

Wendel R. Wendel - STAR*FLITE Airship

Peter Lobner, 8 March 2022

1. Introduction

Wendel R. Wendel graduated from Hofstra University cum laude in 1969 with a degree in production management and industrial engineering. He studied briefly with R. Buckminster Fuller before starting his first company, Dome East Inc., in Hicksville, NY in 1971. In 1977 he founded and was president of the privately-held firm Space Structures International Inc., in Plainview, NY, which focused



on terrestrial space frame structural design and construction. He was granted a US trademark for that corporate name in January 1980.

Wendel also was the founder and president of STAR*FLITE Airships and STAR*NET Structures, Inc., which focused on space frame structures for outer space applications. He also served as the Chairman, Board Of Directors, of STAR*TECH Engineering.

Wendel held three US patents and two Canadian patents for inter-locking hubs used for constructing space frame structures. His various business ventures over the years resulted in the design and fabrication of nearly 1,600 structures worldwide.

Wendel's STAR*FLITE airship design concept implemented a geodesic rigid hull based on his patented inter-locking hubs. He was a member of the Lighter-than-Air Society, the Association of Balloon and Airship Constructors, the Airship Association and the Airship Explorers Club.

2. Wendel's geodesic design patents and process

In 1981, Wendel filed two US patent applications for his inter-locking hub designs known as the Orba Hub and Octa Hub. Patents were granted in 1984. In 1988, he filed a patent application for another inter-locking hub known as the Geo Hub. That patent was granted in 1990. In this section, we'll take a look the designs of these hubs.

In 1985, Lawrence Van Gelder, writing for the NY Times reported:

“By profession, Wendel R. Wendel (‘I liked my last name better than my first name’ is the way he explains his double-barreled name) is a structural designer. His eight-year-old privately held corporation, which has about 100 employees, is primarily engaged in designing, engineering and fabricating what Mr. Wendel calls large-span space networks.

‘A network,’ he said, ‘is the use of a triangulated form to create an envelope - a building envelope to regulate the environment. It's like your clothing. Your shirt is a building envelope. Here we're doing large-scale structures. A hangar protects planes from sun or rain.’

Using the triangle as their basic form, these networks are used in building not only hangars but atriums, canopies and pavilions, among other structures. ‘The triangle is the strongest shape in nature,’ Mr. Wendel said. ‘We're the systems specialist who is brought aboard by the architect, engineer or owner of the project to design and build the space frame and its associated components for the particular project’.

Among projects Space Structures has contributed to, he said, are the Omnimax Theater at Caesar's Palace in Las Vegas; two pavilions at the World's Fair in Knoxville, Tenn.; Hartz Mountains Industries' complex in Secaucus, N.J.; hangars at the Miami International Airport and at Baghdad International Airport, and a \$375 million castle being constructed by the Sultan of Brunei.

Behind all this is something called SSCAD, for Space Structures Computer Aided Design. It is, he explained, a computer program that will actually generate the geometry of the structure being contemplated and open the way for exploration of various options. Besides enabling the builders to see the proposed structure in color, Mr. Wendel said, SSCAD permits analysis of load paths and support reactions and is used in selecting construction materials.”



“‘Secondarily,’ he said, ‘in the post-processing of the analysis, the computer generates a bill of materials, shop drawings for fabrication and assembly plans. A simple project can go from design to finish in one day - a simple atrium on an office building. It would have been impossible before the advent of computers to do space-network design. It was beyond the capabilities of the human mind to calculate readily without errors’.”

Spaceframe system designer Wendel R. Wendel poses with the Octa Hub (left) and Orba Hub (right) he designed and patented. Source: OTA report (Aug 1984) via Neil Flanagan (Aug 2012)

The Orba Hub

As described in patent US4438615A, an Orba Hub is a structural connection device for joining many tubular struts that are part of a space frame structure:

“In the subject invention the connection system is composed of a round, solid spherical hub and a round tube strut with tapered ends. Round cylindrical strut members of similar external diameter and varying wall thickness are utilized to create architectural simplicity and uniformity with the required

structural integrity. The system allows for multiple strut members to fill any spaceframe geometry design requirements and includes a collar clip-on detail that results in smooth lines for strong architectural appeal.”

A representative Orba Hub is shown in patent Figure 3. The spherical hub (24) provides a secure connection point for many cylindrical struts with tapered end fittings (26).

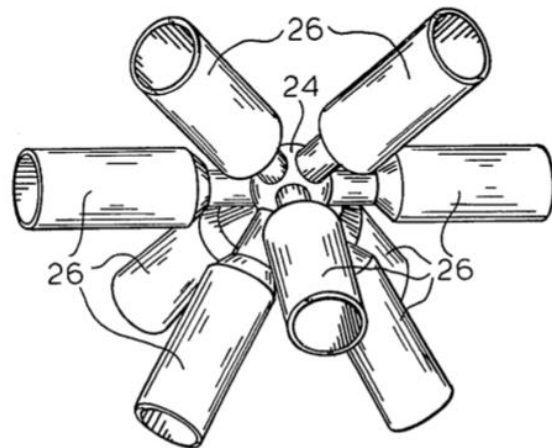


FIG.3

Orba Hub. Source: Patent US4438615A

The Octa Hub

As described in patent US4449843A (granted 1984), an Octa Hub is a structural connection device for joining eight rectangular struts that are part of a space frame structure:

“Essentially, the hub of this invention consists of two or three components pre-compressed together by a high-strength bolt to form a structural unit capable of transferring axial and shear loads from truss members via direct and bending action..... The typical hub of this invention consists of one component with typically four orthogonal sets of ears which bolt to top or bottom chord members, and a second component rotated 45° from the chord axes which bolts to the diagonals.”

A representative Octa Hub configuration is shown in patent Figures 3 & 4.

FIG.3

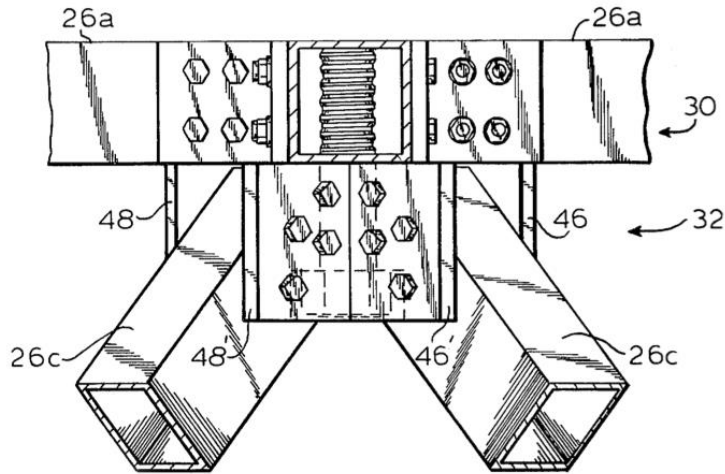
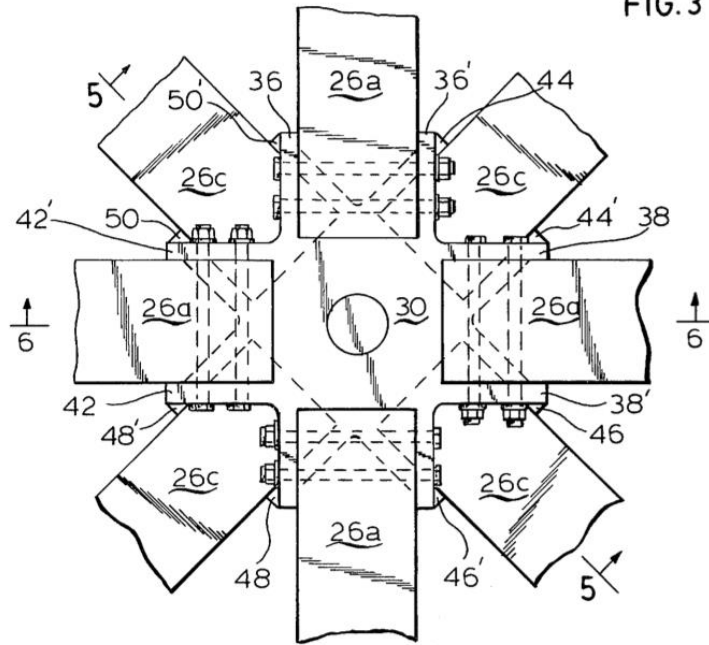


FIG.4

Legend:

- 26a: horizontal struts connecting to the top component (30)
- 26c: diagonal struts connecting to the bottom component (32)
- 30: top (horizontal) component of the octa hub
- 36, 36', 38, 38', 40, 40', 42 & 42': ears on top component (30)
- 32: bottom (diagonal) component of the octa hub
- 44, 44', 46, 46', 48, 48', 50 & 50': ears on bottom component (32)

Octa Hub. Source: Patent US4449843A

The Geo Hub

As described in patent US4904108A (granted 1990), a geo hub is a structural connection device with several (3, 4, 6 or more) extending “ear” pairs for connecting the hub to elongated rectangular struts to form a space frame structure. Multiple hubs can be stacked together and secured with a central connecting rod and the hubs may be rotated at different angles. Two representative geo hubs, each with four ear pairs, are shown stacked and assembled in patent Figure 1 and stacked and exploded in Figure 2.

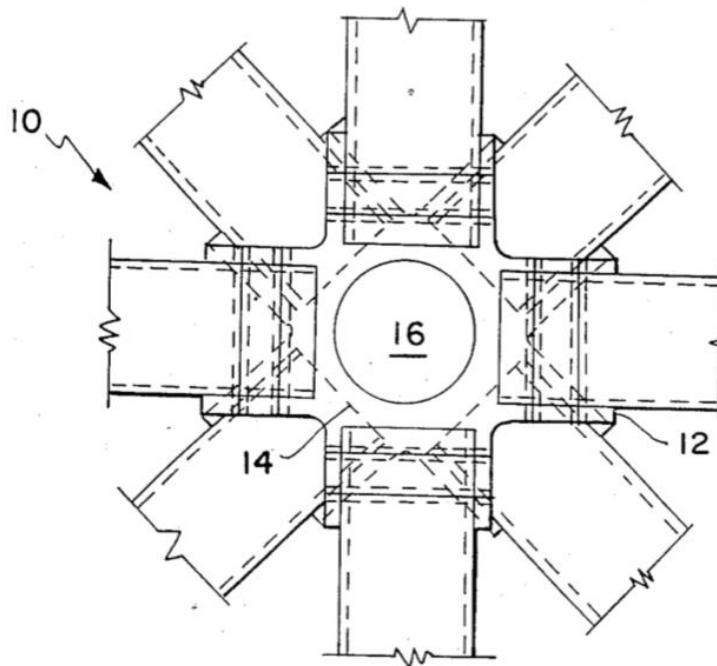


FIG. 1

Legend:

- 10: the stacked and connected hubs (12 & 14)
- 12 & 14: two hub components
- 16: rod connector

Geo Hub assembled, transverse view. Source: Patent US4904108A

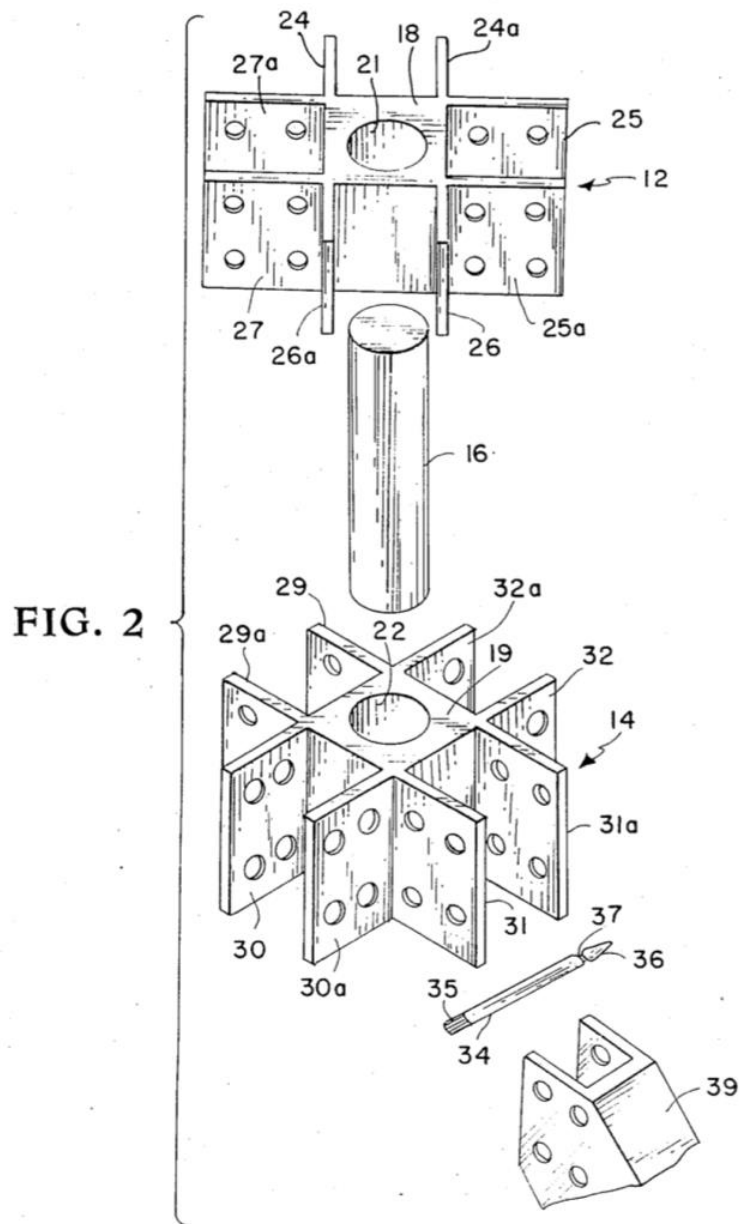


FIG. 2

Legend:

- 12 & 14: two hub components
- 16: rod connector
- 18 & 19: the center sections of the two hub components
- 21 & 22: the hole in the hub components for the rod connector
- 24, 25, 26 & 27 (and 24a, 25a, 26a & 27a): the paired "ears" of hub 12
- 29, 30, 31 & 32 (and 29a, 30a, 31a & 32a): the paired "ears" of hub 14
- 34, 35, 36 & 37: a connecting pin (STAR*PIN) for joining struts to the hubs
- 39: end of a strut connected to a hub

Geo Hub exploded view. Source: Patent US4904108A

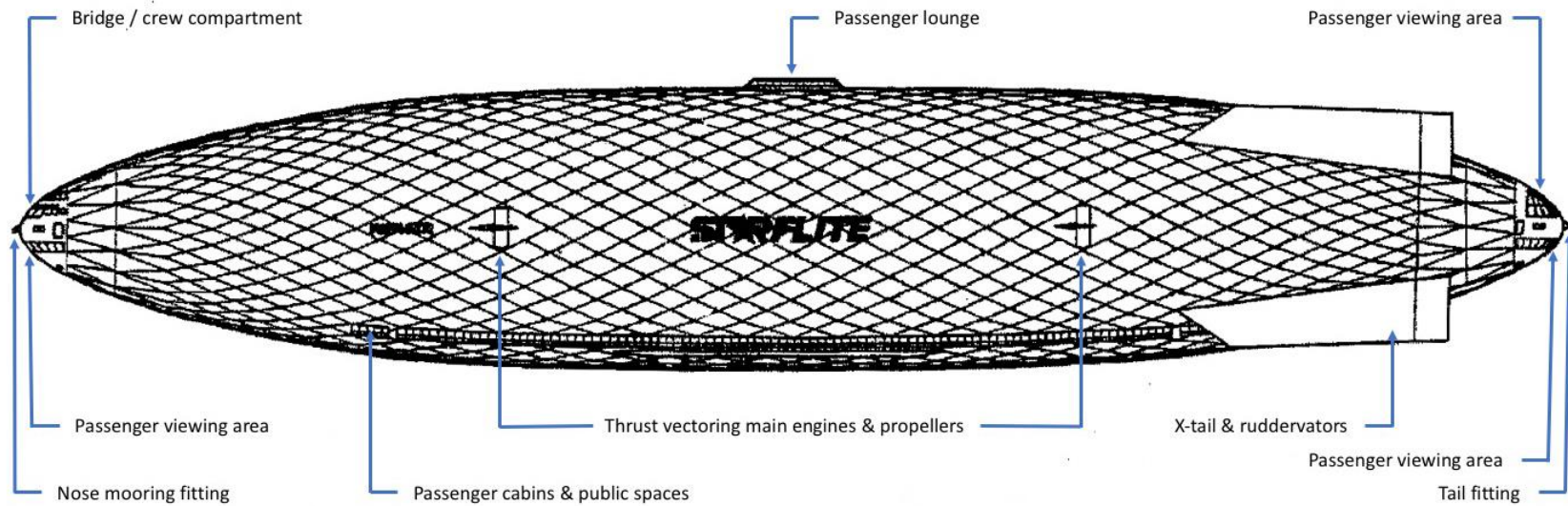
3. The STAR*FLITE rigid airship

In 1993, Peter Andrews, writing for Invention & Technology magazine, reported on Wendel's plans for STAR*FLITE rigid airship:

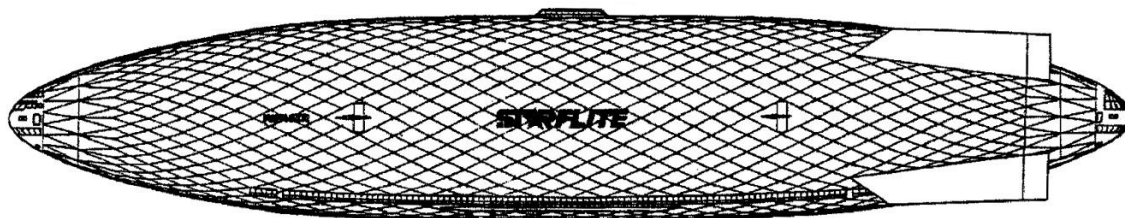
“Wendel R. Wendel, an airship entrepreneur, is glad to see the military out of the LTA business. The future of the air and even outer space belongs to civilian enterprise, according to Wendel. ‘Space will eventually be explored by tourists,’ he says. Like the aeronauts of old, Wendel thinks big. He is currently working on a project to design and build an eight-hundred-foot rigid-frame dirigible to go after the entertainment and tourism market. He envisions an upscale operation in which passengers pay a thousand dollars a day for an airborne luxury cruise. ‘You get to see the world differently,’ Wendel says as he describes a trip in which the airship would sail to the Yucatan in Mexico, set down to allow for exploration, and then swing back by way of the Everglades.”

The STAR*FLITE airship would have been approximately the same length as the German pre-WW II airship LZ-129 Hindenburg, which was 245 meters (803.8 feet) long, with a 41.2 meter (135.1 feet) diameter, and a gas volume of 200,000 cubic meters (7,062,000 cubic feet).

STAR*FLITE airship had an elliptical geodesic hull with an X-tail. It was propelled by four thrust vectoring main engines mounted along the hull mid-plane, two on each side. There was no gondola. The bridge / crew compartment was at the nose of the airship. Passenger cabins and public spaces were arranged internally, along the keel of the airship, with additional viewing areas / lounges at the nose, tail and at the top of the hull.



*Wendel R. Wendel's 800-ft (244-m) long STAR*FLITE rigid airship design concept.
 Source: adapted from Bock & Knauer (p. 110, updated English edition, 2019)*



*Relative sizes of Wendel R. Wendel's 800-ft (244-m) long STAR*FLITE rigid airship design concept and the 803.8-ft (245-m) long LZ-129 Hindenburg. Sources: Hindenburg outline from Airships.Net, STAR*FLITE plan view from Bock & Knauer (p. 110, updated English edition, 2019)*

4. For more information

- Lawrence Van Gelder, "Long Islanders: A Cowboy of the Space Age," New York Times, 2 July 1985:
<https://www.nytimes.com/1985/06/02/nyregion/long-islanders-a-cowboy-of-the-space-age.html>
- Peter Andrews. "Lighter Than Air," Invention & Technology – The Magazine of Innovation, Volume 9, Issue 1, Summer 1993:
<https://www.inventionandtech.com/content/lighter-air-1?page=full>
- "Technology and the Future of the U.S. Construction Industry," report by the U.S. Congress Office of Technology Assessment (OTA), Section 7, "Structural Systems," by Wendel R. Wendel, pp. 104 to 122, ISBN 0-913962-81-3, August 1984:
<http://ota.fas.org/reports/8427.pdf>

- “Wendel R. Wendel,” obituary, Miami Herald, 19 January 2008: <https://www.legacy.com/us/obituaries/herald/name/wendel-wendel-obituary?id=24367479>
- Neil Flanagan, “Space(frame) Cowboy,” Tsarchitect, 4 August 2012: <http://tsarchitect.nsflanagan.net/?tag=humor>
- J.K. Bock & B. Knauer, “Lighter Than Air – Transport and Carrier Systems,” English language / updated edition, ISBN 978-0-9725423-8-8, 2019.

Patents

- US4438615A, “Orba hub,” Inventor: Wendel R. Wendel; Application filed 30 November 1981; Granted 27 April 1984; assigned to Space Structures International Corp.: <https://patents.google.com/patent/US4438615A/en?q=US4438615>
- US4449843A, “Octa hub,” Inventor: Wendel R. Wendel; Application filed 30 November 1981; Granted 22 May 1984; assigned to Space Structures International Corp.: <https://patents.google.com/patent/US4449843A/en?q=US4449843>
- US4904108A, “Geo hub,” Inventor: Wendel R. Wendel; Application filed 28 March 1988; Granted 27 February 1990: <https://patents.google.com/patent/US4904108A/en?q=US4904108>

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- *Modern Airships - Part 3*: <https://lynceans.org/all-posts/modern-airships-part-3/>