

Goodyear Aerospace Corp. Dynastat hybrid airships

Peter Lobner, Updated 25 July 2021

1. Introduction

Goodyear Aircraft Corp. became Goodyear Aerospace Corp. (GAC) in 1963 and, over the next 25 years, continued the company's legacy of developing many different types of airships.

“Dynastat” is a term originated by Goodyear Aerospace in the mid-1960s to define a class of semi-buoyant, semi-rigid, hybrid airships that are identifiable by four or more flank-mounted, large diameter, vectoring prop / rotors that rotate vertically for lift and return to the horizontal position for cruise propulsion. In a Dynastat, the aerostatic lift of the gas envelope carries most or all of the deadweight of the airship. During vertical takeoff and landing (VTOL), dynamic lift from the propellers provides the additional lift and control needed to hover, carry a payload and transition to or from forward flight. In forward flight, aerodynamic lift replaces dynamic lift, allowing the propellers to move to the horizontal position for cruise propulsion. There is no exchange of ballast while passengers and cargo are transferred.

In this article, we'll look at Goodyear's design concepts for a two heavy-lift Dynastats, a passenger Dynastat, and a similar airport feeder hybrid airship. None of these hybrid airships were built.

2. The Goodyear Aerospace heavy-lift Dynastats

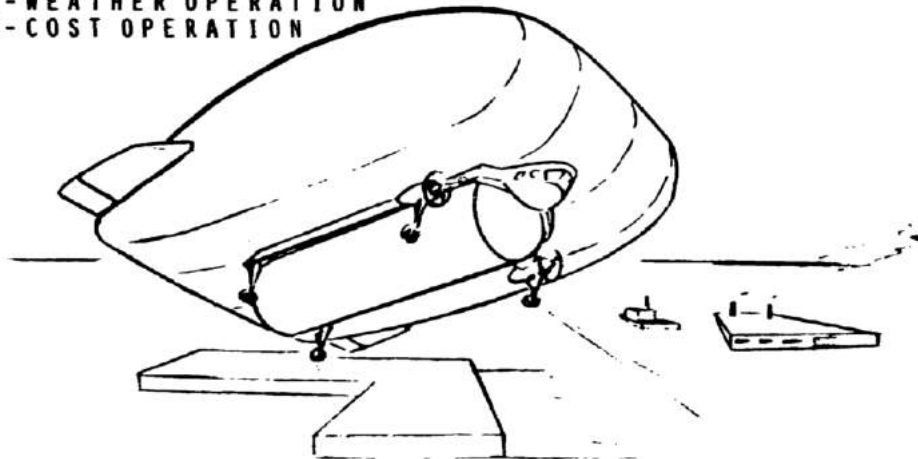
In the late 1960s, Goodyear Aerospace Corp. developed concepts for very heavy-lift, semi-rigid Dynastats that combined the basic shape of their patented 1957 dynamic lift hybrid airship design with powerful, vectored thrust propulsors. Two concepts are described below.

The first concept is an “intermediate cargo transport” designed for point-to-point transport with VTOL operations at the endpoints. This Dynastat is a very large airship with a length of 730 ft (222.5 m) and a width of 175 ft (53.3 m). It has a design altitude of 10,000 ft (3,048 m). With vectored thrust engines delivering a total of 23,000 hp (17,151 kW), the top speed is 140 knots (161 mph).

INTERMEDIATE CARGO TRANSPORT (100 MILES PER HOUR)

POINT-TO-POINT DELIVERY
REDUCE CARGO VIBRATION
REDUCE CARGO SHOCK
ALL-WEATHER OPERATION
LOW-COST OPERATION

TRANSPORT COMPLETELY
ASSEMBLED UNITS.



REACH INACCESSIBLE AREAS
SCHEDULE INTEGRITY
EXTENDED DISTANCE DELIVERY
V. T. O. L. - NO RUNWAY REQUIREMENT

MISSILE TRANSPORT
MINE OPERATIONS
FARM - LIVESTOCK

Goodyear concept drawing circa 1969 for an intermediate cargo Dynastat. Source: Report AMCA 70-001, Appendix K

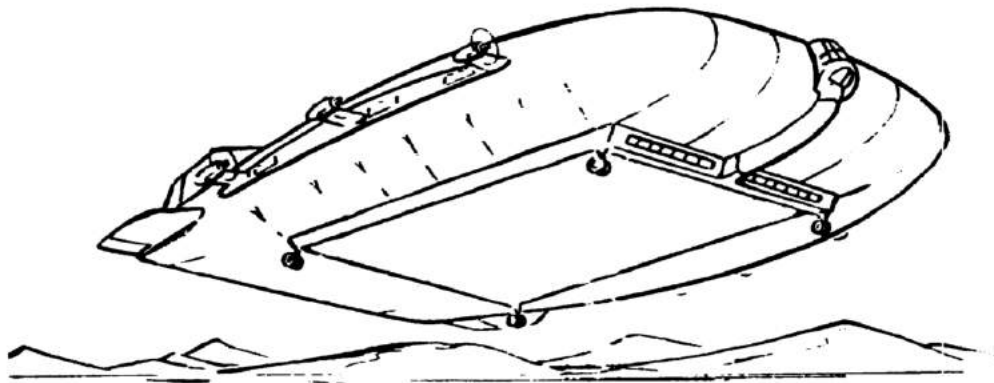
With a helium lift gas volume of 10,700,000 cubic feet (302,990 cubic meters), this Dynastat should generate a gross aerostatic lift of 738,300 pounds (334,887 kg). Goodyear projected that this Dynastat had a useful lift of 275,000 pounds (124,738 kg) when taking credit for 125,000 pounds (56,699 kg) of dynamic lift. This translates to a useful lift of 150,000 pounds (68,038 kg) using aerostatic lift alone. That would put the Dynastat's deadweight at about 588,300 pounds (226,848 kg) and a maximum gross weight of 863,300 pounds (391,586 kg).

For a vertical takeoff at maximum gross weight, 125,000 pounds (56,699 kg) of dynamic lift from propulsors would be required to ascend and transition to forward flight where significant aerodynamic lift will be generated by the airfoil-shaped hull. During the approach to a vertical landing, aerodynamic lift decreases as the heavy airship slows, and propulsive lift must be used to support the gross weight of the airship and control the final descent to the landing site.

The second concept is a “giant transport” designed to carry 800,000 to 1,000,000 pound (400 to 500 tons, 363 to 454 metric tons) payloads over a long range at a cruise speed of 174 knots (200 mph). Vectored thrust propulsors delivering a total of 60,000 hp (44,742 kW) are located along the flanks of the airship hull.

GIANT TRANSPORT

(800,000 - 1,000,000 POUND PAYLOAD)
FUEL: CHEMICAL OR NUCLEAR



20,000,000 CUBIC FEET
200 M. P. H. CRUISE

WORLD POLICE - ARMIES - PASSIVE OBSERVATION -
INTELLIGENCE - TELEVISION RELAY - AIRCRAFT
BEACON

*Goodyear concept drawing, circa 1969, for a giant transport Dynastat
Source: Report AMCA 70-001, Appendix K*

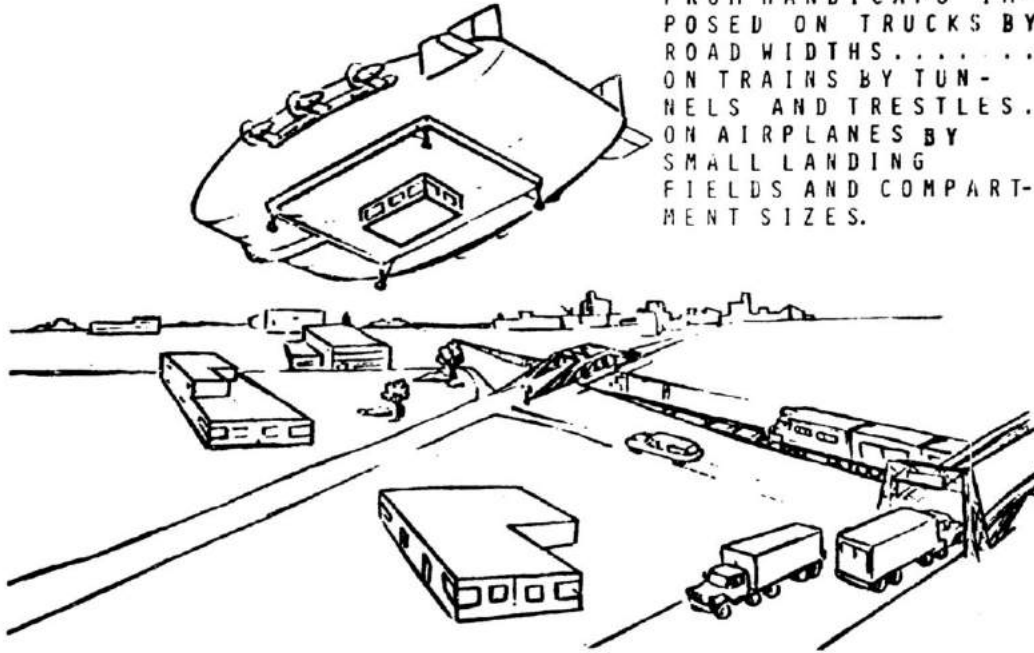
The giant transport Dynastat has a 20,000,000 cubic foot (566,337 cubic meter) lift gas volume (almost three times that of Hindenburg). With helium lift gas, the giant transport Dynastat would generate an aerostatic lift of 1,380,000 pounds (690 tons, 626 metric tons), which is way more than the deadweight of the airship. Most payloads would be carried in an internal cargo bay. Very large items (i.e., a house or a bridge section) could be carried externally under the airship.

It is not clear how Goodyear planned to manage the airship's buoyancy while heavy cargo was unloaded or loaded. Some serious ballasting capabilities and powerful vectored thrusters pushing downward would have been needed to hold an empty giant transport Dynastat on the ground after discharging its heavy loads.

GIANT TRANSPORT

HOUSE - BRIDGES - FACTORIES - OBSERVATORIES

THE AIRSHIP IS FREE
FROM HANDICAPS IM-
POSED ON TRUCKS BY
ROAD WIDTHS
ON TRAINS BY TUN-
NELS AND TRESTLES .
ON AIRPLANES BY
SMALL LANDING
FIELDS AND COMPART-
MENT SIZES.



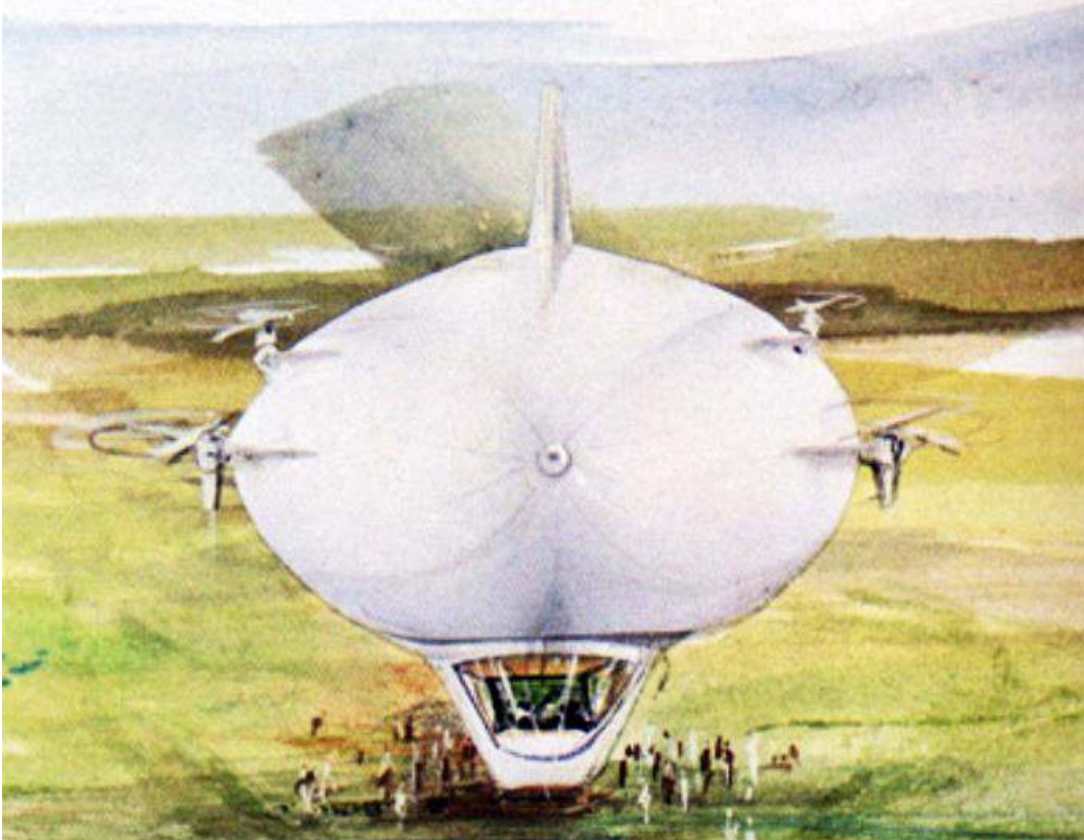
Goodyear concept drawing circa 1969 for a giant transport Dynastat carrying a large external load

Source: Report AMCA 70-001, Appendix K

3. The Goodyear Aerospace VTOL Dynastat

In 1970, a semi-rigid commercial passenger Dynastat, dubbed the "VTOL Dynastat" was described at the American Helium Society symposium in Washington D.C. This was a short-haul intercity craft designed for relatively quiet VTOL operations in populated areas. Basic design characteristics included:

- 100 x 30 ft (30 x 9 m) passenger cabin for 100 passengers
- 200 – 500 mile (300 – 800 km) range
- Powered by four to six engines driving vectorable prop / rotors for forward and vertical thrust. A rigid structure inside the envelope supported the propulsors on outriggers.

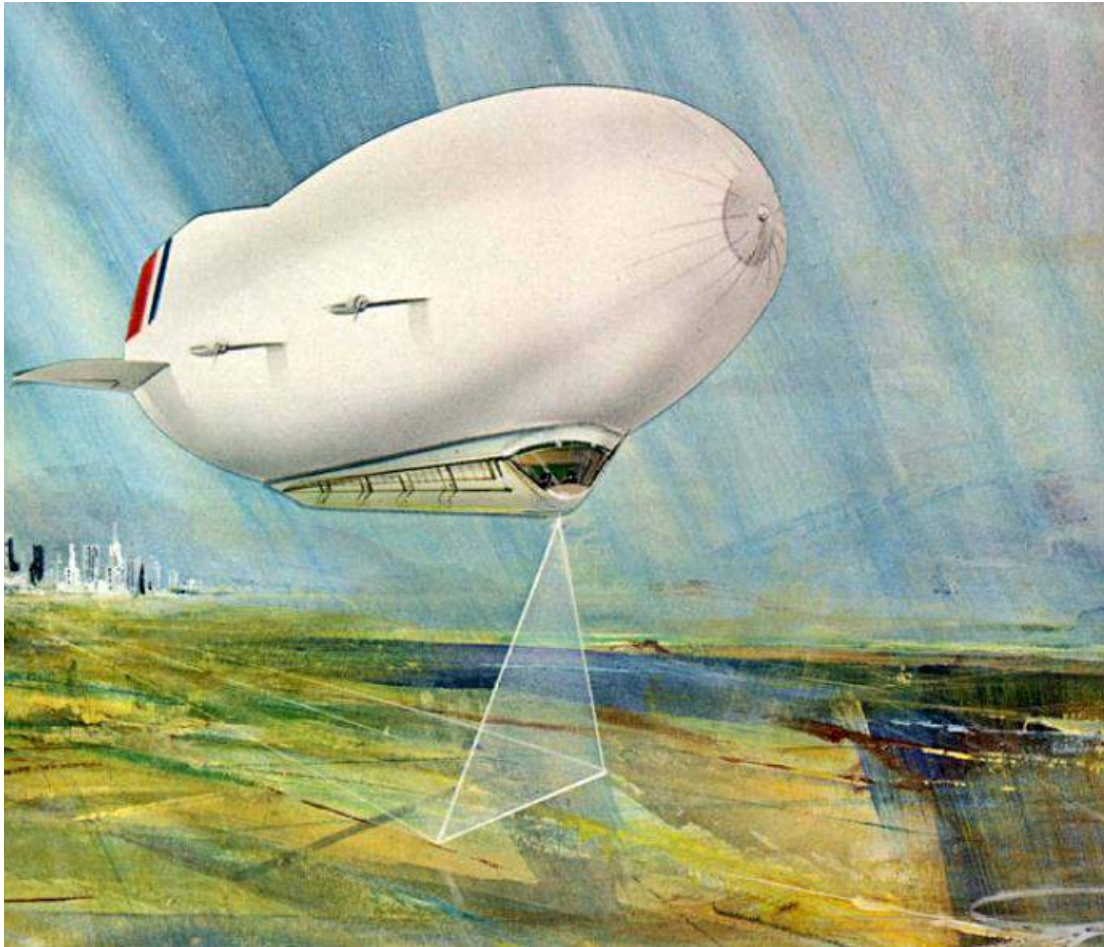


VTOL passenger Dynastat in flight, viewed from the bow. Note all propulsors are vectored up for lift. Source: Nigel Kaley (2003)

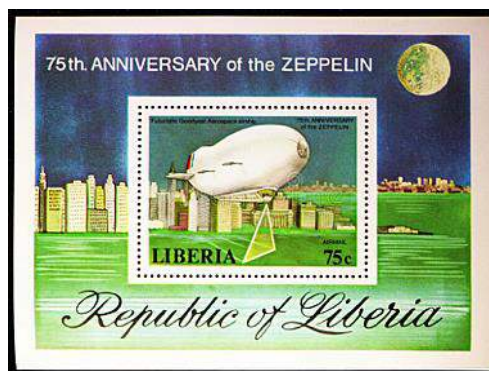


VTOL Dynastat at a rooftop landing pad with engines vectored up. Source: Nigel Kaley (2003)

The VTOL Dynastat could be adapted for a range of civil and military missions.



VTOL Dynastat conducting a ground scanning mission during cruise flight, with engines vectored forward. Source: Nigel Kaley (2003)



Liberian commemorative stamp with a Dynastat. Source: <https://www.dreamstime.com/photos-images/postage-stamp-liberia.html>

4. Airport feeder airship (Feedliner)

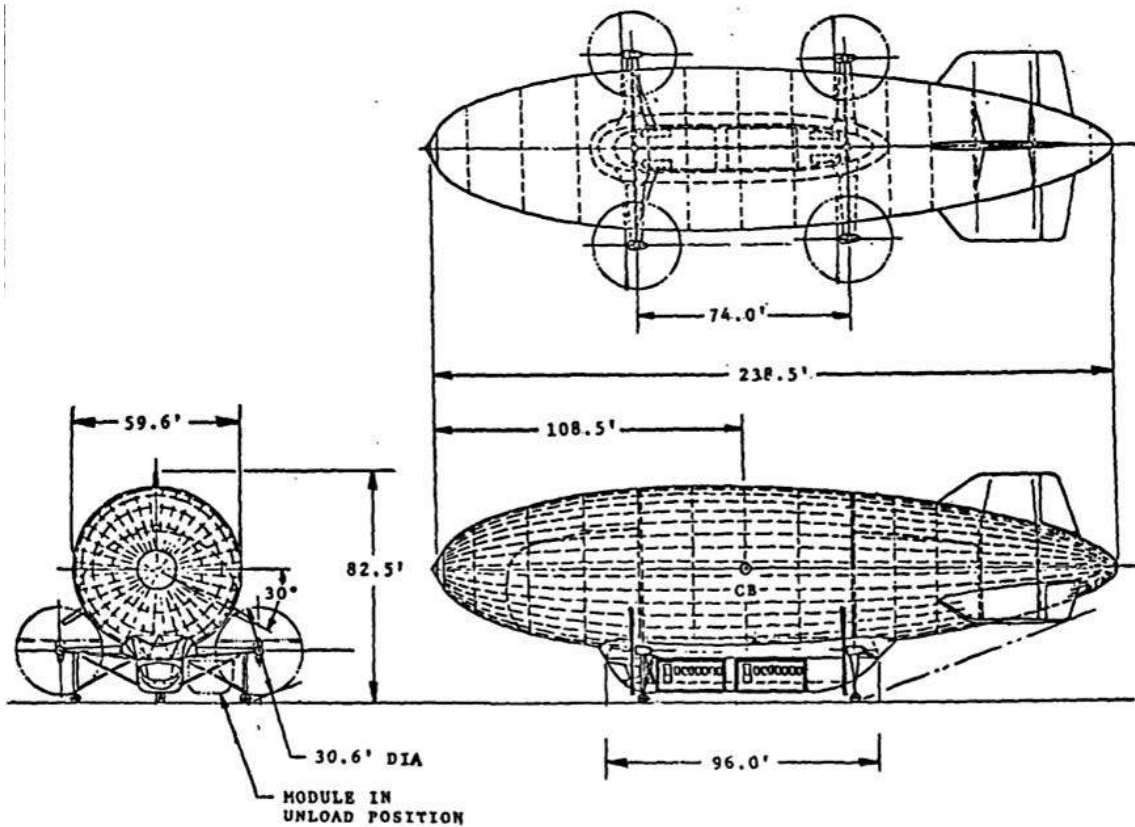
In 1975, the National Aeronautics and Space Administration (NASA) initiated a study called “Feasibility of Modern Airships – Phase I,” and continued with additional Navy sponsorship for Phase II in 1976 – 77. Goodyear Aerospace was a contractor in both phases. In Phase II, Goodyear developed a conceptual design for a civilian airport feeder vehicle (a feedliner), which was a quad-rotor, VTOL, semi-buoyant, ellipsoidal airship capable of transporting passengers or cargo to major hub terminals from distributed suburban and downtown terminals. The distributed terminals would be located on roof-tops of parking garage type facilities.

To enable operations in urban and suburban areas, the airship was subject to a takeoff noise limit of 95 perceived noise decibels (PNdB) at 500 ft (152 meters) from the vehicle centerline.

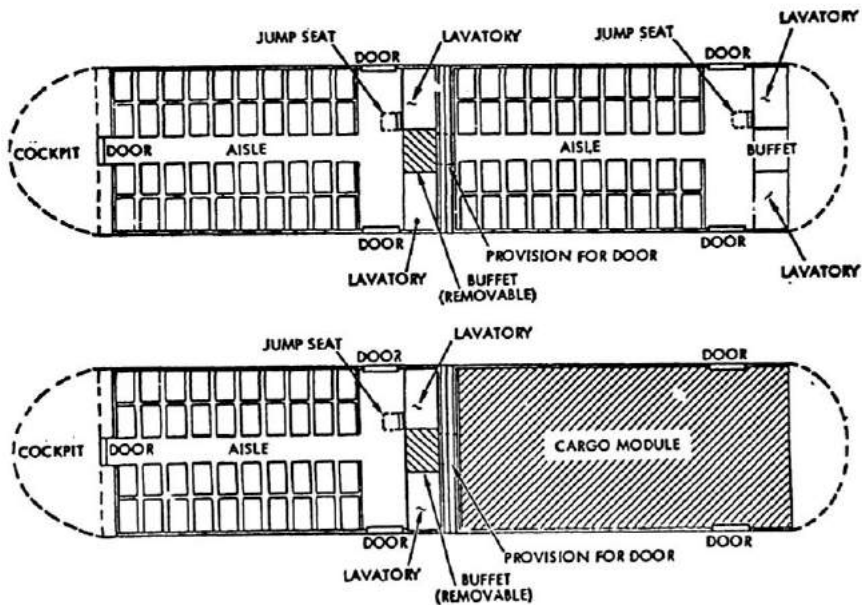
The airport feeder was a rigid, metal-clad airship design concept, and in that respect, it was different than the semi-rigid VTOL Dynastat described previously.

Airport feeder airship design & performance characteristics

Parameter	Airport feeder airship
Length	238.5 ft (72.7 m)
Diameter	59.6 ft (18.2 m)
Height, overall	82.5 ft (25.1 m)
Envelope type	Metal clad, with 2 ballonets
Envelope volume	428,500 ft ³ (12,135 m ³)
Gross weight	67,500 lb (30,618 kg)
β = Static lift / Gross weight	0.35
Propulsion	4 x vectorable prop / rotors installed on rigid outriggers between the gondola and the envelope
Gondola length	96 ft (25.2 m)
Accommodations	Crew + modular capacity for 80 passengers / cargo
Speed, cruise	130 knots
Altitude, cruise	2,000 ft (610 m)
Range, max	400 n.mi (741 km)
Flight stage length	Range from 15 to 150 n.miles (27.8 km to 278 km), average stage length 40 n. mi (74.1 km)



General arrangement of the Goodyear Feedliner.
 Source: NASA CR-151920 (1976)



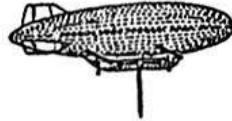
Gondola module options for 80 passengers (above) and 40 passengers + cargo (below). Source: NASA CR-151920 (1976)



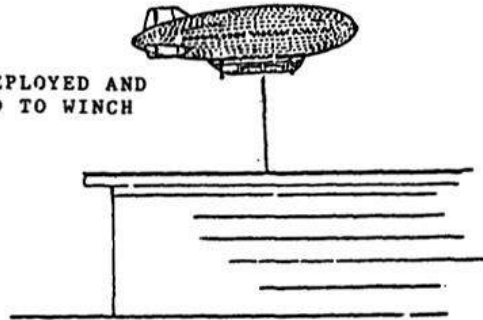
CRUISE FLIGHT



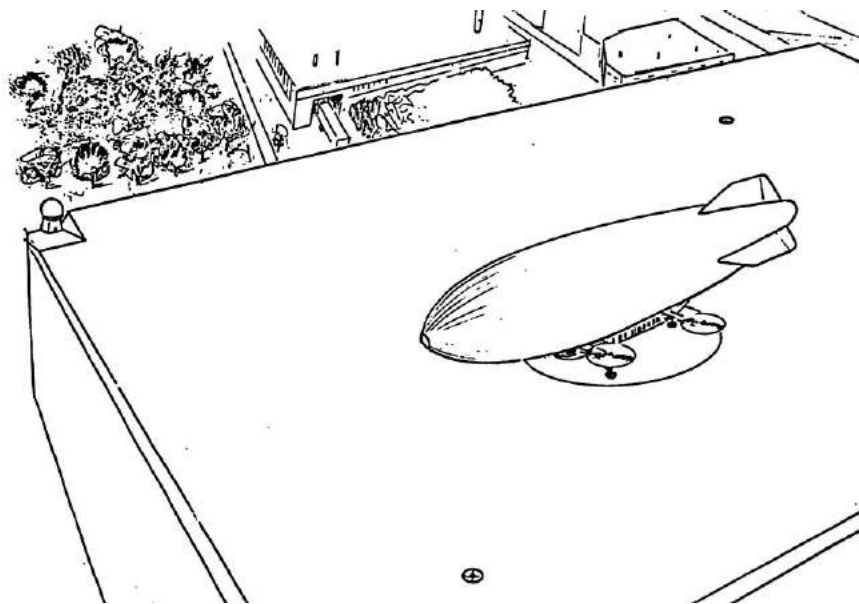
TRANSITION TO HOVER (DEPLOY CABLE)



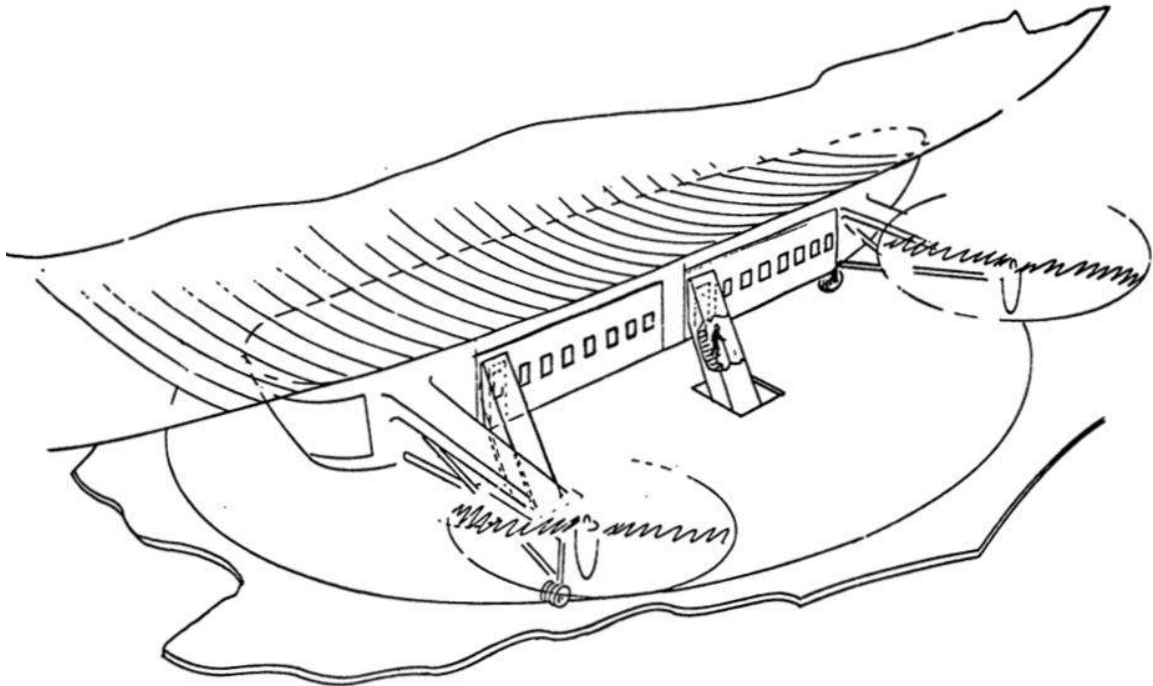
CABLE DEPLOYED AND ATTACHED TO WINCH



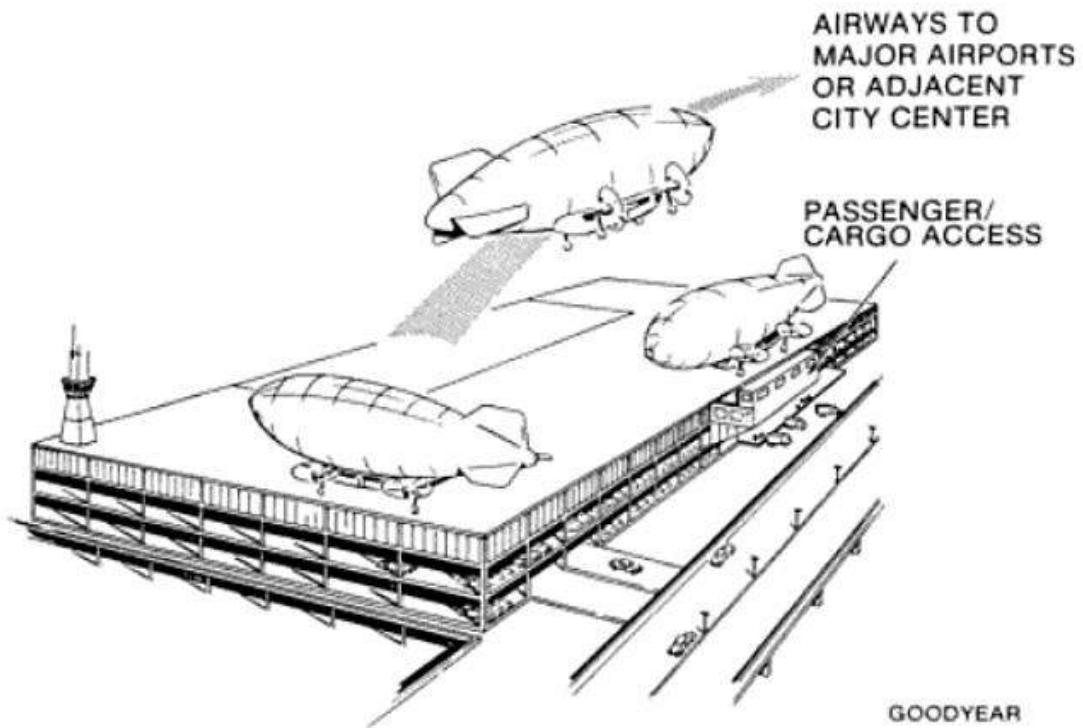
Approach and transition for rooftop landing with the aid of a winch on a rotating turntable landing pad. Source: NASA CR-151920 (1976)



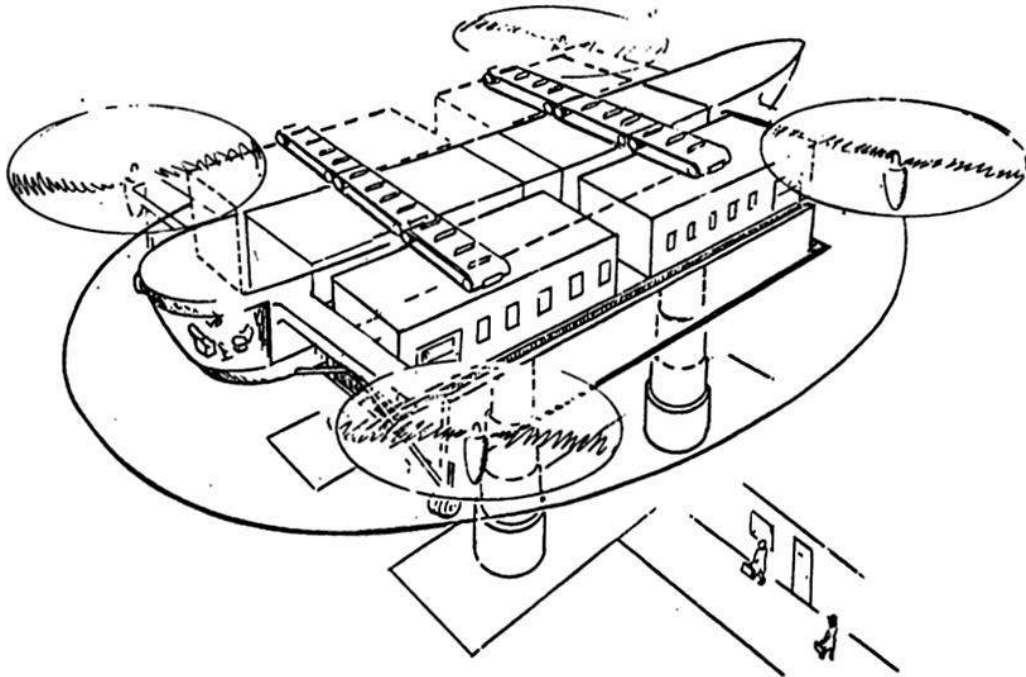
A rooftop landing site with a rotating turntable to align the airship into the wind. Source: NASA CR-151920 (1976)



*Concept for passenger loading / unloading on a rooftop landing pad.
Source: NASA CR-151920 (1976)*



*Goodyear airport feeders cycling through a hub terminal.
Source: 9th AFGL Scientific Balloon Symposium, 1976*



Concept for exchanging whole passenger / cargo modules at a hub terminal. The full modules are extracted from one side of the gondola and lowered into the terminal, while replacement modules are raised from the terminal and loaded from the opposite side of the gondola.

Source: NASA CR-151920 (1976)

5. For more information

- E. Ross, "Lighter-Than-Air Vehicle Technology," Goodyear Aerospace Corporation, Appendix K in US Army Advanced Material Concepts Agency Report AMCA 70-001, November 1969: <https://apps.dtic.mil/dtic/tr/fulltext/u2/864891.pdf>
- "Feasibility study of modern airships - Phase II, Volume 2 - Airport feeder vehicle," NASA CR 151920, Goodyear Aerospace Corporation, September 1976: <https://ntrs.nasa.gov/api/citations/19770016115/downloads/19770016115.pdf>
- Nigel Kaley, "Modern Airship: A review of 40 years of airship development," (2003): <https://docplayer.net/79584867-Mr-nigel-kaley-united-kingdom-the-modern-airship-a-review-of-40-years-of-airship-development.html>

- “Goodyear "Dynastat" Giant Transport Projects,”
Stargazer2006, Secret Projects, 14 September 2012:
<https://www.secretprojects.co.uk/threads/goodyear-dynastat-giant-transport-projects.16680/>

Related *Modern Airship* articles

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