Wren Skyships Ltd. & Advanced Airship Corporation

Peter Lobner, updated 12 February 2022

1. Introduction

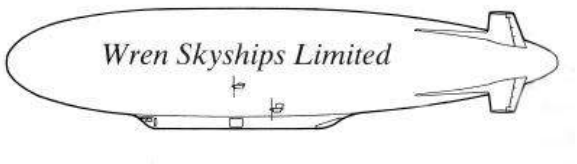
In 1972, Major M.W. (Malcolm) Wren was one of the founders and Managing Director of the firm Mercantile Airship Transportation Limited (MAST), which was formed for the development of large rigid airships to fill a transportation gap between fast jet air transportation and slower sea transportation. In 1978, the firm reincorporated on the Isle of Man as Thermo-Skyships Limited (TSL), focused on developing Thermo-Skyship rigid thermal airships.

In May 1980, TSL acquired Roger Munk's firm Airship Developments Ltd. (AD) for £1 million. A goal for this acquisition was to form a single firm that was large enough to produce a large rigid airship and a smaller non-rigid airship. In July 1980, TSL changed the name of the newly merged firm to Airship Industries Limited (AI).

During the next two years, AI resources were divided between nonrigid and rigid airship projects. AI's rigid airship team, under Major Malcolm Wren, developed two different, large rigid airship designs, the conventional R40 / R130 and the metal-clad R150 metal-clad.

While there was significant interest from FedEx and Redcoat Air Cargo, no contracts were placed for rigid airships. Development of Wren's Thermo-Skyship hybrid thermal airship ended during this period. You'll find more information on this airship in my separate article on Thermo-Skyships Ltd. (TSL).

Airship Industries was in significant financial difficulty in 1982. In late 1982, a "de-merger" was agreed, and the former TSL rigid airship technical and management team left AI to form Wren Skyships, Ltd. on the Isle of Man with Major Wren as Managing Director. Their focus was on developing the R.30 and the RS.1 metal-clad rigid airships. Roger Munk remained with AI.

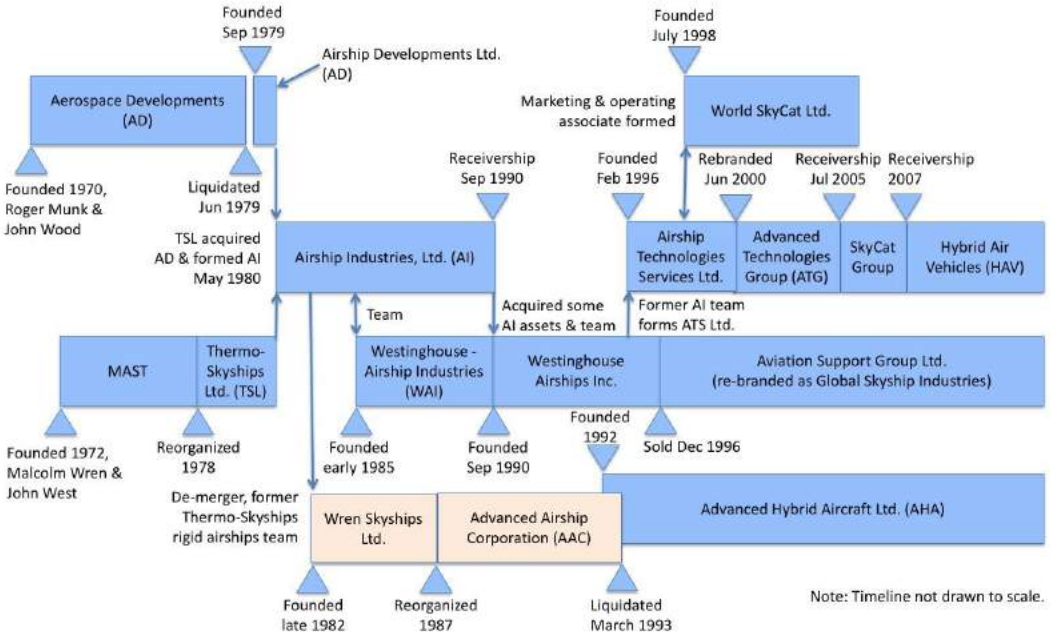


Wren Skyships took over the Airship Industries Isle of Man facilities and acquired two AI subsidiaries: American Skyship Industries Inc., based at Lansdowne Airport, Ohio, and New Zealand Airships Ltd.

In mid-1985, the US Naval Air Development Center (NADC) awarded three six-month contracts for design studies of a radar-carrying Battle Surveillance Airship System (BSAS) to Goodyear Aerospace, and the teams of Westinghouse / Airship Industries (WAI) and Boeing / Wren Skyships. WAI was selected in 1987 to build the Sentinel airship.

In 1987, Wren Skyships was reorganized and renamed Advanced Airship Corporation (AAC), which focused on developing the Advanced Non-Rigid (ANR) airship. Work on the rigid R.30 and RS.1 stopped. AAC was formally incorporated in February 1988.

After the end of the Cold War in the early 1990s, the UK had a significant drop in defense spending, high inflation rates, and the onset of a recession. By early 1993, funding options to sustain the business were no longer available to AAC. Hence, work on the nearly complete ANR-1 and recently started ANR-2 airships ceased. AAC went into liquidation on 1 March 1993. Chief designer Bruce Blake went on to form Advanced Hybrid Aircraft (AHA) in 1982 in Surrey, BC, Canada.

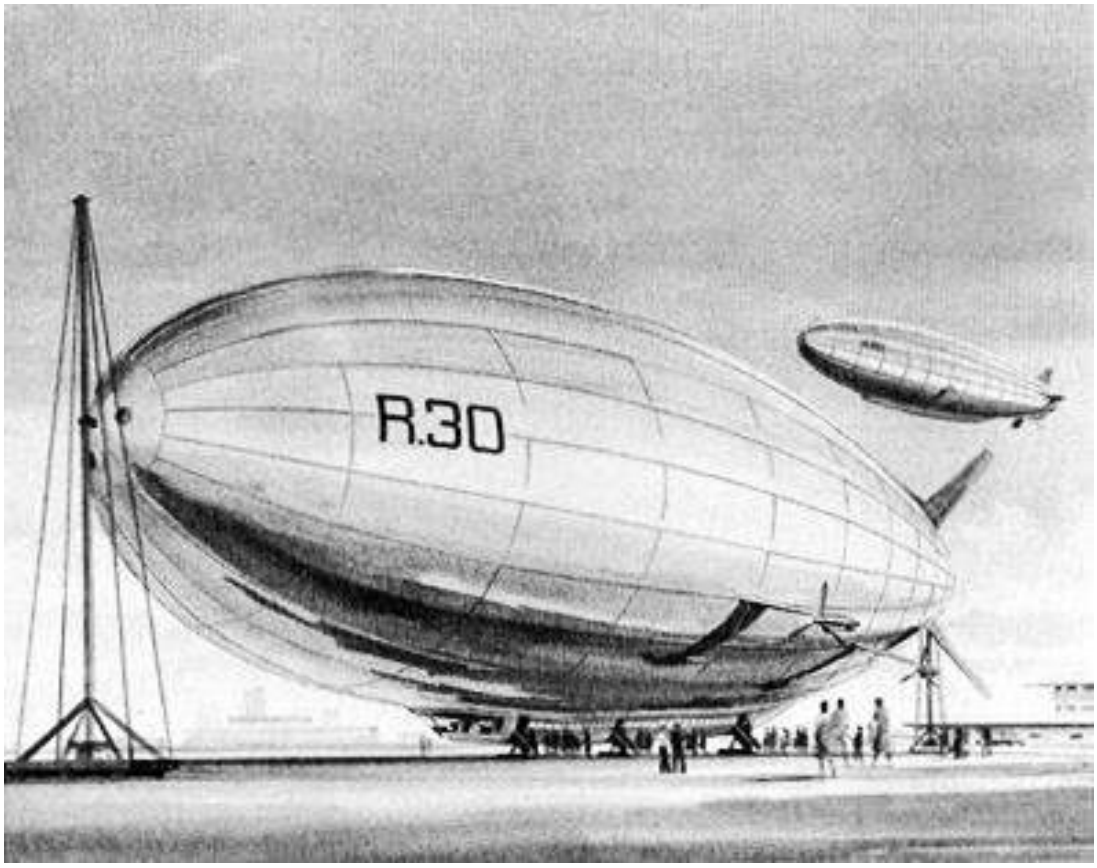


Roadmap to airship firms managed or strongly influenced by M.W. Wren and Roger Munk, highlighting Wren Skyships and AAC.

2. R.30 rigid airship

The R.30 was a scaled-down version of the R150 developed by Wren and the design staff at Airship Industries before the de-merger in 1982. Both hull designs were similar in concept to the successful US Navy metal-clad ZMC-2 airship built in 1929. Design work on the R.30 metal-clad, rigid airship was initiated at Wren Skyships in 1982 in response to a US Coastguard requirement for a patrol airship.

Design concepts also were developed for passenger and cargo / utility versions. Both versions shared the same metal-clad envelope. With four thrust vectoring turboprop engines installed on fixed stub wings, the passenger version was substantially faster than the cargo / utility version, which had two turboprop engines. For passenger service, the R.30 was expected to be practical and economically competitive with other forms of commuter travel over distances up to 400 km (249 miles). European city pairs, such as London-Paris and London-Amsterdam are within this range.



Concept drawing of the R.30. Source: Airships Online

General characteristics of the R.30

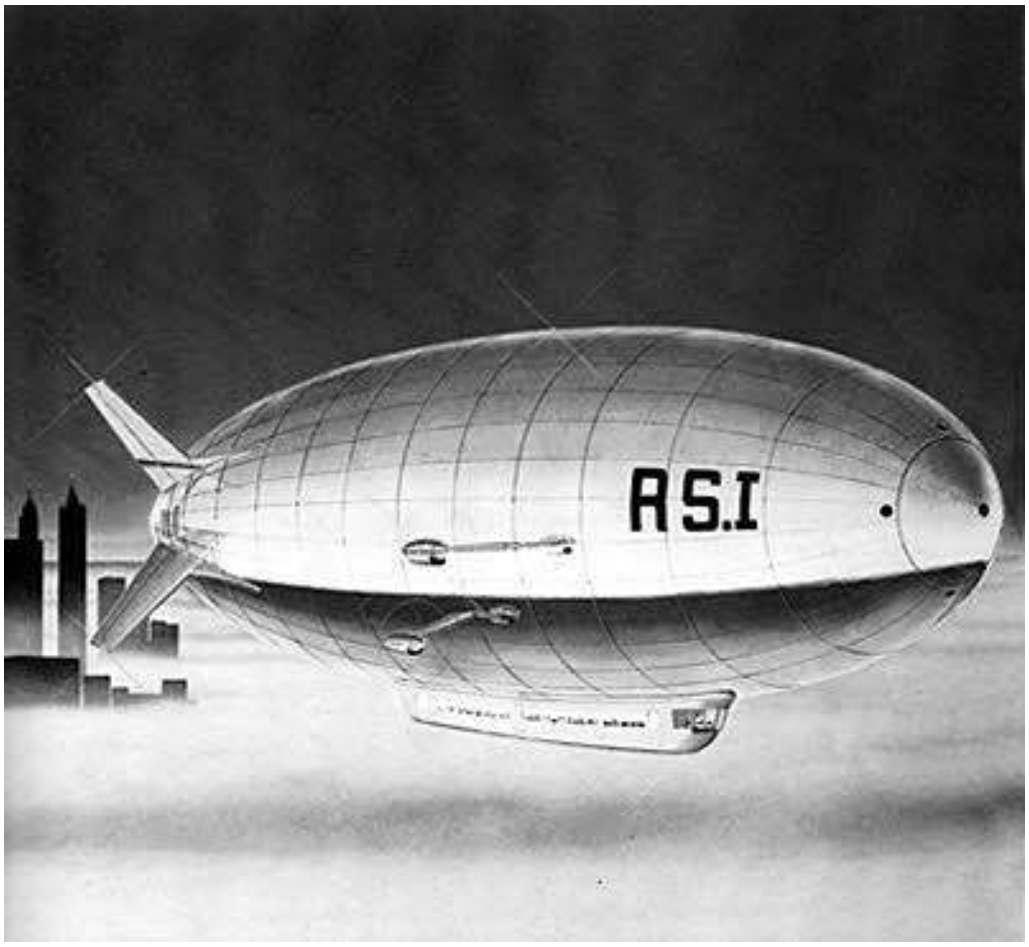
Parameter	**R.30**
Airship type	Rigid, aluminum alloy frame, metal-clad
Frame	24 longitudinal & 14 ring frames, two of which were heavy duty to support engines and loads.
Length	328 ft (100 m)
Diameter	75.5 ft (23 m)
Width	108.3 ft (33 m), including turboprop engines
Height	82 ft (25 m) overall
Lift gas	Helium. No individual lift gas cells. The metal-clad envelope was the lift gas cell.
Envelope type	• Metal-clad envelope, no individual gas cells • Alclad 2024-T3 aluminum with a thickness range of .010 to .025 in. (0.254 to 0.635 mm) • Supported by 24 longitudinal and 14 ring frames, two of which would be heavy duty to support engines and gondola loads.
Envelope gross volume	1,100,000 ft^3 (31,149 m^3) with two ballonets
Propulsion and control	• Passenger: 4 x thrust vectoring Honeywell TPE 331-15 turboprops rated @ 1,650 shp (1,230 kW) each, driving three-bladed feathering and reversing propellers, 16.4 ft (5 m) in diameter. Total installed power: 6,600 shp (4,920 kW). • Cargo/utility: 2 x thrust vectoring Honeywell TPE 331-15 turboprops, same thrust vectoring installation & propellers. Total installed power: 3,300 shp (2,460 kW) • 1 x auxiliary power source for bow and stern 5-port thrusters
Fuel load	10,000 lb (4,536 kg)
Payload	• Passenger: 15.5 tons (14 metric tons), for a passenger capacity of 100 – 120 depending on seating density • Cargo/utility: 17.6 tons (16 metric tons) of low density cargo
Speed, maximum	• Passenger: 154 mph (248 kph) • Cargo/utility: 122 mph (197 kph)
Speed, cruise	• Passenger: 149 mph (240 kph) • Cargo/utility: 116 mph (187 kph)
Range, maximum	770 nautical miles (1,426 km)
Endurance	7.7 hours
Range with ferry tanks	3,500 nautical miles (6,482 km) max. (with special in-flight ballasting arrangements)

In 1983, the targeted sale price for an R.30 was in the $8 million to $12 million range. Plans were made for Wren's US subsidiary, American Skyship Industries Inc., to establish a US manufacturing facility at Lansdowne Airport, Ohio. That facility was not built.

3. RS.1 rigid airship (redesigned later as RS30)

The metal-clad RS.1 multi-mission airship was much larger than the contemporary non-rigid Skyship 600 being developed at that time by Airship Industries. Design concepts were developed for four versions: maritime patrol, passenger carrier, car/passenger carrier and cargo carrier. None were built.

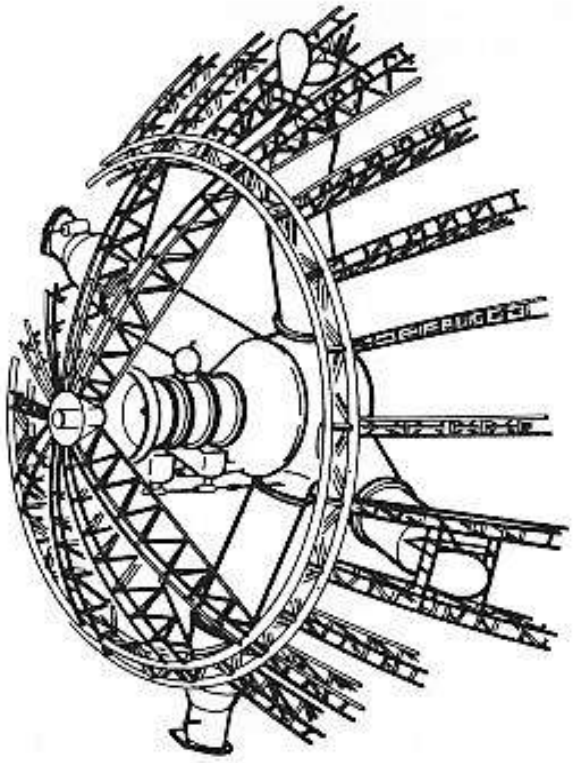
In 1987, when Wren Skyships Limited was reorganized and became the Advanced Airship Corporation (AAC), the RS.1 and R.30 projects were cancelled.



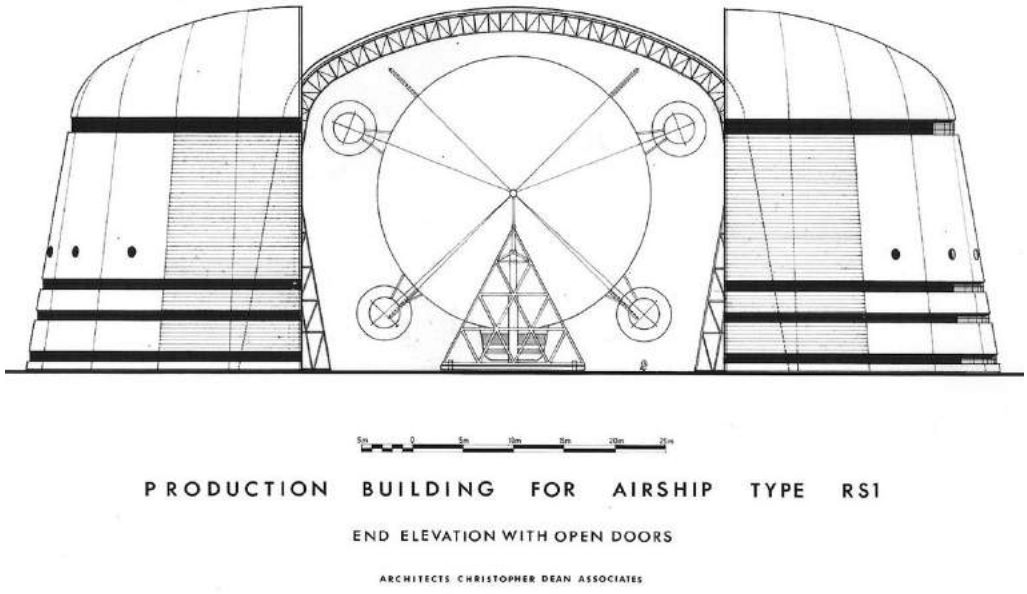
Concept drawing of the RS1. Source: Airships Online

General characteristics of the RS.1

Parameter	RS.1
Airship type	Rigid, aluminum alloy frame with aluminum alloy envelope
Application	Maritime patrol, passenger carrier, and passenger/car ferry
Length	128 m (420 ft)
Diameter, max	25.3 m (83 ft)
Width, overall	36 m (118 ft)
Height, overall	29 m (95 ft)
Lift gas	Helium. No individual lift gas cells. The metal-clad envelope was the lift gas cell, with two internal ballonets.
Envelope type	Metal-clad, likely similar to R.30
Envelope gross volume	45,080 m^3 (1,592,000 ft^3), with two ballonets
Aerostatic lift	47,000 kg (103,617 lb)
Weight, empty	20,000 kg (44,092 lb)
Weight, max takeoff	50,000 kg (110,231 lb)
Payload	25,000 kg / 25 metric tons (55,116 lb / 27.5 tons)
Gondola dimensions	40 L x 4.9 W x 2.6 H m 161 L x 16 W x 8.5 H ft
Cargo compartment volume	433 m^3 (15,291 ft^3)
Accommodations	Crew + 200 passenger seats
Propulsion system	• 4 x Honeywell TPE 331-15 turboprops @ 1,230 kW (1,650 shp) each, thrust-vectoring engine mount, driving 3-bladed propellers. Total installed power: 4,920 kW (6,600 shp) • 1 x auxiliary power source for bow and stern 5-port thrusters
Speed, maximum	240 kph (149.3 mph)
Speed, cruise	• 220 kph (136.7 mph) with four engines, • 165 kph (102.5 mph) with three engines, • 125 kph (77.7 mph) with two engines
Altitude, maximum	1,524 m (5,000 ft)
Range at economic cruise speed	12,000 km (7,456 miles)
Service life	15 to 20 years



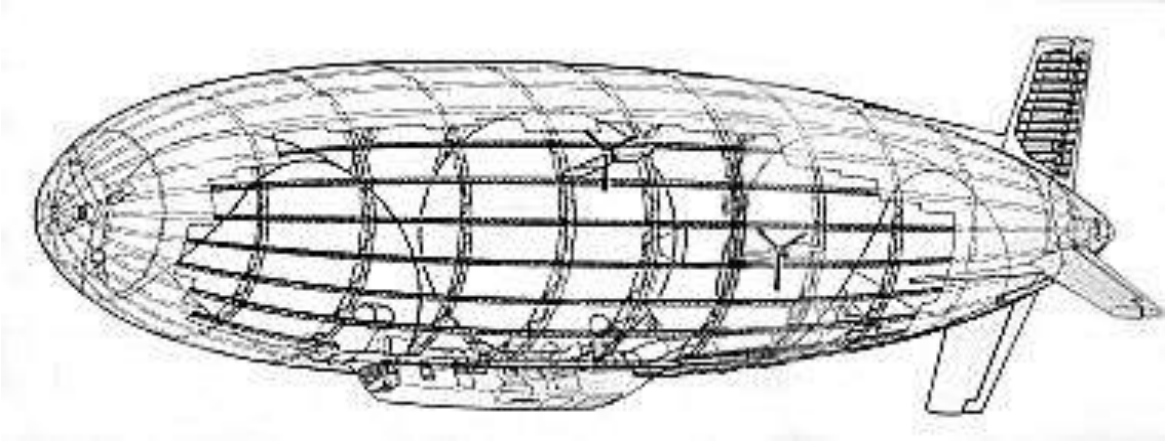
RS.1 bow/stern 5-port thruster configuration (similar to R.150 and R.30 configurations). Source: Airship Heritage Trust



Planned RS.1 construction hangar. Source: Airship Heritage Trust

RS.1 Maritime Patrol Configuration

The RS.1 rigid, metal-clad airship was capable of long range, long endurance missions operating with regular naval forces. For the search and rescue role, the gondola was equipped with an all-weather seaboat tender that could be deployed and recovered at sea. Up to 200 survivors could be accommodated in the gondola.



RS.1 Maritime Patrol variant, rigid hull layout.
Source: adapted from Airship Heritage Trust.

RS.1 cargo configurations

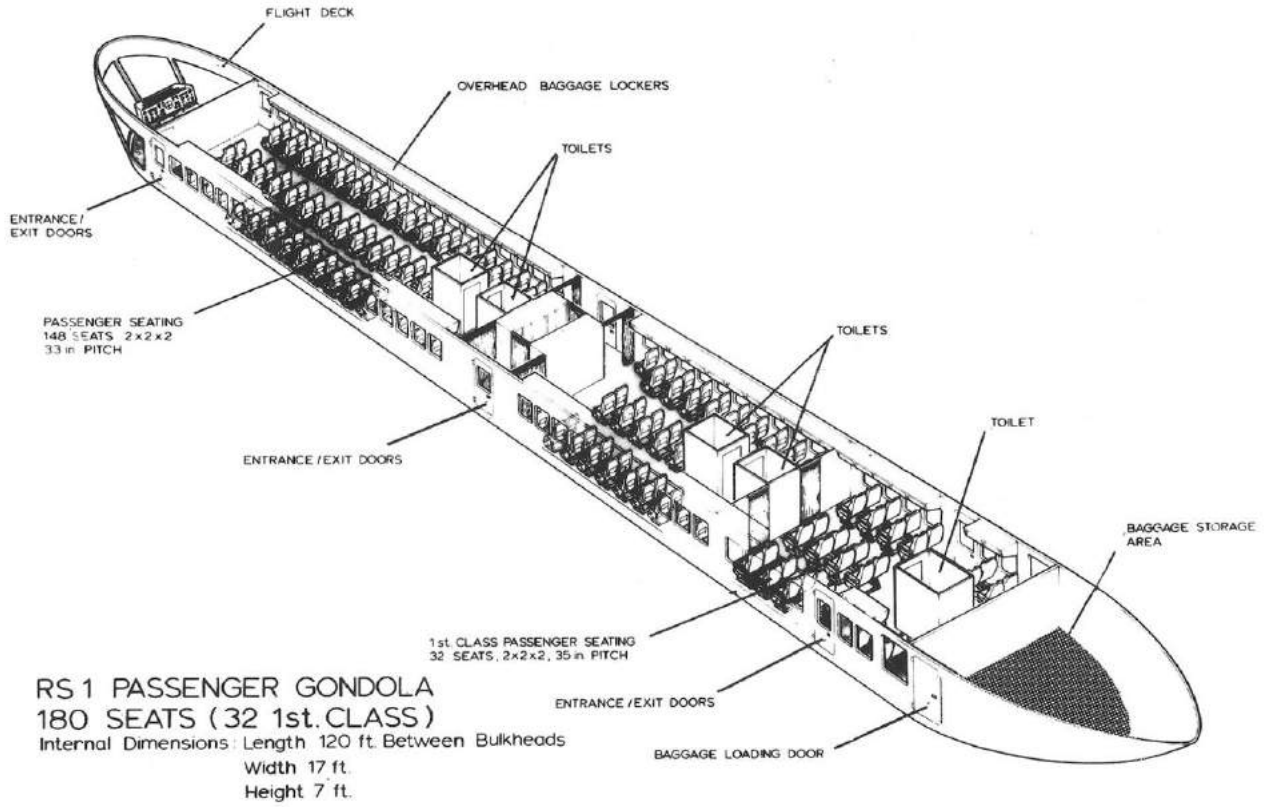
RS.1 delivering emergency medical facility modules.
Source: Airship Heritage Trust

RS.1 delivering heavy external cargo for a pipeline project. Source: Airship Heritage Trust

RS.1 offloading a ship. Note the four turboprop main engines mounted on stub wings. Source: Airship Heritage Trust

RS.1 Passenger Configuration

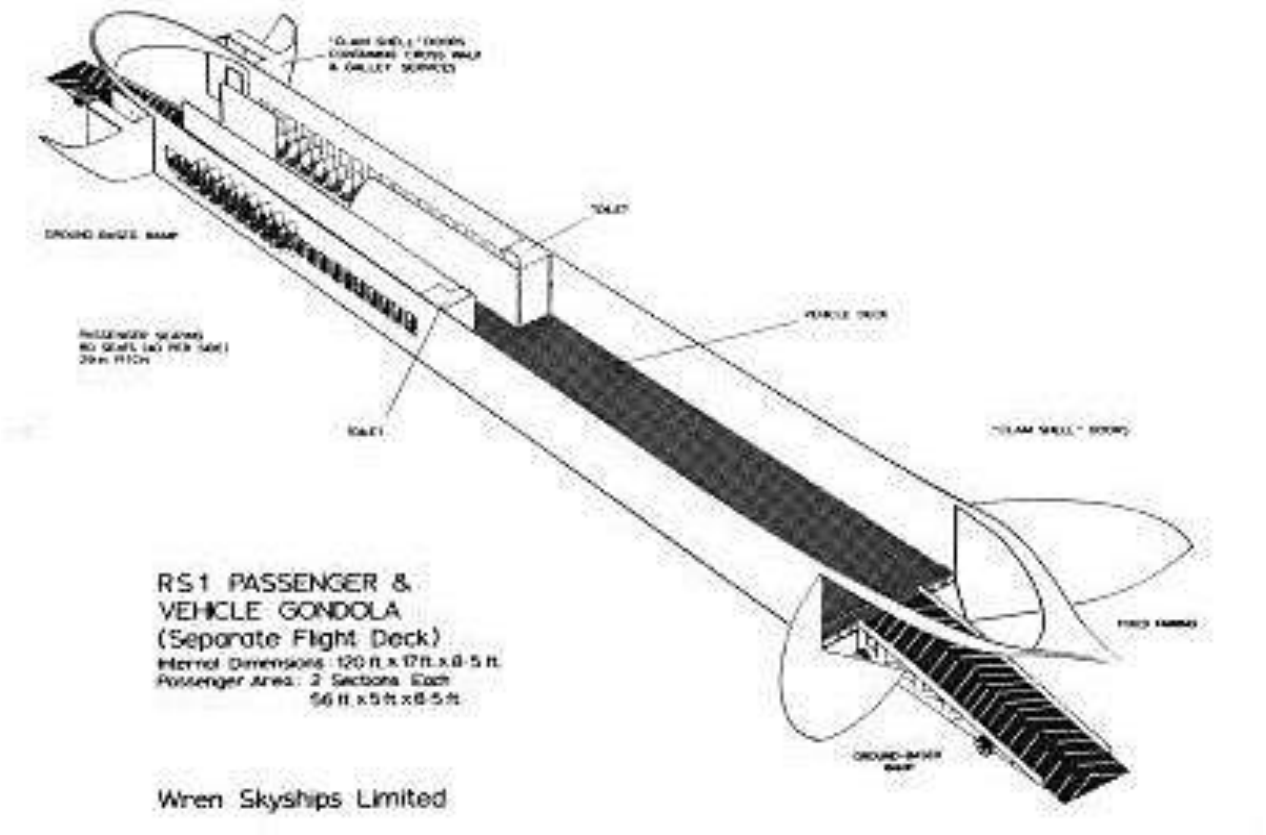
The passenger carrier was designed to accommodate 180 passengers, 148 in economy and 32 in a first class cabin.



Source: Airship Heritage Trust.

RS.1 Car Ferry Configuration

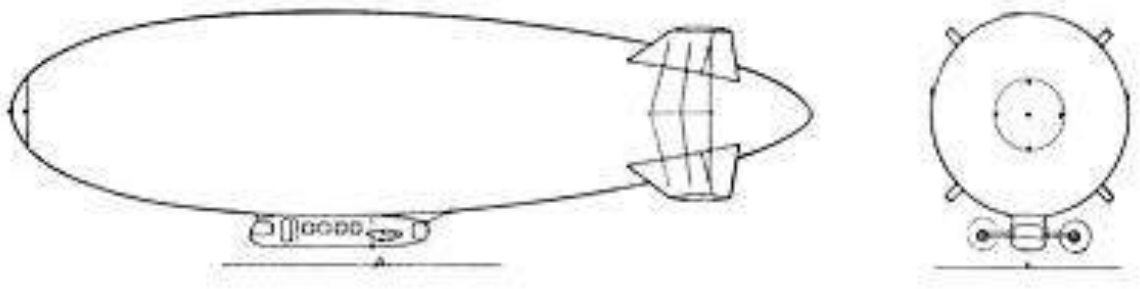
The car ferry was designed for roll-on/roll-off operation with clam shell doors forward and aft.]Vehicles would drive on via the rear loading ramp and park on the vehicle deck. Passengers would move to seating areas, consisting of 80 seats that were positioned 40 seats on each side of the gondola.



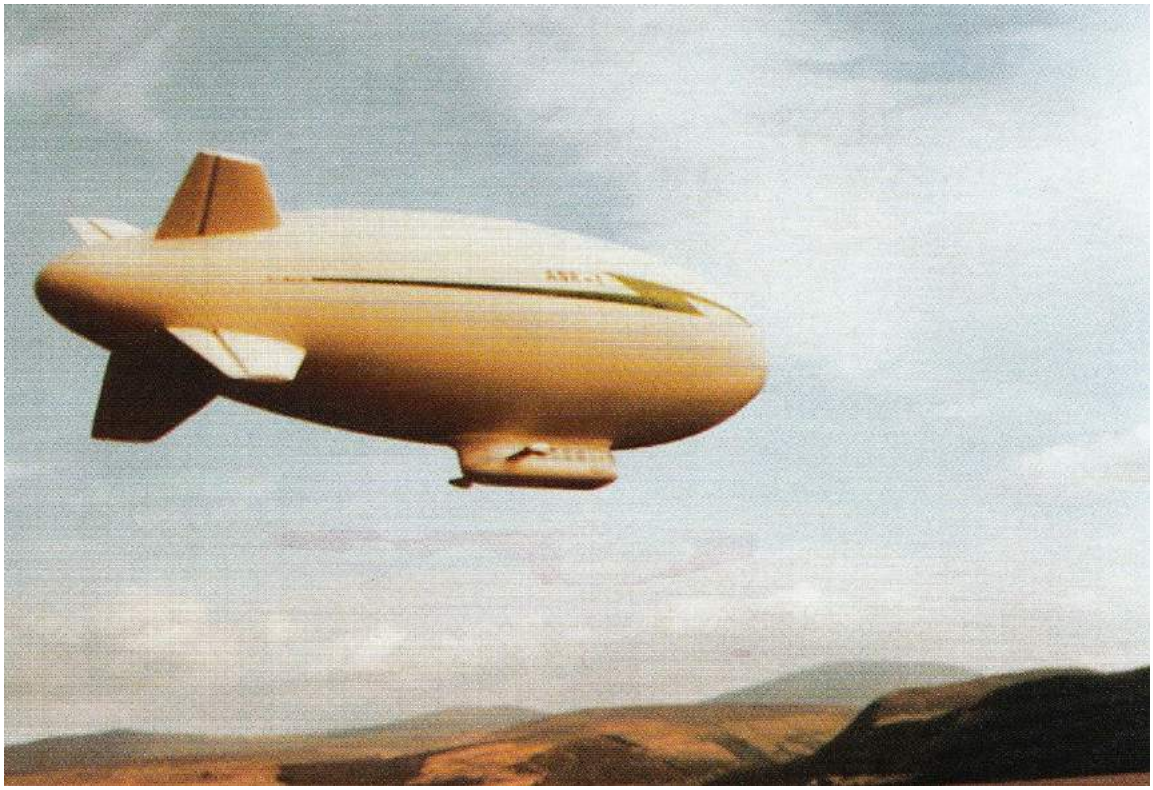
Source: Airship Heritage Trust

4. The Advanced Non-Rigid (ANR) airship

The ANR non-rigid airship was designed to be a cost-effective passenger transport for regular point-to-point routes of up to 80 nautical miles (148 km), such as from the UK to the Isle of Man, or UK to Ireland, with a higher airspeed than the SkyShip models being developed by Airship Industries.

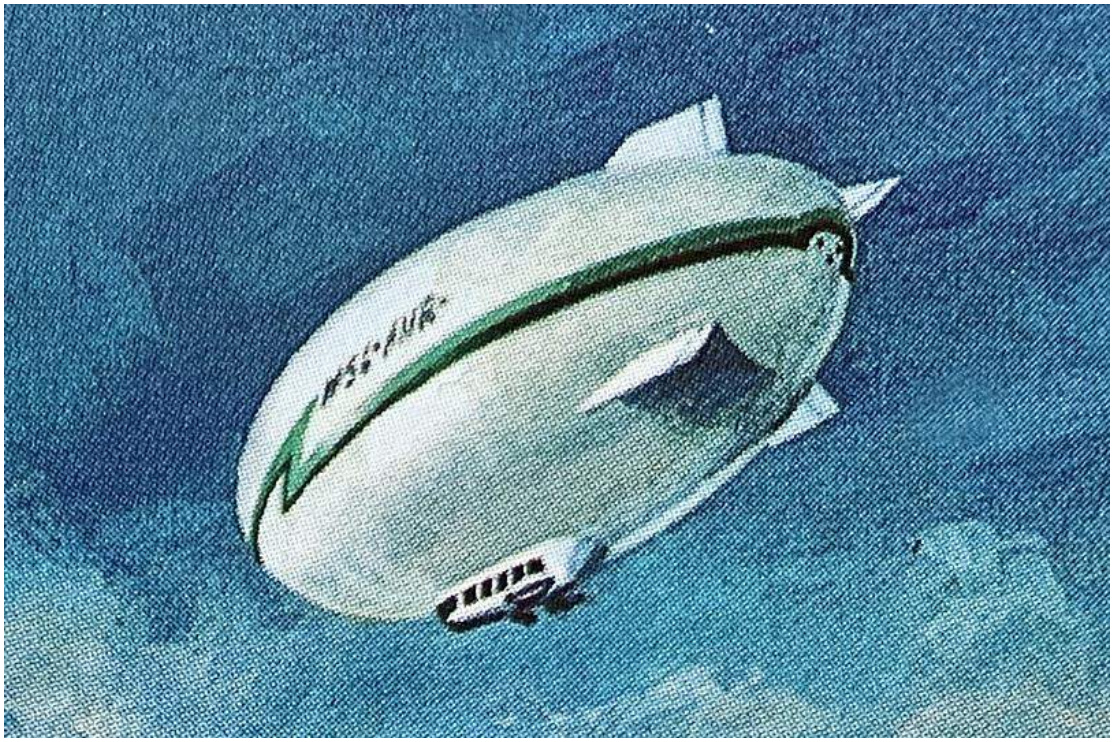


ANR-1 general arrangement. Source: Airship Heritage Trust



Rendering of the ANR-1 in flight. Source: Boyko (2001)

Rendering of ANR-1 boarding passengers. Source: Airships Online



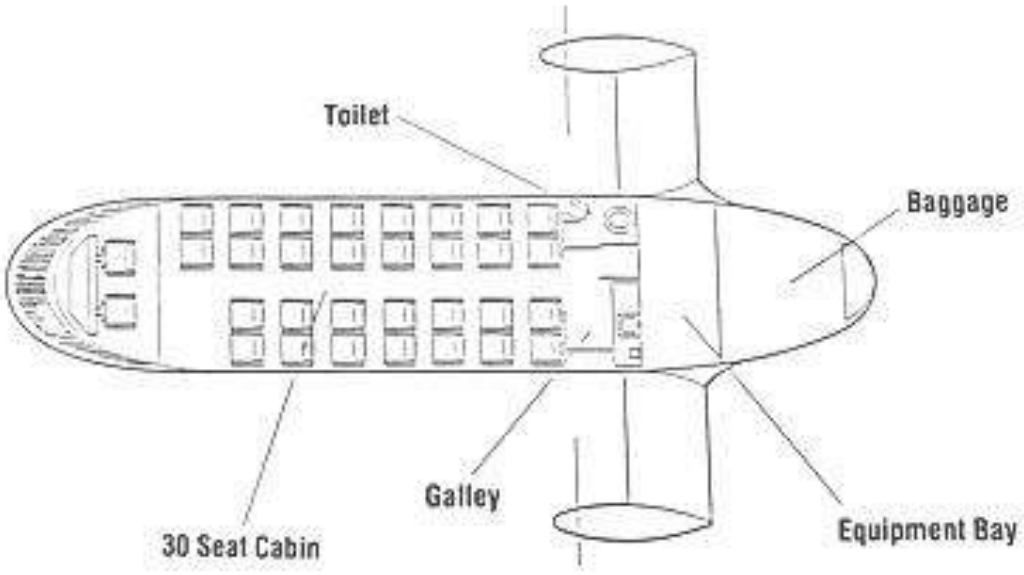
Rendering of ANR-1 in flight. Source: Adapted from Airships Online

General characteristics of the ANR-1

Parameter	ANR-1
Airship type	Non-rigid
Length	61 m (200 ft)
Diameter, max	15.2 m (50 ft)
Width, overall	15.3 m (50.2 ft)
Height, overall	18.9 m (62 ft)
Lift gas	Helium
Envelope gross volume	7,277 m^3 (257,020 ft^3)
Envelope type	Multi-layer fabric
Aerostatic lift	6,367 kg (14,036 lb)
Weight, max takeoff	7,167 kg (15,800 lb)
Dynamic lift from engines	800 kg (1,764 lb)
Weight, empty	3,266 kg (7,200 lb)
Weight, disposable (incl. fuel, payload, special equip)	3,747 kg (8,260 lb)
Payload, with std. fuel load	2,585 kg (5,700 lb)
Gondola dimensions	14.3 L x 2.64 W x 2.36 H m (46.8 L x 8.67 W x 7.75 H ft)
Accommodations	2 crew and 25 to 30 passengers
Propulsion system	• 2 x Allison 250 - B17C turboprops @ 313 kW (420 hp) each, driving 3-bladed 2.4 m (8 ft) diameter propellers • Total installed power: 626 kW (840 hp) • Engines mounted on vectoring aluminum stub wings
Speed, max	151.9 kph (82 kts)
Speed, cruise	144.4 kph (78 kts)
Range	• 559 km @ 120.3 kph (302 n. mi. @ 65 kts) • 1,482 km @ 74.1 kph (800 n. mi. @ 40 kts) • 4,511 km @ 74.1 kph (2,436 n. mi. @ 40 kts) with ferry fuel & in-flight ballasting
Pressure altitude	1,524 m (5,000 ft)
Endurance	20 hours
Service life	8 years

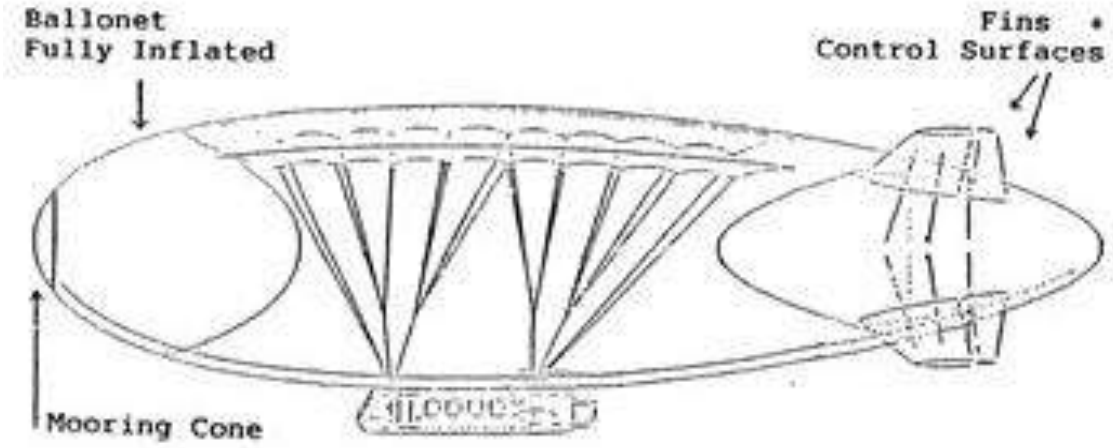
Source: adapted from AAC Newsletter, Issue 1.

The ANR-1 aluminum gondola. Source: Airships Online, Photo by Anthony Leyfeldt (Skylarkair) at Aviodrome, Lelystad airport



Early ANR-1 gondola layout. Source: Airship Heritage Trust

The ANR-1 has two large air ballonets, one at the nose and the other at the tail of the envelope. Catenary curtains (fabric curtains and metal cables) arranged inside the envelope carry the load of the gondola and distribute that load broadly into the upper surface of the fabric envelope.

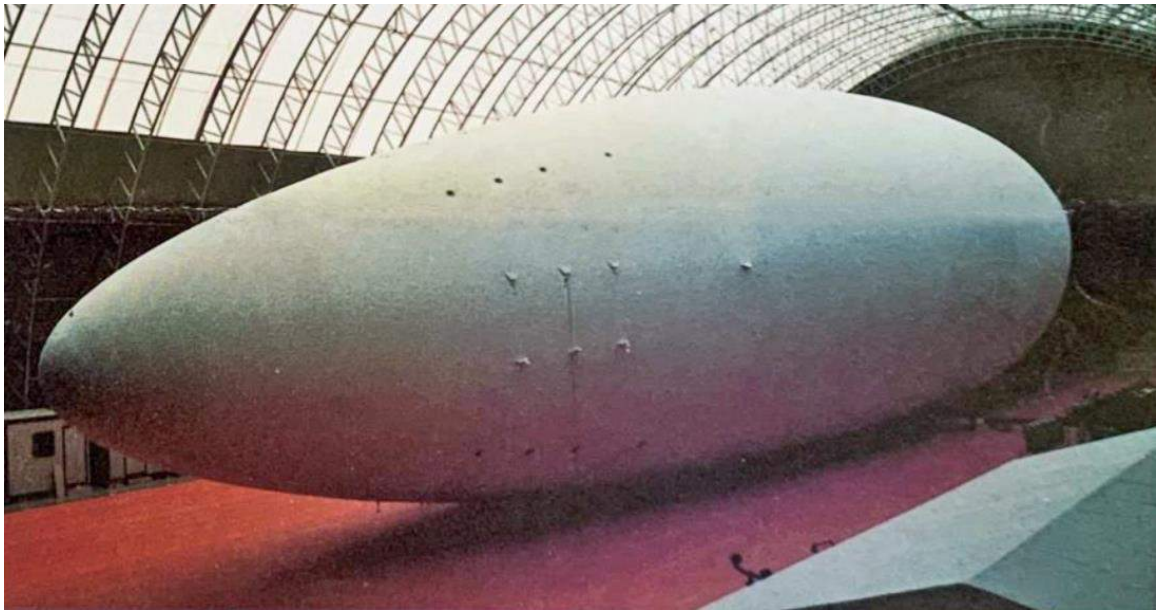


ANR-1 ballonet & catenary arrangement.
Source: Airship Heritage Trust

ANR-1 gondola catenary curtains inside the envelope.
Source: Airship Heritage Trust

The AAC airship shed at Jurby, Isle of Man, was officially opened on 14 June 1988 and demolished 2009. Source: Airship Heritage Trust

The AAC airship shed, at Jurby, Isle of Man, was officially opened on 14 June 1988 and construction of the ANR-1 began shortly thereafter. The prototype envelope was delivered in August and air inflation tests were conducted starting in October 1988.



ANR-1 initial inflation test, stern quarter view. Note reinforced patches for fin support cables. Source: AAC newsletter, October 1988

During a winter storm in January 1989, the main fabric door on the hangar was torn and eventually destroyed. The airship's envelope was quickly deflated in order to safeguard the airship. In March, the envelope was re-inflated inside the repaired hangar.

Testing of the prototype envelope identified the need for a new envelope made of stronger fabric. A Kevlar-based fabric selected would be lighter, stronger and less permeable to helium gas. After receipt, the new envelope was inflated with air and was fitted to the prototype gondola and tail fins.

By mid-1990, the construction work focused on installation of avionics, fuel systems and main pilot controls. ANR-1 was approaching completion and work on the second unit, ANR-2, gondola had started. Not long thereafter, work on the two airships stalled. In June 1991, all work on the airships ceased and 90 of the 120 staff at the company were made redundant. AAC finally went into liquidation on 1 March 1993.

ANR-1 with gondola and fins attached to the envelope in the Jurby shed. Source: Airship Heritage Trust

Today a segment of the ANR-1 composite nose carapace, one fin structure and one ruddervator are on display at the Isle of Man Motor Museum.

5. For more information

- "Wren Skyships RS.1," Airships Online / Airship Heritage Trust: https://www.airshipsonline.com/airships/Wren%20Skyships%20RS%201/index.html
- "Advanced Airship Corporation (AAC) – ANR-1," Airships Online / Airship Heritage Trust:, https://www.airshipsonline.com/airships/Advanced_Airship_Corporation/index.html
- "Airship Sheds – United Kingdom – Jurby," Airship Heritage Trust: https://www.airshipsonline.com/sheds/Jurby.htm
- Anthony J. Dolman, "Current and Possible Future Developments in Lighter-Than-Air (LTA) System Technology," United Nations Industrial Development Organization (UNIDO), pp. 58 – 59 (The Wren Skyship R30), 1983: https://open.unido.org/api/documents/4793600/download/CURRENT%20AND%20POSSIBLE%20FUTURE%20DEVELOPMENTS%20IN%20LIGHTER-THAN-AIR%20
- Don P. Simons, "Talk: Lansdowne Airport," Wikiwand: https://www.wikiwand.com/en/Talk:Lansdowne_Airport

Other *Modern Airships* articles

- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
  - Airship Industries Ltd. airships
  - Navy YEZ-2A (Sentinel 1000 & 5000)
  - Advanced Hybrid Aircraft Ltd. - Patroller
- *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/