Frank Tinsley – 1957 Twin-hull cruise airship

Peter Lobner, 15 February 2025

1. Introduction

In the December 1957 issue of Mechanix Illustrated, Frank Tinsley presented his conceptual design for a large, rigid, twin-hull, amphibious, nuclear-powered airship outfitted for long-distance, low-cost vacation air cruises targeted for “today’s average office or industrial worker with a two-week vacation and a limited budget.” These airships, “in conjunction with a chain of similarly run resort hotels, could be used for low-cost vacation cruise (packages), conventions, etc.”…“the (onboard) hotel comfort, unique sightseeing facilities and cruise ship social life make the journey an integral part of the vacation, not just a ‘get-there’ chore.”

Source: Frank Tinsley graphic, Mechanix Illustrated, Dec. 1957

At a cruise speed of 100 mph (161 kph), a 36 hour (two-day and one-night) cruise could transit from New York City to London or Paris. Any destination in the Caribbean could be visited from New York City within 24 hours. Cruising from San Francisco to Hawaii also would take about 24 hours. The twin-hull cruise airship was designed with a strengthened, water-tight lower hull to enable water landings and operation from a mooring at a port facility after taking on water ballast. Alternatively, Tinsley claimed the twin-hull cruise airship could operate like other rigid airships from a land-based terminal with a mooring tower.

Most passengers would board the airship via a retractable landing stage located beneath the center wing's trailing edge. If operating from a mooring, these passengers would arrive by boat. Alternatively, passengers could arrive via helicopter and land on a retractable platform extended above the thick central wing's trailing edge.

The basic airfare would be set at a low "popular" price, which provided access to a designated stateroom and public areas housed in the thick central wing between the twin hulls, including the reception salon, lounges and a spacious observation deck along the entire leading edge of the wing. The passengers also had access to sun decks along the top of each hull and passenger promenades along the outer flanks of each hull. These are accessed from the central wing via passageways through the rigid catamaran hulls, and via elevators to the sun decks. There was plenty of room to move around during the flight.

The cost of meals was extra, and passengers could choose between a lower-priced cafeteria / snack bar / cocktail lounge and a higher-priced restaurant / night club. Access to more luxuriously furnished lounges, a movie theater, and television and music rooms also would cost extra.

2. Frank Tinsley's twin-hull cruise airship design

Frank Tinsley's large catamaran cruise airship featured two large, rigid hulls joined by a broad, thick wing section that housed the passenger staterooms and many of the public areas.

<u>Airship hull and central wing structure</u>

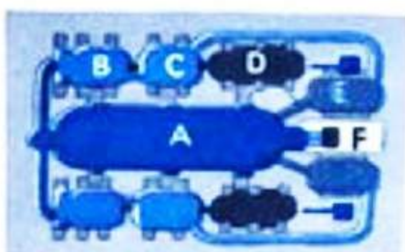
Each of the individual rigid catamaran hulls is a scaled-down version of Frank Tinsley's 1,000 ft (305 m) long monohull Atoms-for-Peace dirigible, which was first presented in the March 1956 issue of Mechanix Illustrated.

The sundecks and promenades are built within triangular side and top keels that reinforce the rigid hull structure.

The thick, constant chord central wing is a rigid structure designed with a Durand 13 section, which, NACA Langley reported, produced "…an unusually high maximum lift.." The wing is installed with "…an optimum four-degree angle of attack." Tinsley reported that, at cruise speed, the aerodynamic lift of the wing would carry its own weight.

Power and propulsion systems

The airship would be powered by two small nuclear power units that are installed low in each hull, near the longitudinal center of gravity. The nuclear power plant design would be similar to the one Frank Tinsley proposed in March 1956 for his Atoms-for-Peace dirigible design concept, which is shown in the following diagram.



Nuclear power plant plan view (one of two on the twin-hull airship).
Source: Frank Tinsley graphic, Mechanix Illustrated, Mar. 1956

The nuclear reactor type is unspecified, but it would be an integral nuclear power plant (A), in which the reactor and the entire closed-loop primary coolant system are inside a single, shielded pressure vessel along with a primary-to-secondary heat exchanger (a steam generator). The non-radioactive high-pressure steam produced on the secondary side of the steam generator is directed through piping to two identical, parallel power conversion trains, both of which are normally operating, but can operate independently. Each train is comprised of a high-pressure and low-pressure steam turbine (B, C) that together drive an electric generator (D). Steam exhausted from the low-pressure turbine (C) passes into a steam condenser (E), where it is condensed into water and then pumped back to the steam generator, completing the closed, secondary-side heat transfer loop. In this application, the steam condenser likely would be air-cooled.

The two power conversion trains for each reactor, and the two separate reactor installations (one in each hull) provide redundancy and physical separation to help ensure that a single failure would not disable all airship power and propulsion.

Electric power generated by the two nuclear power plants would supply the main propulsion system, all other airship systems and would charge batteries, which could provide backup power.

The airship is propelled in flight by two electric motor-driven, large diameter, reversible propellers mounted in the widely-spaced vertical stabilizers. To balance torque effects, the two propellers rotate in opposite directions. When the propellers are operated differentially at low airspeed, the airship should be able to turn in its own length.

When waterborne, the airship is propelled by two small marine propellers installed near the trailing edge of the lower keels, with a rudder behind each propeller.

Aerodynamic controls

The airship has the following aerodynamic control surfaces.

- A split elevator is hinged in two parts (port & starboard) along the central wing section's trailing edge. The fixed middle section of the wing houses the upper and lower landing platforms.
- Two horizontal tail fins on the outboard sides of the hulls with movable elevators the function as “outsize trim tabs.”
- Two vertical tail fins with movable rudders on the upper sections.

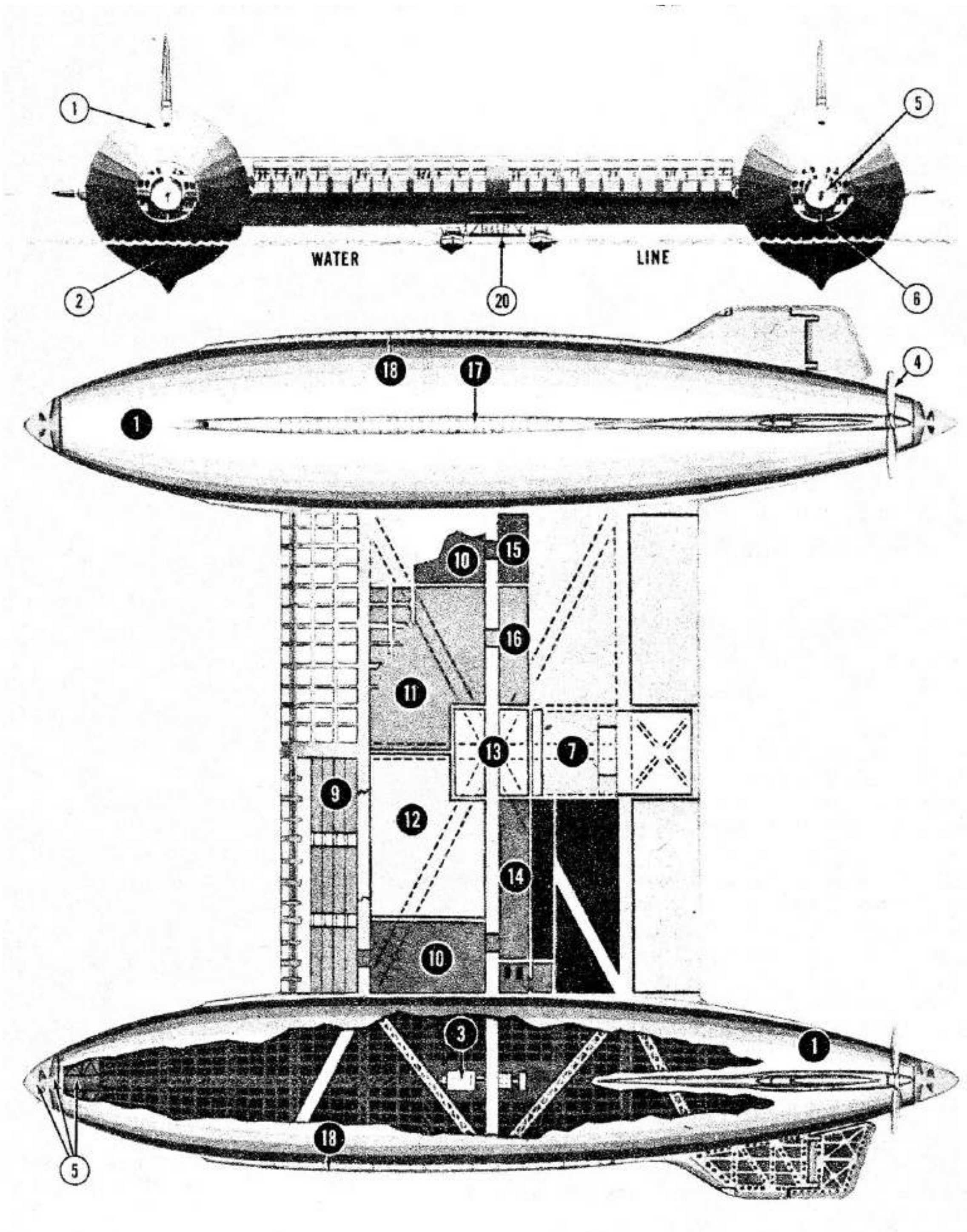
Lift control

Lift control for this catamaran cruise airship is a bit puzzling. On one hand, Tinsley’s stated that this airship was capable of “…tying up to land based mooring masts...” The airship doesn’t have thrust-vectoring engines to provide dynamic lift and fine maneuvering controls during mooring operations. In this case, the catamaran cruise airship would make a landing much like a conventional zeppelin, approaching the mooring mast slowly from downwind, trimmed to nearly neutral aerostatic buoyancy and mooring with the support of a significant ground crew.

On the other hand, the aerodynamically powerful central wing suggests that the catamaran cruise airship is a heavier-than-air hybrid airship that needs to make short takeoffs and landings (STOL). Tinsley stated, "…the gargantuan wing lifts its own weight at cruising speeds." In forward flight, the airship's total lift is the sum of its aerostatic lift and its aerodynamic lift, which is a function of airspeed. The airship didn't have a variable buoyancy control system to reduce its buoyant lift in flight to compensate for the large increase in aerodynamic lift. Therefore, a conventional catamaran cruise airship would generate more total lift than it needed to maintain level cruise flight.

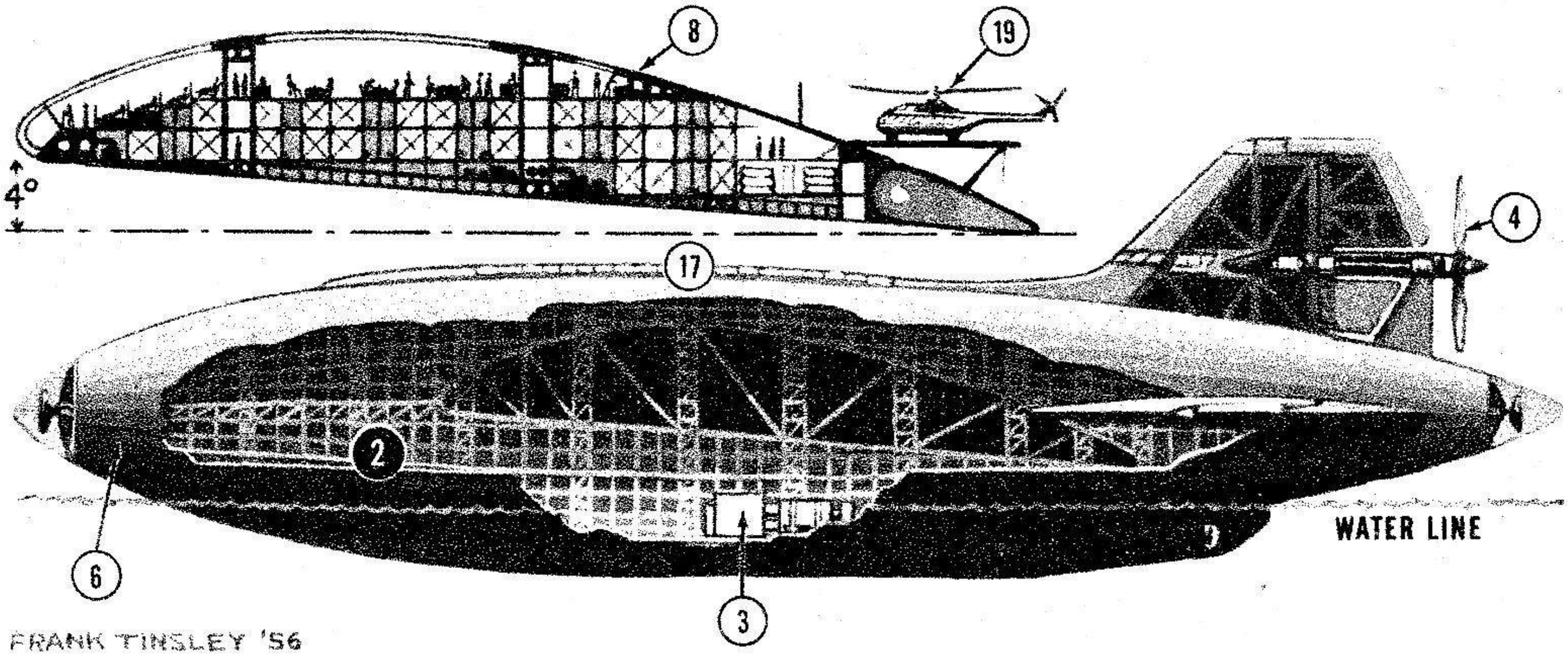
In the 1975 NASA-sponsored study named *Feasibility of Modern Airships – Phase I*, Frank Tinsley's twin-hull design concept was one of the referenced airship concepts considered at the start of the study. However, it was not one of the conventional airship candidates. Instead, it was a candidate for the semi-buoyant, hybrid, short takeoff and landing (STOL) "auxiliary wing" category. As a semi-buoyant hybrid airship, Tinsley's twin-hull design would be heavier-than-air on the ground and would need a short takeoff run to generate enough aerodynamic lift to become airborne and reach cruise flight conditions. At the end of the flight the airship would make a short landing approach and dissipate speed rapidly after touchdown.

Tinsley also stated that the catamaran cruise airship was capable of "…tying up to buoys anchored in terminal harbors….. held down by tons of water ballast pumped into its twin keels." As a conventional airship, it could hover before touchdown and add water ballast until it settled in the water and was secure at its mooring. For takeoff, it would discharge the additional water ballast, lift off vertically and fly away. As a hybrid airship, it would behave like a big STOL seaplane, making a short approach and landing runout before mooring, and possibly taking on water ballast to ensure stability while afloat. Before takeoff, any additional water ballast would be discharged immediately prior to making a short takeoff run in the water and then becoming airborne.



1. INFLATED HULL; 2. Boat hull; 3. Atomic plant; 4. Props; 5. Bridges, radar, crew; 6. Mooring gear; 7. Passenger wing; 8. X-section of wing; 9. Observation deck; 10. Lounges; 11. Cafeteria; 12. Dining room; 13. Kitchen; 14. Movies; 15. Music room; 16. TV room; 17. Sun decks; 18. Passenger promenades; 19. Helicopter landing pad; 20. Boat landing.

Bow external view and plan cross-section view of the twin-hull cruise airship.
Source: Frank Tinsley graphic, adapted from Mechanix Illustrated, Dec. 1957



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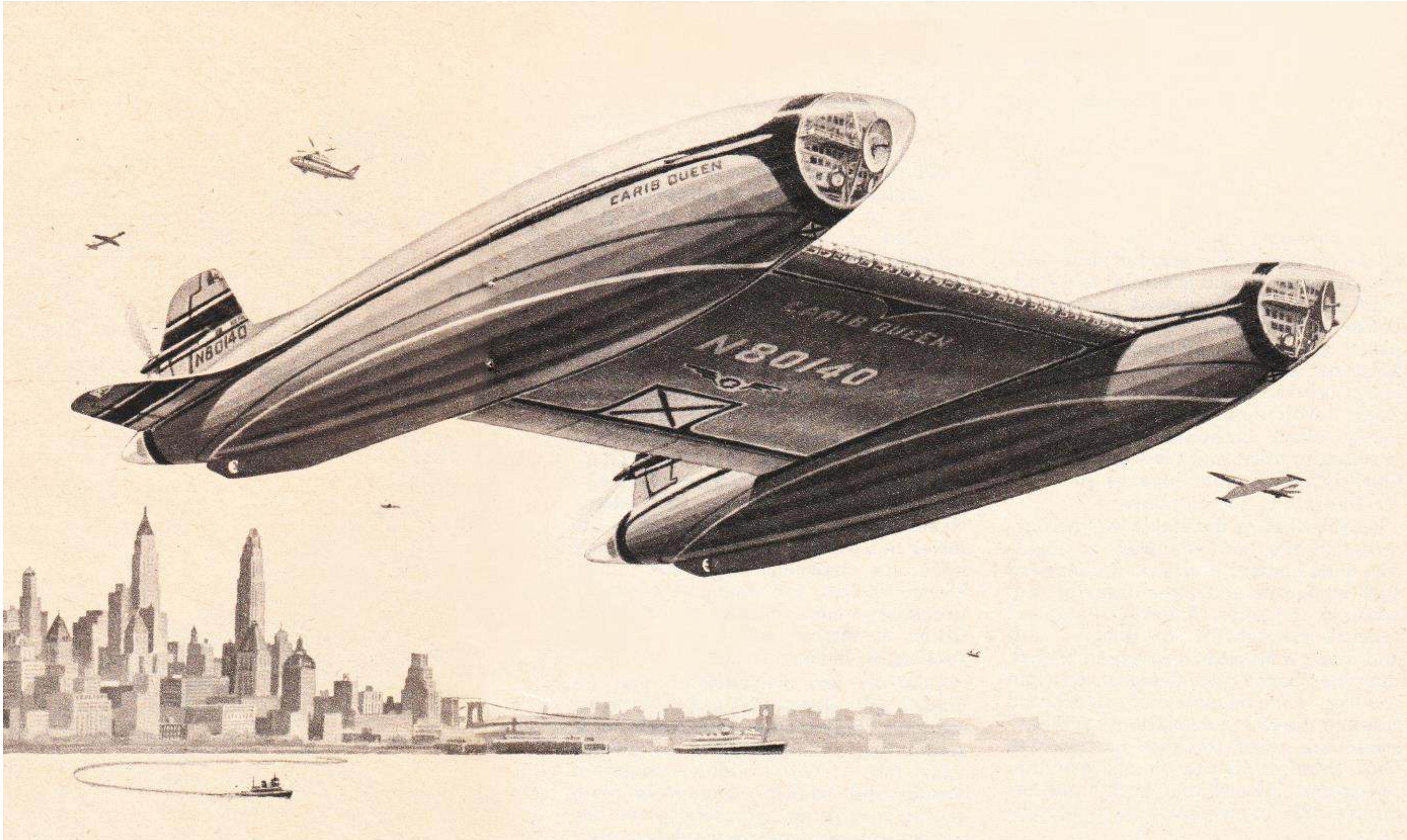
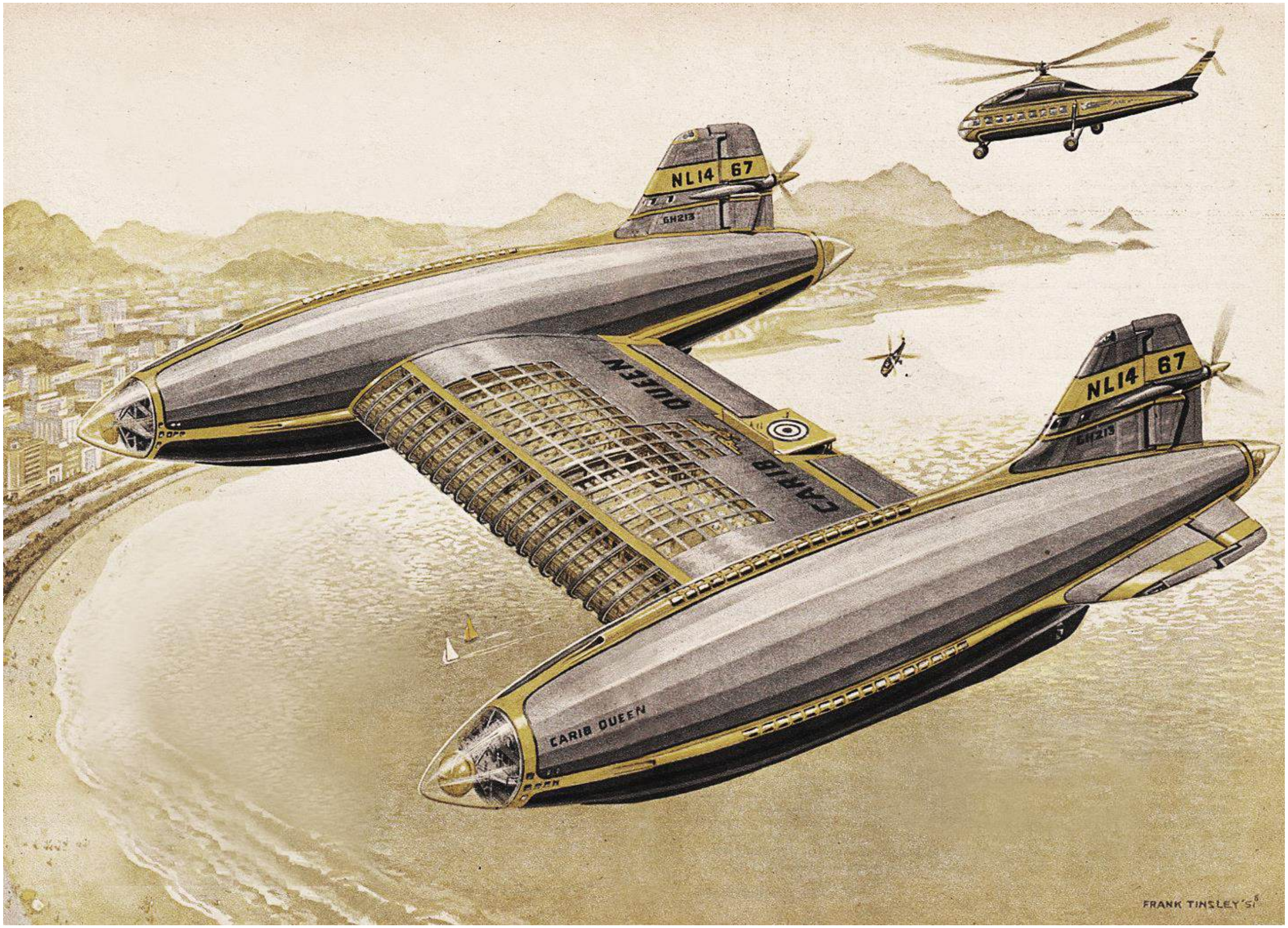
Longitudinal cross-section of the twin-hull cruise airship hull and its thick, constant chord central wing.
Source: Frank Tinsley graphic, adapted from Mechanix Illustrated, Dec. 1957



Rendering of the twin-hull cruise airship departing New York City.
Source: Frank Tinsley graphic, adapted from Mechanix Illustrated, Dec. 1957



Rendering of the twin-hull cruise airship in flight.
Source: Frank Tinsley graphic, adapted from Mechanix Illustrated, Dec. 1957

3. Twin-hull airship in NASA's 1975 study, *Feasibility of Modern Airships – Phase I*

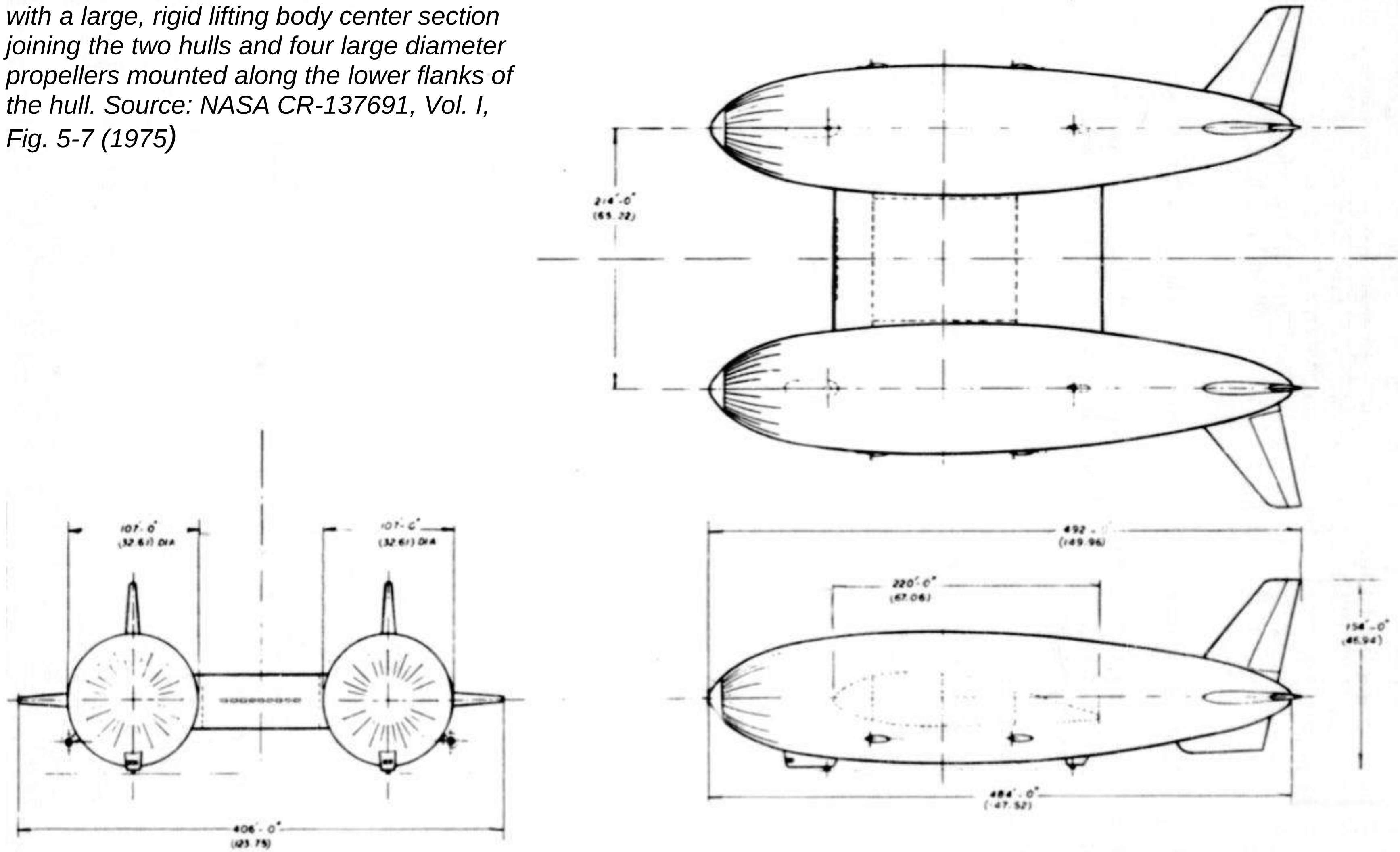
A big twin-hull airship configuration was briefly considered in the 1975 NASA-sponsored study named *Feasibility of Modern Airships – Phase I,* with Goodyear Aerospace Corp. and Boeing Vertol Company as contractors performing studies of civilian roles for lighter-than-air (LTA) craft. The Frank Tinsley's twin-hull design concept was not included in the conventional airship category. Rather, it was one of the referenced concepts considered in the STOL auxiliary wing(s) category.

The twin-hull airship configuration was reviewed during the initial screening and sizing analysis phase but was not selected for a more detailed analysis. Details on the design considered in this 1975 NASA-sponsored study are summarized in the following comparison table and 3-view diagram.

Comparison of 1957 Frank Tinsley and 1975 NASA twin-hull airship concepts

Parameter	1957 Frank Tinsley	1975 NASA
Type	Rigid, conventional, twin hull, amphibious	Semi-buoyant, hybrid, twin hull, not amphibious
Length, OA	560 ft (170.6 m)	492 ft (150.0 m)
Diameter, hull, max	100 ft (30.5 m)	107.5 ft (32.8 m)
Width, max, OA	About 546 ft (166.4 m)	406 ft (123.7 m)
Central wing chord	245 ft (74.4 m)	220 ft (67.1 m)
Central wing span	About 296 ft (90.2 m)	About 105 ft (32.0 m)
Central wing thickness, max	40 ft (12.2 m)	About 53 ft (16.2 m)
Distance between hull centerlines	About 392 ft (119.5 m)	214 ft (65.2 m)
Height, OA	About 155 ft (47.2 m)	154 ft (46.9 m)
Propulsion	Two large-diameter electric motor-driven propellers mounted on the vertical tails	Four flank-mounted propellers, two each on the outboard lower flanks of the two hulls
Propulsion, waterborne	Single propeller & rudder in the keel of each hull.	None
Power source	Two nuclear reactors, one in each hull, with turbo-electric power conversion system	Fossil fuel. Prime mover & power conversion system not specified.
Speed, cruise	100 mph (161 kph)	Not specified
Range	Unlimited	Not specified

Three-view drawing of a twin-hull hybrid airship with a large, rigid lifting body center section joining the two hulls and four large diameter propellers mounted along the lower flanks of the hull. Source: NASA CR-137691, Vol. I, Fig. 5-7 (1975)



4. For more information

- Frank Tinsley, "Why don't we build…? An Atoms-for-Peace Dirigible," Mechanix Illustrated, pp. 92 – 97, March 1956:
- Frank Tinsley, "Why don't we build…? Dirigible Cruise Ships," Mechanix Illustrated, pp. 62 – 67, December 1957: https://lynceans.org/wp-content/uploads/2025/01/Twin-hull-airship_Mechanix-Illustrated_Dec1957_compressed.pdf
- F.H. Norton, "The Aerodynamic Properties of Thick Airfoils Suitable for Internal Bracing," Report No. 75, Aerodynamical Laboratory, National Advisory Committee for Aeronautics, Langley Field, Va., 1920: https://ntrs.nasa.gov/api/citations/19930091136/downloads/19930091136.pdf
- "Feasibility Study of Modern Airships – Phase I, Volume I – Summary and Mission Analysis," NASA CR-137691, Volume I, Fig. 5-7 and Appendix A, p. A-10, Boeing Vertol Company, May 1975: https://ntrs.nasa.gov/api/citations/19750024930/downloads/19750024930.pdf

Other *Modern Airships* articles

- *Modern Airships - Part 1:* https://lynceans.org/all-posts/modern-airships-part-1/
    - Sky Station International Inc. – original Sky Station HAPS design concept
- *Modern Airships - Part 2:* https://lynceans.org/all-posts/modern-airships-part-2/
    - La Grue Volante (LGV) - Alain Balleyguier's twin-hull, flying crane airship
- *Modern Airships - Part 3:* https://lynceans.org/all-posts/modern-airships-part-3/
    - Frank Tinsley - Atoms-for-Peace Dirigible
    - Lazzarini Design Studio - Air Yacht catamaran airship