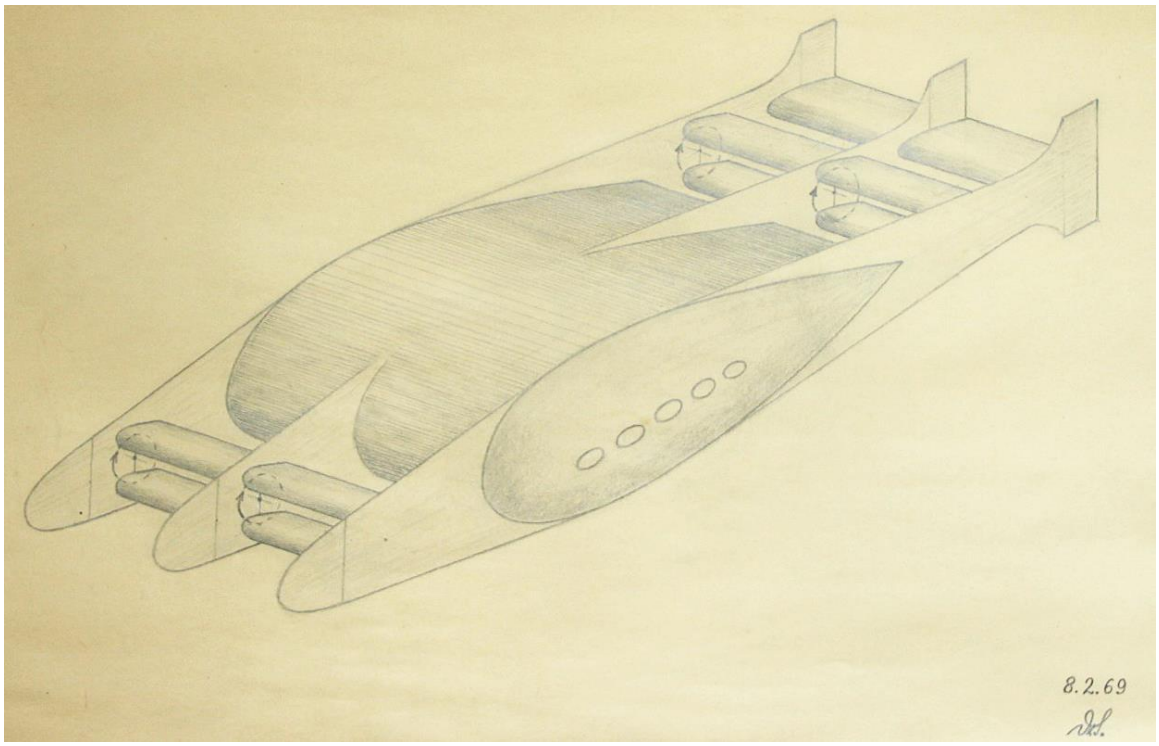
Dolphin (Delphin) Luftschiff

Peter Lobner, 11 February 2022

1. Introduction

German Democratic Republic (GDR) aerodynamicist Dr. Wilhelm Schmidt and graduate economist and transport scientist Ulrich Queck collaborated from the 1968 to the 1980s to develop a unique “wave propulsion system” with an application to rigid airships.

The result of their work was the conceptual design of the Dolphin (Delphin) airship. The rigid airframe was a load-bearing wing installed between three narrow vertical fuselages partitions that supported horizontally rotating “Wellpropellers” (“corrugated” propellers) fore and aft of the main wing to provide propulsion. Rudders were located at the fore and aft ends of each of the fuselage partitions. A fixed horizontal stabilizer with elevators joined the three fuselage partitions aft of the second “Wellpropeller.”



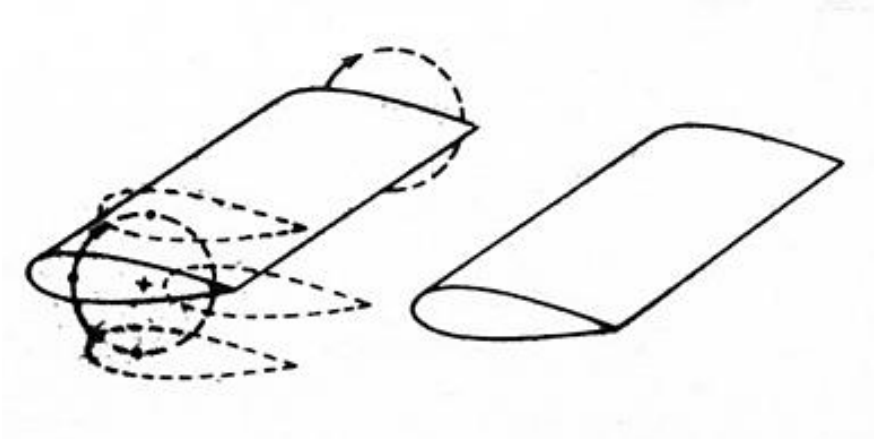
Perspective drawing of the Dolphin airship, 1969.
Source: Otto-Lilienthal-Museum / Wittig

2. The Wellpropeller (corrugated propeller) patents

Wilhelm Schmidt (1901-1991) worked in the GDR on his corrugated propeller (aka “wave mover” and “undulator unit”) design and applications since the late 1940s. His early work focused on heavier-than-air vehicles. While his corrugated propeller designs generated a propulsive force, they did not generate the lift needed for heavier-than-air flight. Starting in 1968, Schmidt collaborated with Ulrich Queck on the application of corrugated propellers for airships.

Between 1951 and 1981, Schmidt was granted several US and GDR patents for the corrugated propeller.

As applied to the Dolphin airship, a corrugated propeller consists of one or more airfoil-shaped vanes attached at their ends to rotating drums, as shown in the following diagram. The dashed airfoil outlines show the changing position of one vane in its neutral position as the drum rotates clockwise. A trailing airfoil, which may be fixed or adjustable in pitch angle, is installed behind the corrugated propeller to extract propulsive power from the undulating flow field created by the propeller, and in so doing, to “de-undulate” the flow field.



Rotating corrugated propeller (“undulator unit”) and de-undulator for the Dolphin airship. Source: Queck & Schmidt, TIZL 6 (1970)

The pitch angle of the propeller vanes is adjustable, enabling each propeller to deflect its downstream flow up or down relative to its neutral position. This enables the corrugated propellers to generate lift or downforce in addition to propulsive power. These propellers also serve as stabilizers, damping undesired pitch and roll motions.

Patent US3666212A, granted 30 May 1972, provides a good description of the configuration of the Dolphin airship and the placement and operation of the corrugated propellers (which are referred to as “undulator units” in the patent).

- The hull (1) is configurated as a lifting body, for instance as an airfoil, that is supported between three narrow, vertical hull partitions (3).

- Along the leading end of the hull, one or more undulator units are mounted, each having one or more vanes (4) rotating about an axis perpendicular to the longitudinal axis of the hull, and a drive (6). This produces an undulatory fluid stream (i.e., a corrugated flow stream) flowing opposite the intended direction of movement and providing the desired thrust. Alternate sweeping of the undulatory fluid stream over the surface of the hull downstream of the units causes de-undulation of the stream, which extracts energy that is realized as propulsive thrust. The hull (1) serves as the de-undulator for the corrugated propellers installed at the bow (4,6). The forward undulator unit (4,6) reduces the drag resistance offered of the hull, especially if the hull is relatively thick.

- Behind the trailing end of the hull (1), a second set of rotary undulator units, each with vanes (2) and a drive (5), are installed ahead of a stationary de-undulator unit (3).

- Patent Figure 1 shows a separate horizontal stabilizer (7) and elevator (8) for aerodynamic flight control. The functions of the stationary de-undulator unit (3) and the horizontal stabilizer and elevator (7, 8) are combined in a single tailplane with elevator control surfaces in Figure 3 and on the later Dolphin airship designs.

- Patent Figures 1, 2 & 3 show vertical stabilizers (10) with rudders (11) for aerodynamic flight control at the trailing edge of the vertical partitions (3). Figure 3 also shows rudders (15) installed at the leading edge of each hull partition, as included in the later Dolphin airship designs.

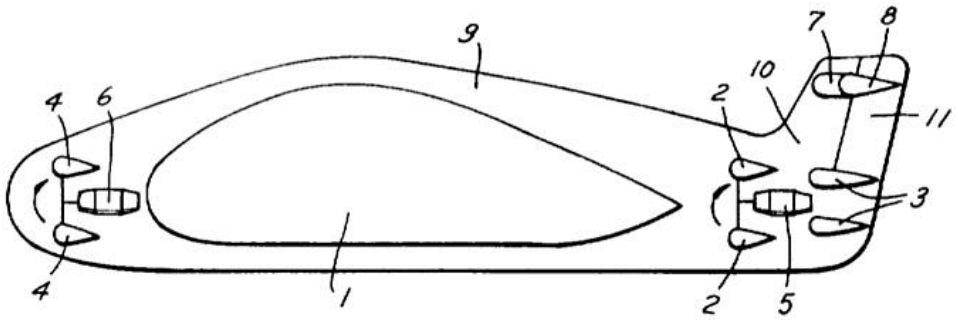


FIG. 1

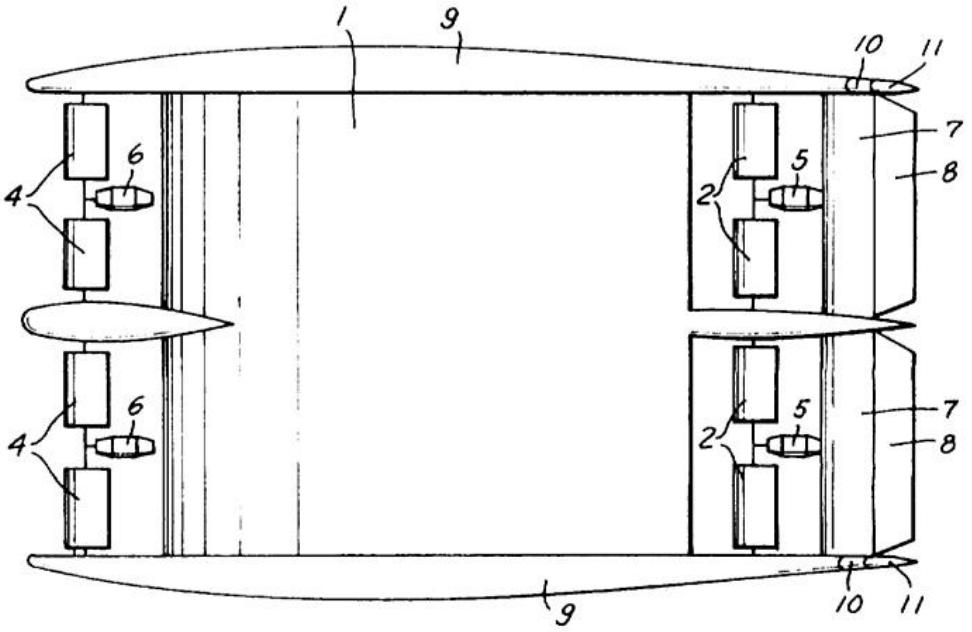


FIG. 2

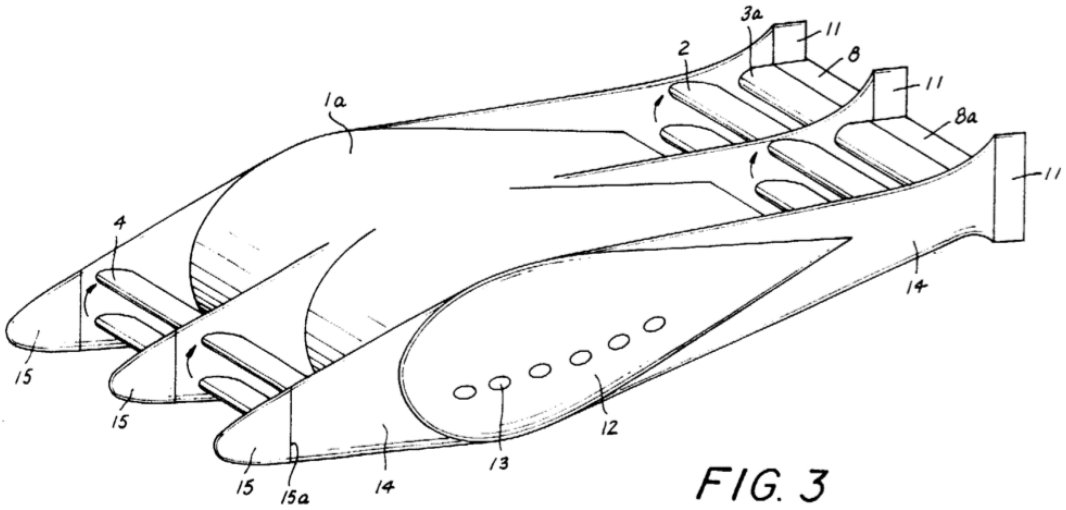


FIG. 3

Source: Patent US3666212

3. Concepts for production Dolphin (Delphin) airships

Wilhelm Schmidt's & Ulrich Queck's Dolphin airship design was scaleable to very large airships that were capable of transporting cargo weighing up to 500 metric tons (550 tons).

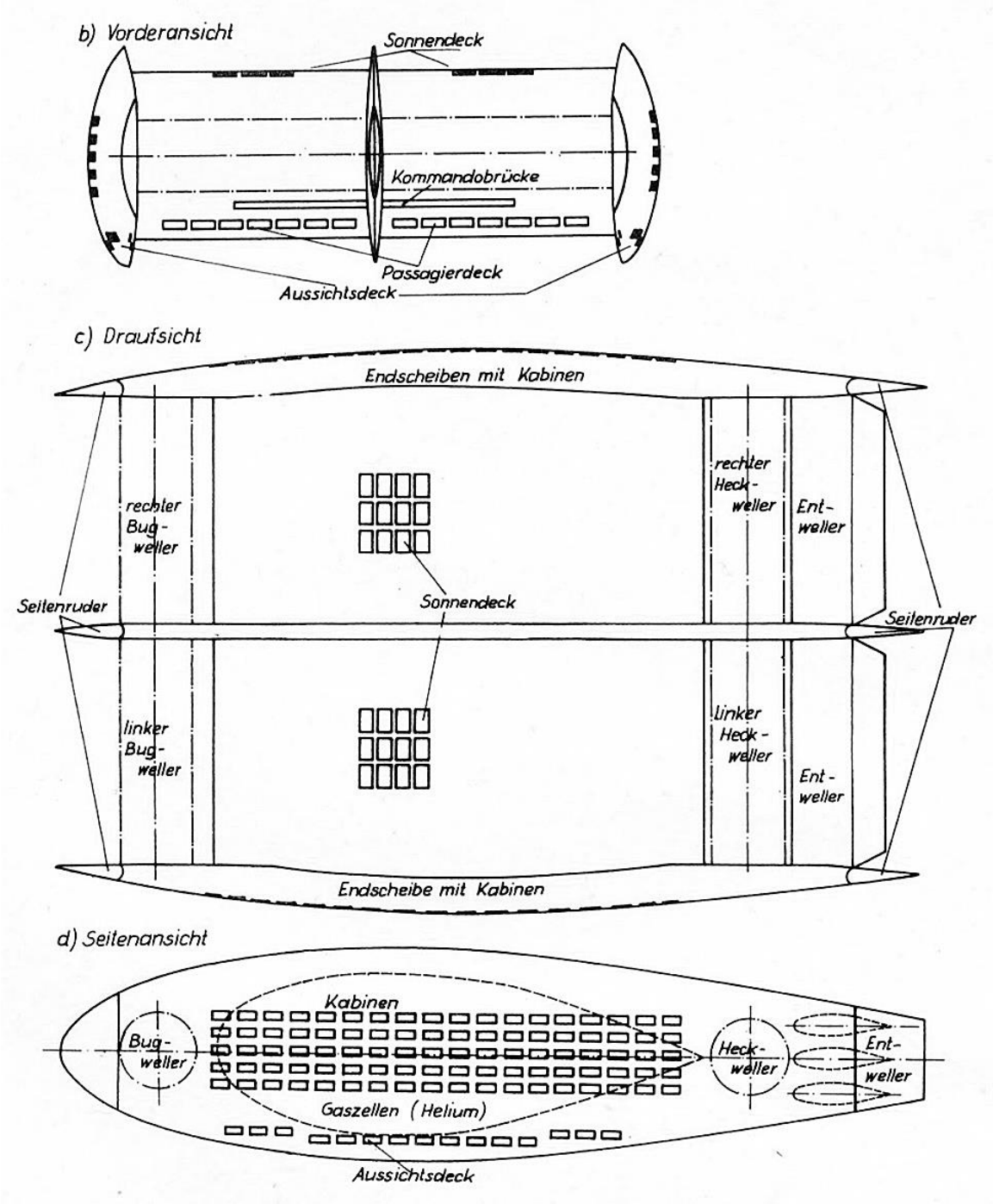
As a heavy-lifter, it was expected that the Dolphin airship could be used to support large construction projects, for example, by delivering an entire preassembled floor to a high-rise construction site, hovering over the building, and placing the new floor precisely on top of the partially-constructed building. This type of operation would only have been possible with a significant exchange of ballast before the new preassembled floor could be safely released from the Dolphin airship.

As a passenger carrier, the Dolphin airship would be equipped with cabins located in the outer hull partitions, an observation deck below the leading edge of the hull, and sundecks on the upper hull (in the undulating airflow from the bow corrugated propellers). The many windows along the sides of the outer hull partitions readily distinguish the passenger carrier from the heavy-lift cargo carrier.

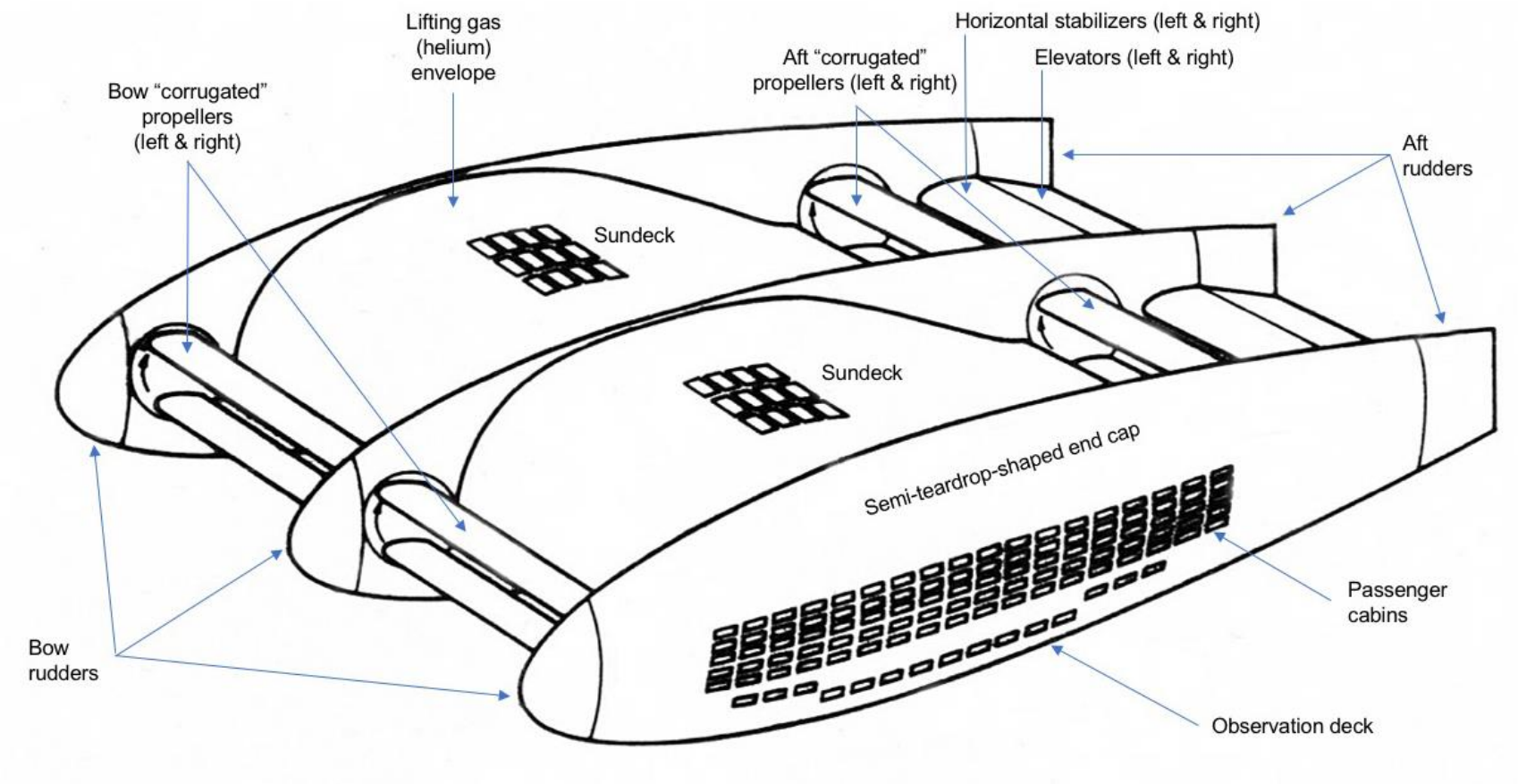
A Dolphin airship sized for a lifting capacity of 100 metric tons (110 tons) would have had a length and width of 90.5 m (297 ft) each and a height of 28.5 m (93.5 ft).

It has been reported that a large-scale model of the Dolphin airship was built has tested in a GDR wind tunnel, perhaps in Leipzig. However, details on these tests are not available.

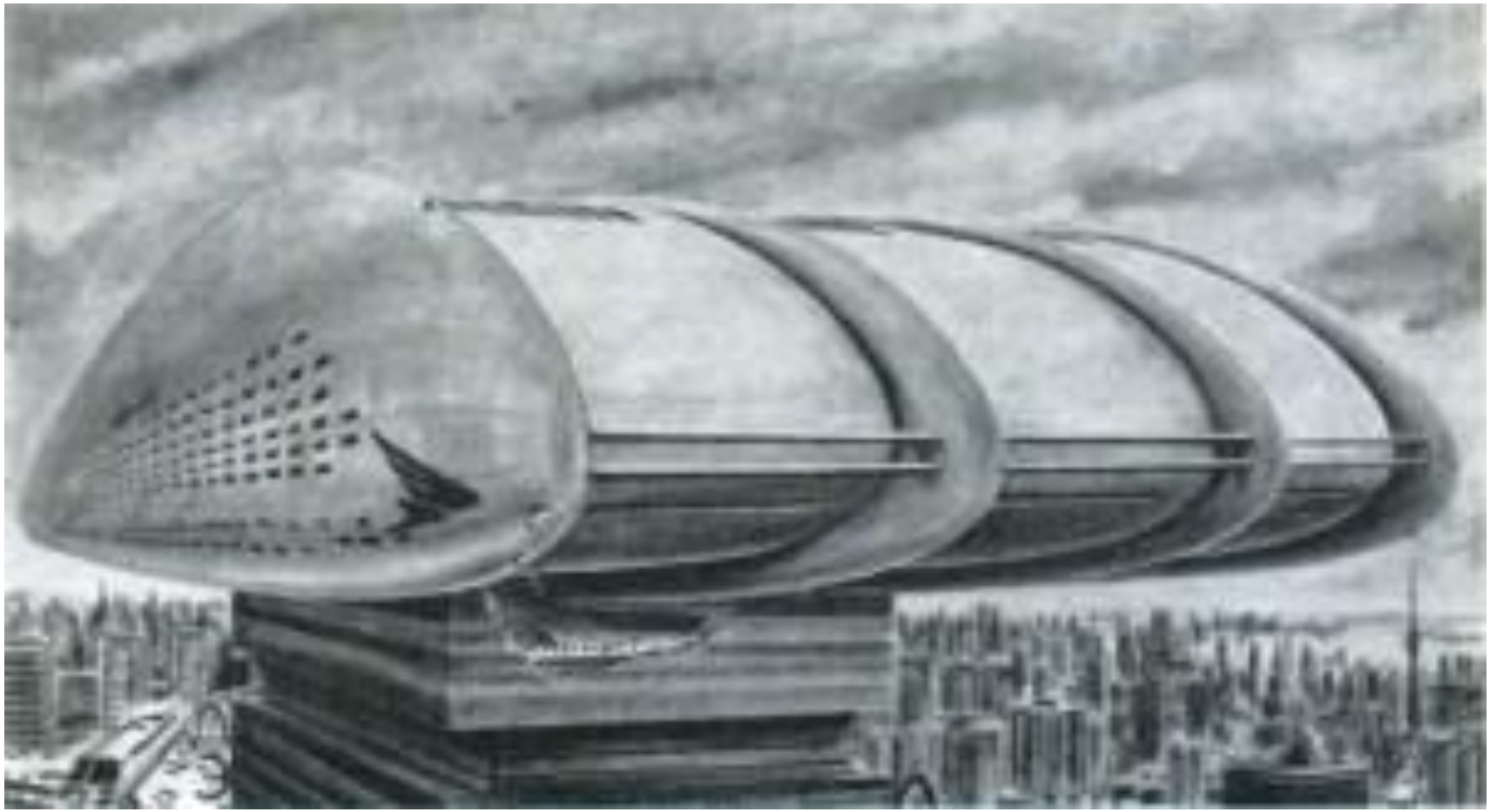
A free-flying prototype was not built and the program was abandoned by the 1980s.



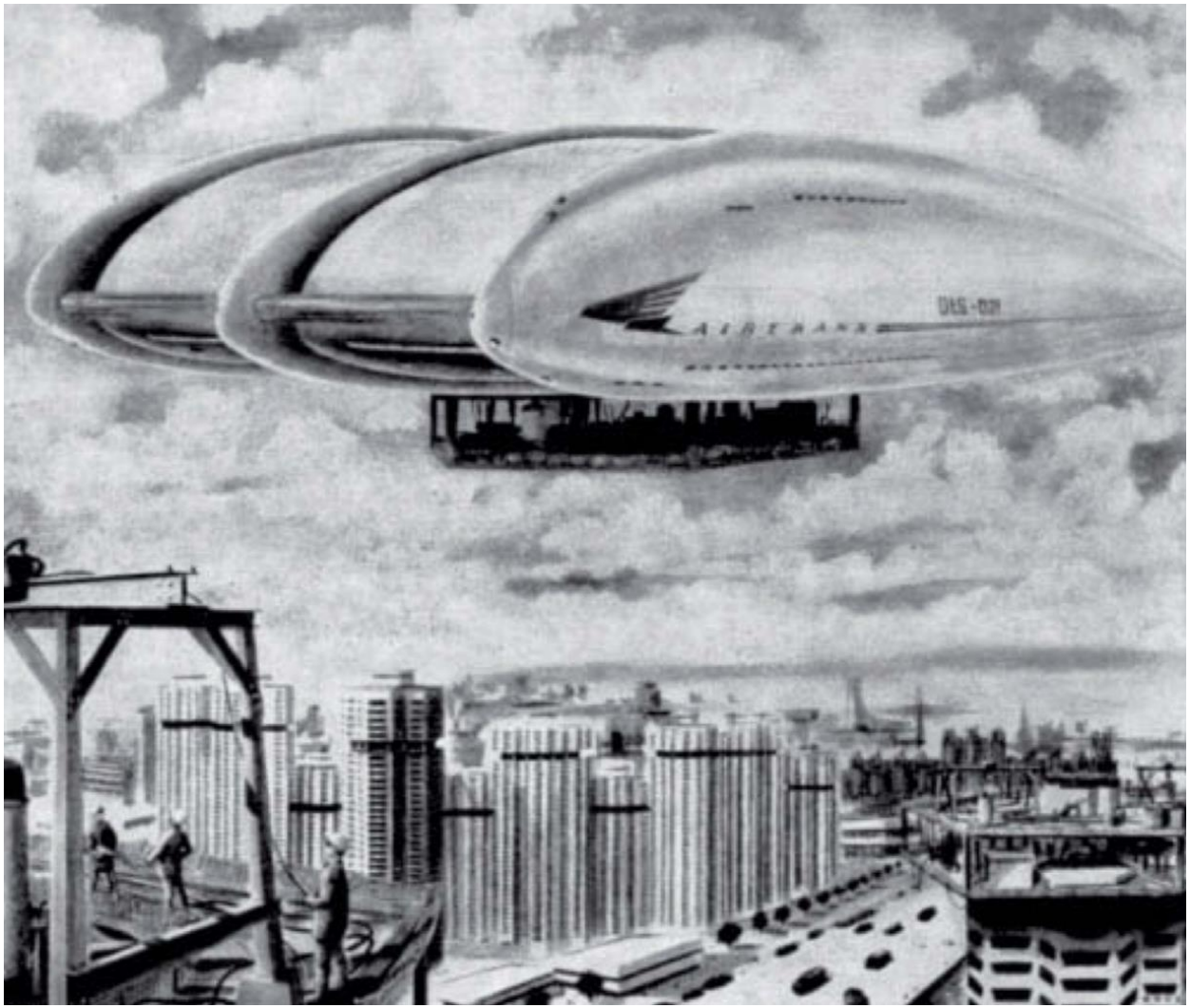
Three-view diagram of the Dolphin airship concept configured for passenger service.
Source: U. Queck & W. Schmidt, TIZL 6 (1970) H.5



Isometric view of a production Dolphin airship concept configured for passenger service.
Source: Adapted from U. Queck & W. Schmidt, TIZL 6 (1970) H.5



Passengers would be comfortably transported from the center of one metropolis to the center of another metropolis.
Source: FliegerReview, Vol. 58



As a heavy-lifter, the Dolphin airship could deliver an entire preassembled floor to a high-rise construction site and place it precisely. Source: FliegerReview, Vol. 58

For more information

- "Delphinluftschiff mit Wellpropeller," ("Dolphin airship with corrugated propeller"), (In German), Otto-Lilienthal Museum, 1969: https://nat.museum-digital.de/index.php?t=objekt&oges=75125
- Ulrick Queck & Wilhellm Schmidt, "Das Delphin-Luftschiff – Luftfhart in gewellter Strömung," (In German), DK-629.132.2, TIZL 6 (1970) H.5, 1970: https://www.fliegerrevuex.aero/wp-content/uploads/2016/03/TIZL-1970-Das-Delphin-Luftschiff.pdf
- "Delphin-Luftschiff mit Wellpropeller," ("Dolphin airship with corrugated propeller"), (In German): http://www.scitron.de/delphin-luftschiff.htm
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- M.Y. Arie, "Dirigibles" (In Russian), Publishing House "Naukova Dumka", Kiev, Ukraine, 1986

Patents

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- US3068642A, "Drive means for land, water and aircraft;" Inventor Wilhelm Schmidt; Filed 17 November 1959; Granted 18 December 1962; Assigned to Forchungzentrum der Luftfahr: https://patents.google.com/patent/US3068642A/en?oq=•US3068642A
- US3111928, "Driving arrangement for land-, water- and air-craft;" Inventor Wilhelm Schmidt; Filed 8 August 1960; Granted 26 November 1963; Assigned to Forchungzentrum der Luftfahrtindustrie:

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- US3215371, ""Driving arrangement for land-, water- and air-craft;" Inventor Wilhelm Schmidt; Filed 10 October 1963; Granted 2 November 1965: https://patents.google.com/patent/US3215371A/en?oq=US+3215371
- US3666212, "Propulsion arrangement for craft which move in a fluid medium;" Inventor Wilhelm Schmidt; Filed 20 May 1970; Granted 30 May 1972; Assigned to Akademic Der Wissenschaften der DDR: https://patents.google.com/patent/US3666212A/en?oq=US+3666212
- German Democratic Republic Patent DD148616A1, "Wellpropeller mit elastischem wellerblatt," ("Corrugated propeller with elastic corrugated blade") (In German); Inventor Wilhelm Schmidt; Filed 11 January 1980; Granted 3 June 1981: https://patents.google.com/patent/DD148616A1/de

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- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
- *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/