fill gaps in the passenger and freight transportation market that were not being adequately served by existing modes of transportation. The airship fits in a delivery time gap between airplanes (hours) and ships (weeks) and enables point-to-point commercial service between suppliers and end-users. To address this market, THAC developed the design for, and later patented, a novel modular rigid airship that could be manufactured rapidly, cost-effectively, and mass-produced.

THAC built and successfully flight-tested the HA-44 manned, sub-scale prototype airship to validate their design concept. Two production models were planned, the HA-80 and the larger HA-140. Both were designed as long-range airships capable of performing a variety of missions. THAC hoped to conduct the first airship crossing of the Atlantic since Zeppelin service ended in 1937. The American Express Travel Division informed THAC that they projected the need for six airships for trans-Atlantic service alone. THAC's perspective was that passenger airships would deliver the ultimate travel experience: "It is not transport. It is travel. It is not the destination. It is the journey."

The firm failed to produce any production models and was liquidated in May 1999 after struggling to raise capital since the founding of the company. Based on interviews at the time, Engineering News (South Africa) reported, "Hamilton is probably the leading airship designer in the world, but neither he nor anyone else in THAC had the necessary business skills to make the project work…… Furthermore… there is a

lack of vision regarding finance and support for new projects by South Africa's financial community…"

The airship patent and some assets were bought by a new company, Advanced Airship Works (AAW), of which Hamilton was a director. The airship patent subsequently was reassigned to Cherokee Ltd. in 2003.

You can watch the short video, **"**The Hamilton Airship Company," (11:13 minutes), at the following link:
https://www.youtube.com/watch?v=rcus8kmJ5aE

2. THAC's rigid airship patent

Patent US6708922B1, simply titled, "Airship," describes the design of a novel rigid airship with a lightweight central spine that is built up from a series of interconnecting hull modules that are stacked longitudinally. The central spine, possibly made of carbon composites, is the primary rigid structure, rather than a rigid shell as used on previous Zeppelins. The patent was filed on 5 Jun 1997, granted on 23 March 2004 and assigned to The Hamilton Airship Company. You can read the patent here:
https://patents.google.com/patent/US6708922B1/en?oq=6708922

Patent Figure 5 shows the overall layout of the airship's rigid hull (bow at left). The central spine (106) and the hull framework are built up from many interconnected modular units (129, only one is shown in detail in the following diagram, the others appear as diamond-shaped outlines).

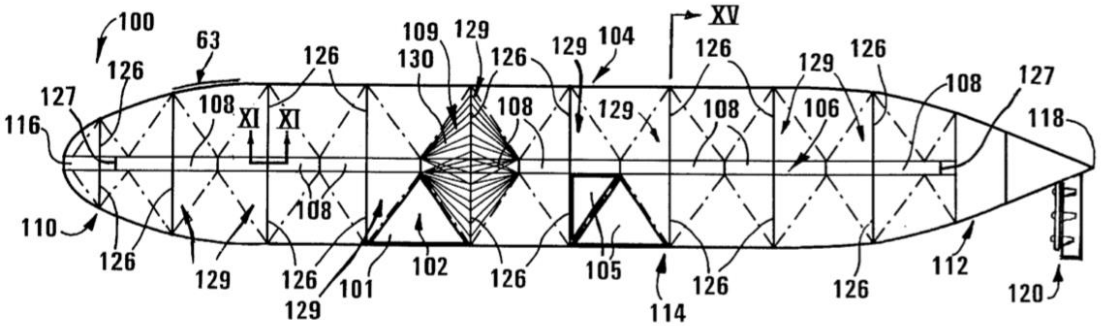


FIG 5

Each modular unit looks like a broad bicycle wheel, with a segment of the spine forming the hub, the rim establishing the outer diameter of the hull, and spokes connecting and carrying the loads between the spine segment and the rim. Patent Figure 7 shows two modular units (129), each with a central interconnecting element (the hub, 108), a peripheral ring (the rim, 126) and locating members (the spokes, 130) that are maintained under tension to create a rigid structural unit. The modular units are rigidly connected end-to-end at their extremities (128). The rims are held in alignment by locating members (136) that are under tension.

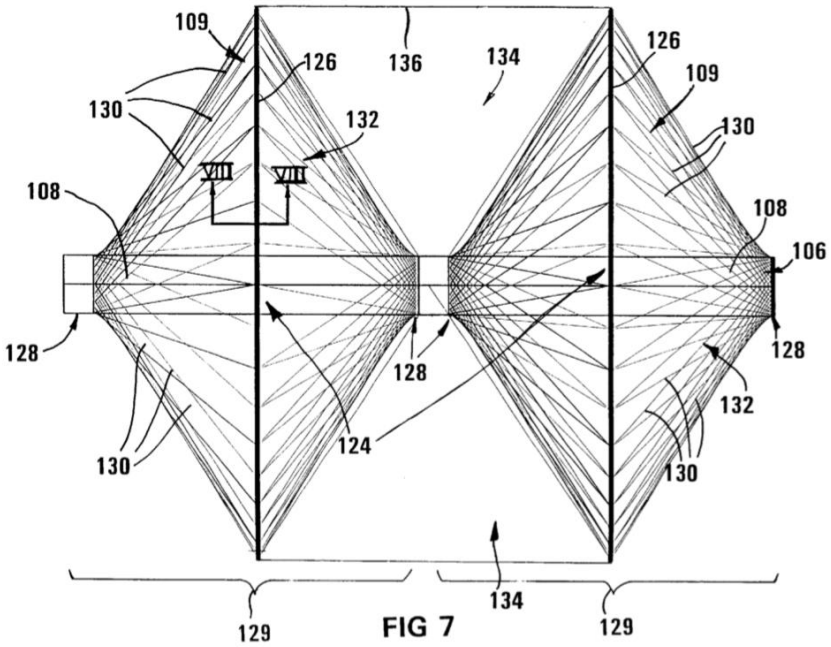


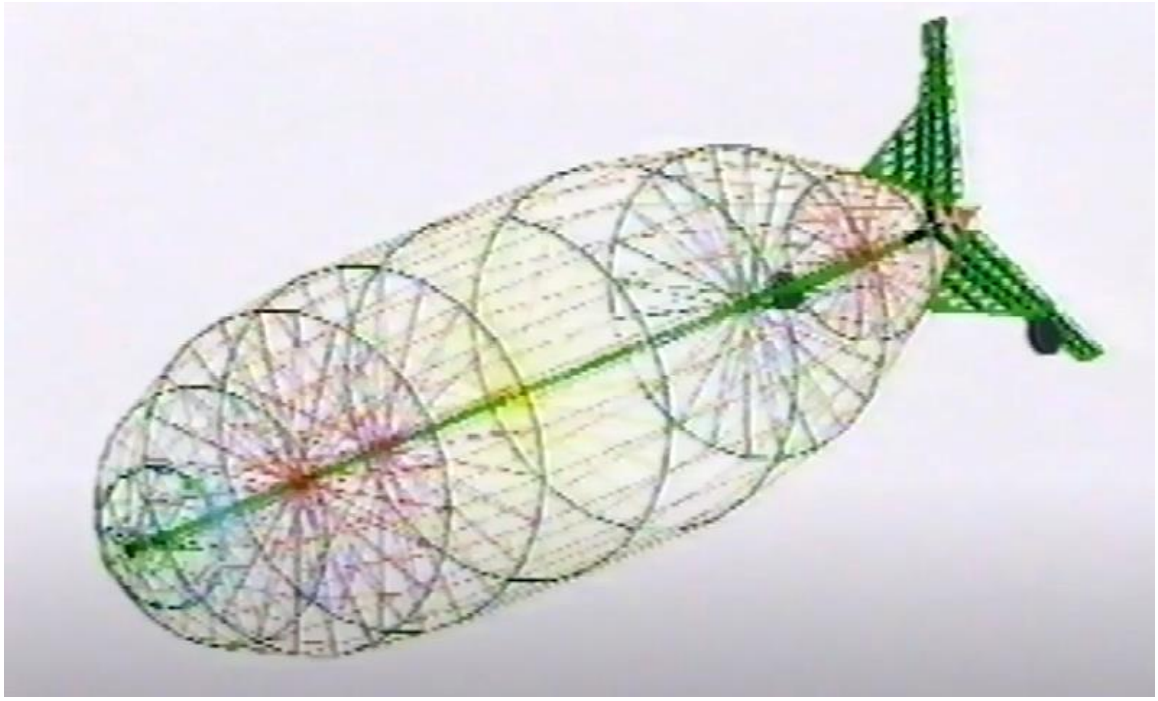
FIG 7

A modular unit being manufactured for the HA-44 prototype. Source: Screenshot from THAC video

The modular units (129) may be designed with a circular or elliptical cross-section. The airship's outer skin is a multi-layered laminated fabric.

The helium lift gas bags may be installed inside the "frustro-conical" space formed by the spokes of a modular unit, and/or in the free space between adjacent modular units.

A multi-deck gondola fits in the lower half of the annular space inside and near the center of gravity of the airship hull. A single gondola module fits between adjacent rings (126) and clear of the locating members (spokes, 134). The gondola module is attached to the two adjacent rings by retractable mountings at the rims and by suspension cables that distribute some loads up into the tops of rims (see patent Figures 15 – 17 for details). The outer surface of the gondola is flush with the hull and semi-circular in cross-section. The complete gondola is comprised of several gondola modules that are attached end-to-end and span several adjacent rings.



Structural diagram of the HA-44 prototype.
Source: Screenshot from THAC video

While the airship's rigid structure is held under tension to create a strong structure, tension relaxing means have been incorporated to

provide “a certain amount of inherent elasticity, which provides inertial relief in flight, whereby the airship…is capable of absorbing externally applied forces and thereafter returning to its original shape.”

The modular units (129) and the gondola modules are designed to be detachable. This feature allows one or more modules to be added or removed to match changing passenger / cargo requirements.

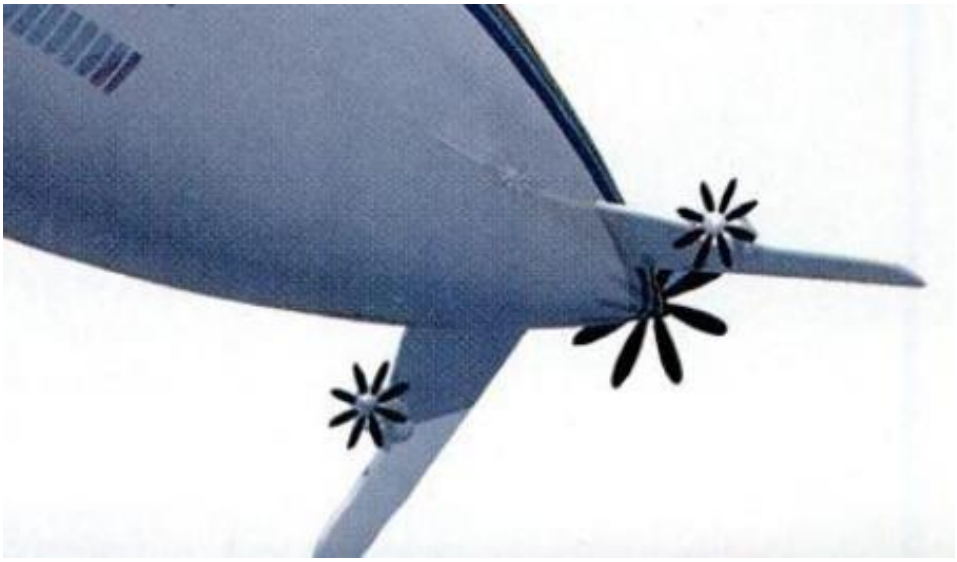
3. The HA-44 prototype (1998)

THAC had the following primary goals for its 145-foot (44.2-meter) HA-44 rigid airship prototype:

- Demonstrate modular manufacturing and rapid airship assembly techniques.
- Demonstrate a vertical takeoff and landing (VTOL) capability and good low speed control.
- Validate the computer models used in the design of the airship.

The prototype incorporated and tested the following features that were planned for the production airships:

- **Cockpit in the nose of the airship**
- **Internal gondola.** In production airships, passenger accommodations and the cargo bay will be inside the hull, along the bottom center of the airship.
- **Multiple gas bags:** Impermeable plastic material. Failure of a single gas bag is not a catastrophic event.
- **Fly-by-wire controls**
- **Bow thruster:** Capable of turning the airship thru 360 degrees and providing precise low speed control for positioning the bow during VTOL.
- **Propulsion system layout:** One stern-mounted main propulsor driven by a 788 hp (588 kW) diesel engine that was mounted on the aft end of the central spine. In addition, two smaller, forward-facing engine-driven propulsors were mounted on the tail fins.



Propulsion system configuration.
Source: Popular Science magazine, July 2001

- **Vectored thrust**: The slipstreams from the two forward-facing propulsors on the tail fins can be deflected by the control surfaces to produce a controllable thrust vector to complement the bow thrusters.
- **Engine exhaust water recovery system:** Water in the engine exhaust is recovered to help manage buoyancy as fuel is burned. This was an common system on long-range Zeppelins in the 1930s.
- **Variable buoyancy control system:** This system can add up to 1 ton of air ballast in flight to help manage buoyancy as fuel is burned. Ambient air is pumped into pressurized storage tanks. When this air ballast is no longer needed, the tanks are vented to the atmosphere to control buoyancy.
- **Vertical Takeoff and landing (VTOL):** Enables approach, landing and departure without requiring a large ground crew.
- **Automated docking system:** Requires only one ground crewman.

The HA-44 prototype successfully conducted more than 50 hours of flight tests.

The HA-44 cockpit (right) and the helium gas bag for the first modular unit. Source: Screenshot from THAC video

The HA-44 prototype April 1998.
Source: Bob Adams, Wikimedia Commons

Two views of the HA-44 in flight.
Source: Screenshots from THAC video

The HA-44 bow cockpit. Source: Screenshot from THAC video

The forward-facing propulsors on the tailplanes. The control surfaces can deflect the slipstream to provide limited thrust vector control. Source: Screenshot from THAC video

4. The planned production airships

THAC initially planned to build two production models, the HA-80 and the larger HA-140. The initial versions of both would have been passenger-carrying airships for long distance routes. Both were configurable for other applications. Neither was built.

THAC planned to build a 180-meter (590.5-ft) long hanger on their 50-hectare (123.5-acre) site.

HA-80

At about 80 meters (262 feet) in length, the HA-80 would have been almost twice the length of the HA-44 prototype. The first unit was intended to be was used on long-distance flights carrying 12 passengers in six cabins. THAC's goal was to make the first airship crossing of the Atlantic since 1937, flying the HA-80 in 2001 and carrying three members of the press to report on this historic event. The 3,500-mile (5,600 km) Atlantic crossing from London to New York City would have taken 2-1/2 days. An 8,300-mile (13,350 km) flight from London to South Africa would have taken about 4 days.

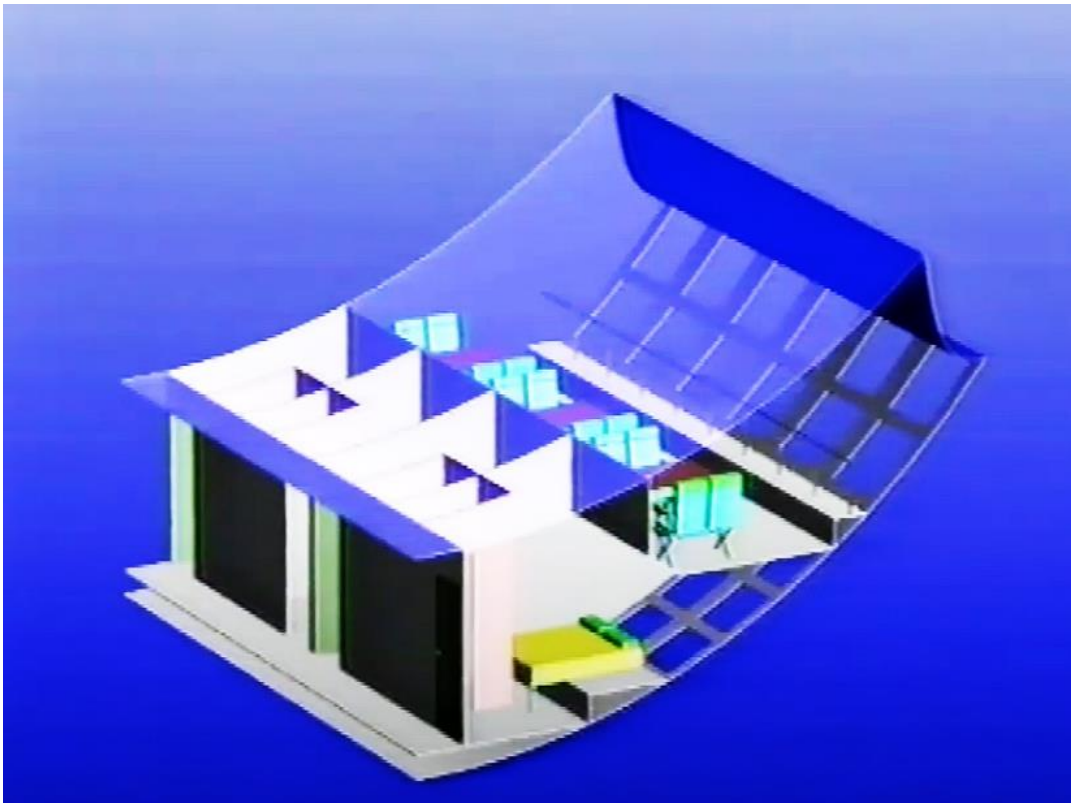
Had it gone into production, THAC intended to promote the HA-80 as a 10 metric ton (11 ton) short-range transport, that also was well suited for naval maritime patrol duty and tourist flights.

HA-140

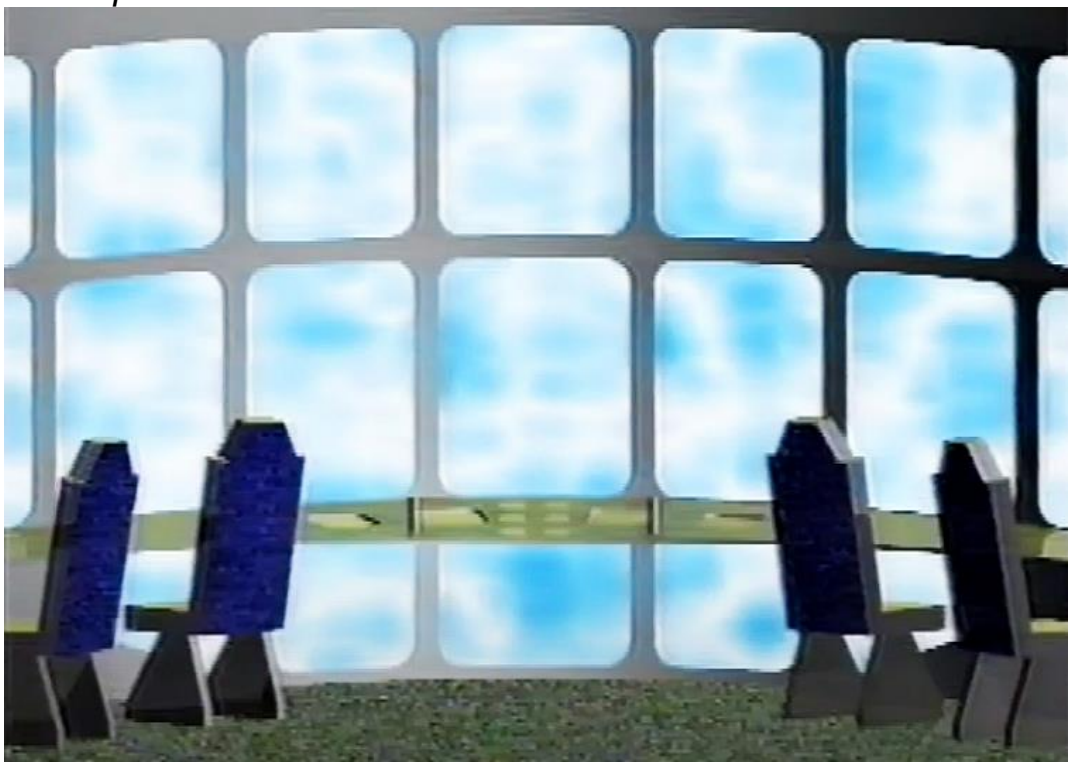
The larger HA-140 (about 140 meters / 459 feet in length) was designed to carry a 25-metric ton (27.5 ton) payload over 6,000 miles (9,656 km). It was intended primarily for luxury air cruises and would have been outfitted with a dining room, gym and other passenger facilities. Passengers would have had 12 x 12 ft (3.7 x 3.7 m) cabins with en suite bathrooms. The preliminary design was 80% complete in January 1998. THAC originally planned to make the first flight in 2002.

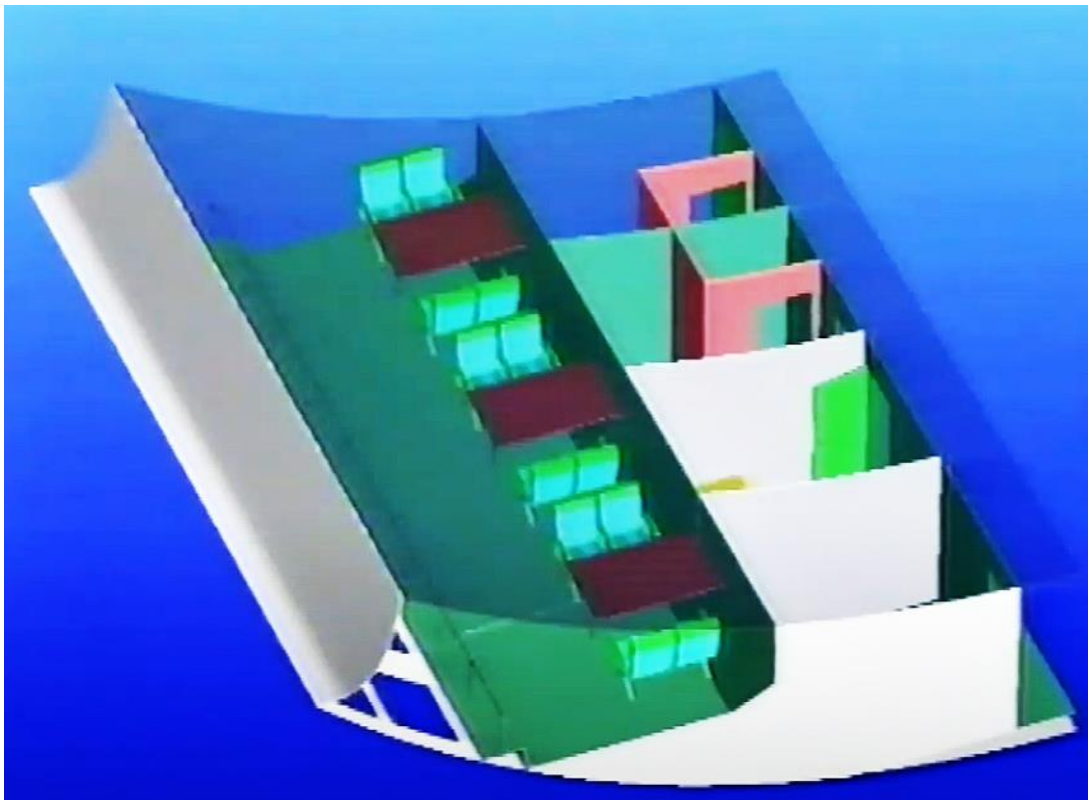
The HA-140 also could have been configured as a mobile hospital, capable of deploying non-stop to any location on the globe.

Two rendering of an HA-140 in flight.
Source: Screenshots from THAC video

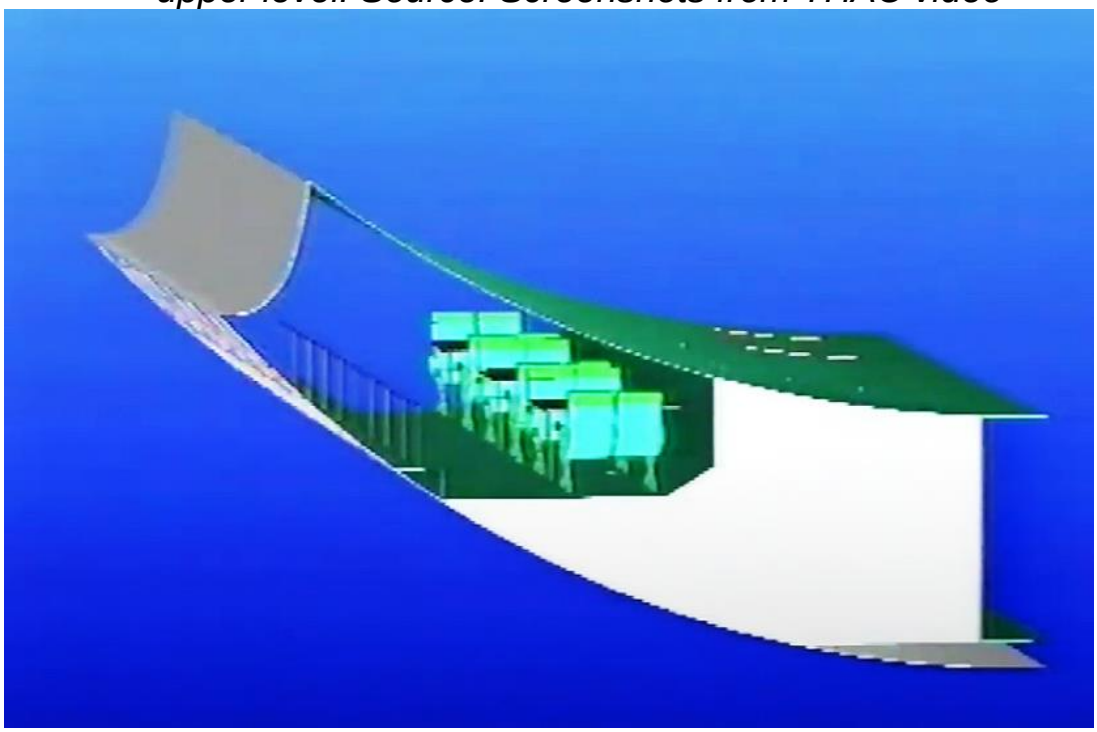


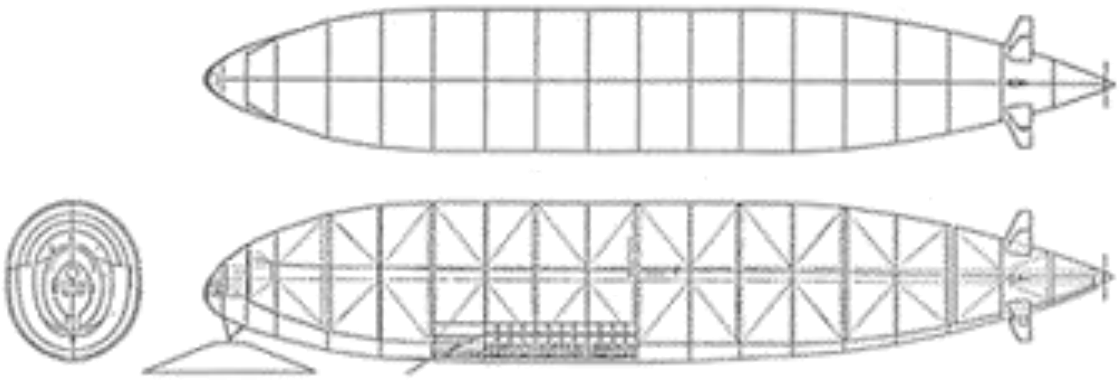
One half of a two-level gondola module, showing passenger cabins on the lower level and passenger seating on the upper level. Note the expansive windows. Source: Screenshots from THAC video





Two more views of one half of a two-level gondola module, showing passenger cabins on the lower level and passenger seating on the upper level. Source: Screenshots from THAC video





HA-140 three-view structural design diagram. Note the elliptical hull cross-section. Also note that the internal gondola spans several modular units. The tailplane configuration is not representative. Source: THAC via Airship and Blimp Resources

Beyond the HA-80 and HA-140

THAC's airship modular structural design is readily scaleable, and was designed from the start to enable individual modular units to be removed or added from a completed airship. Much larger airships could be developed as the market demand increases. For example, an airship capable of lifting 500 metric tons (550 tons) would be capable of delivering 350 cars anywhere in the world in days.

5. For more information

- Ronald Escher, "Hamilton Airship Company," Airship and Blimp Resources: http://www.myairship.com/database/hamilton.html
- "Hamilton Airship down but not out – claim," Engineering News, 19 November 1999: https://www.engineeringnews.co.za/print-version/hamilton-airship-down-but-not-out-x2013-claim-1999-11-19