TP Aerospace, Inc.

Peter Lobner, Updated 3 April 2021

1. Introduction

TP Aerospace, Inc. was a small firm established in 2010 in Sterling, MA to develop a heavy-lift cargo airship, known as the Atlas 80 that used inflatable beams for the primary hull structure. TP Aerospace no longer is a going concern. Their assets were acquired by Global Airships, which is continuing the development of a heavy-lift airship, but without the use of inflatable beams.

This article describes the unique inflatable beam technology and provides some insight into the plans that were being developed for a large cargo airship that implemented this technology.

The heavy-lift airship being developed by Global Airships is described in a separate article.

2. Inflatable airframe patents

In October 2011, TP Aerospace, Inc. filed patent application US2014/0158817A1, "Rigid airship utilizing a rigid frame formed by high pressure inflated tubes," describing the design of a rigid airship frame "formed out of a plurality of high pressure inflated tubes, which are assembled together so as to collectively form the complete rigid frame."

You can read this patent application here:
https://patents.google.com/patent/US20140158817A1/en

International patent WO 2015/065433A1, with the same title, but clearer line drawings, is available here:
https://patents.google.com/patent/WO2015065433A1/en?oq=WO+2015%2f065433+Al

The fabric tubes have a relatively small diameter (4 – 24 inches) and are inflated to relatively high pressure (25 – 100 psig). The patent application claimed:

> “…the high pressure inflated tubes… effectively form substantially rigid ‘air beams’ for assembling a rigid frame. For the purposes of the present invention, the term ‘rigid’ (or ‘substantially rigid’) is intended to mean having a structural integrity which provides operational performance similar to a rigid frame formed by conventional metal and/or composite sections.”
>
> “High pressure inflated tubes are preferably formed out of an airtight knit structure, in order to provide a structurally competent airtight casing able to resist the high pressure loads established within the inflatable tubes, and permit the inflatable tubes to be fabricated with the necessary pre-formed curvatures needed to achieve the desired aerodynamic shape for the airship…….In general, it is preferred that each of the high-pressure inflated tubes be independently inflated so as to ensure that the loss of inflation in one tube does not affect the inflation of other tubes.”

Lifting gas cells and air ballonets would be installed within the inflated structural frame of the airship, which would be covered by a multi-layer skin to form the streamlined exterior aeroshell.

TP Aerospace airbeam suspending a car.
Source: NASA Ames Research Center, June 2016

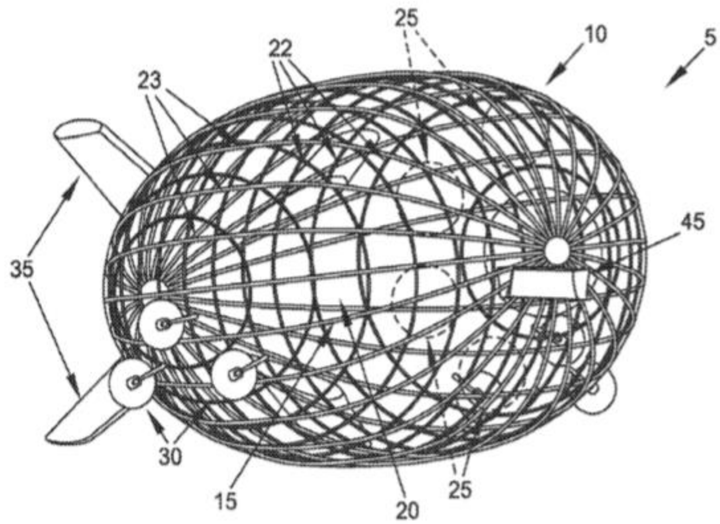


FIG. 1

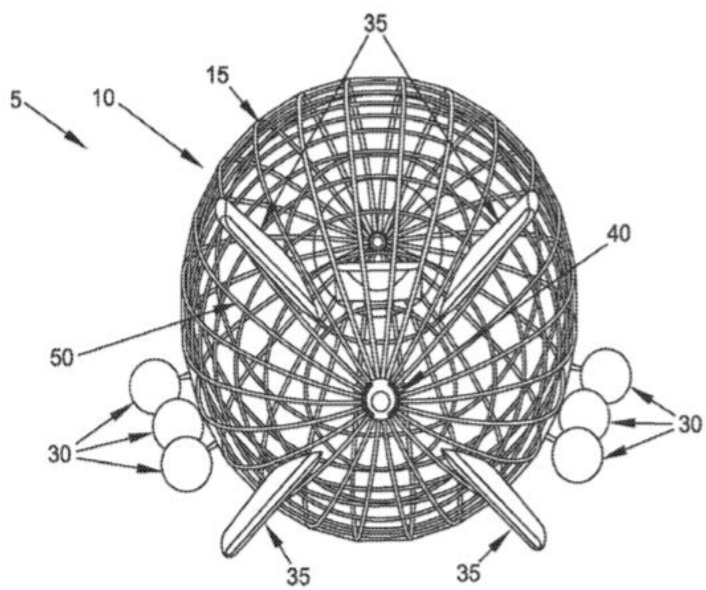
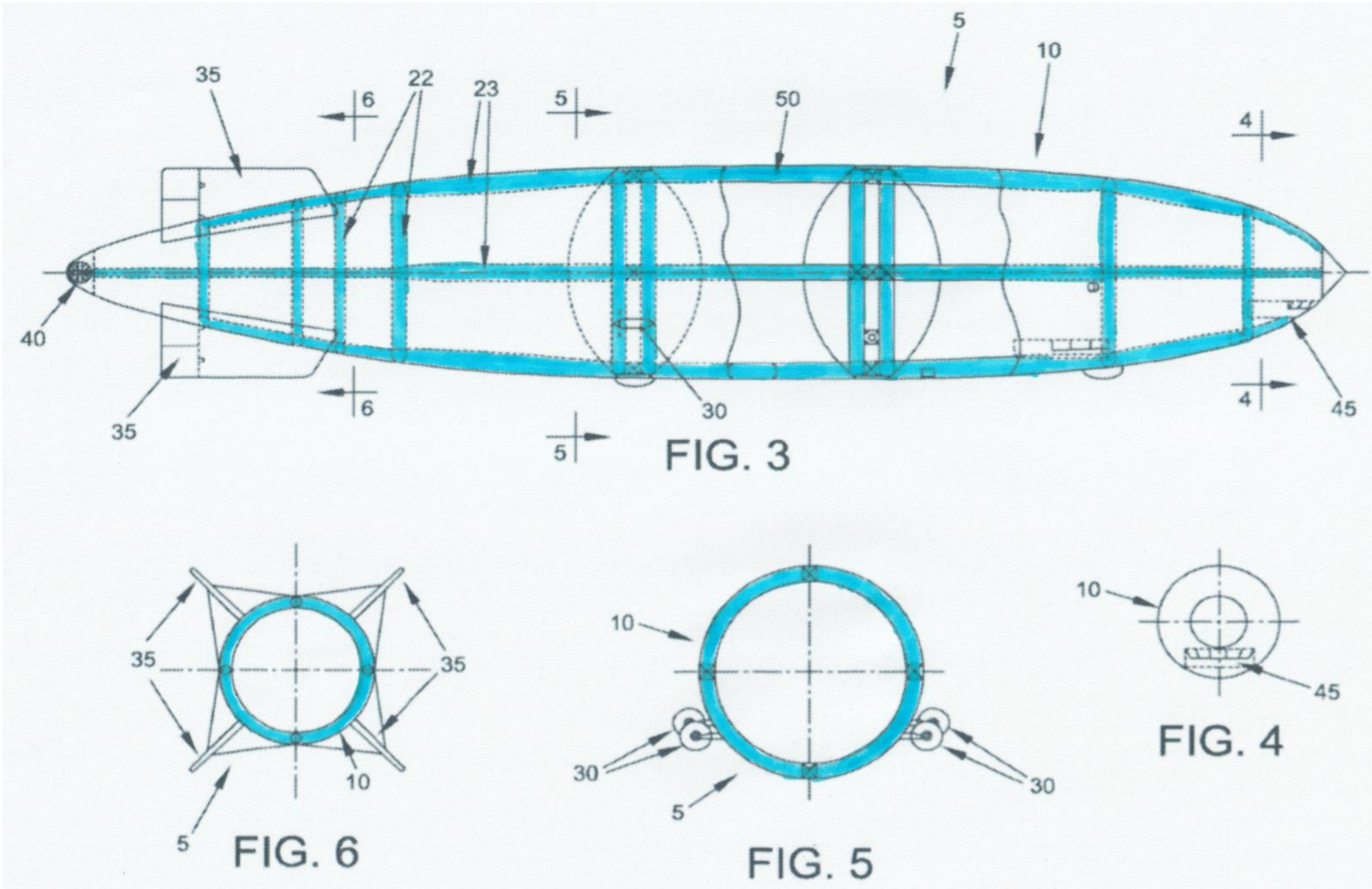


FIG. 2

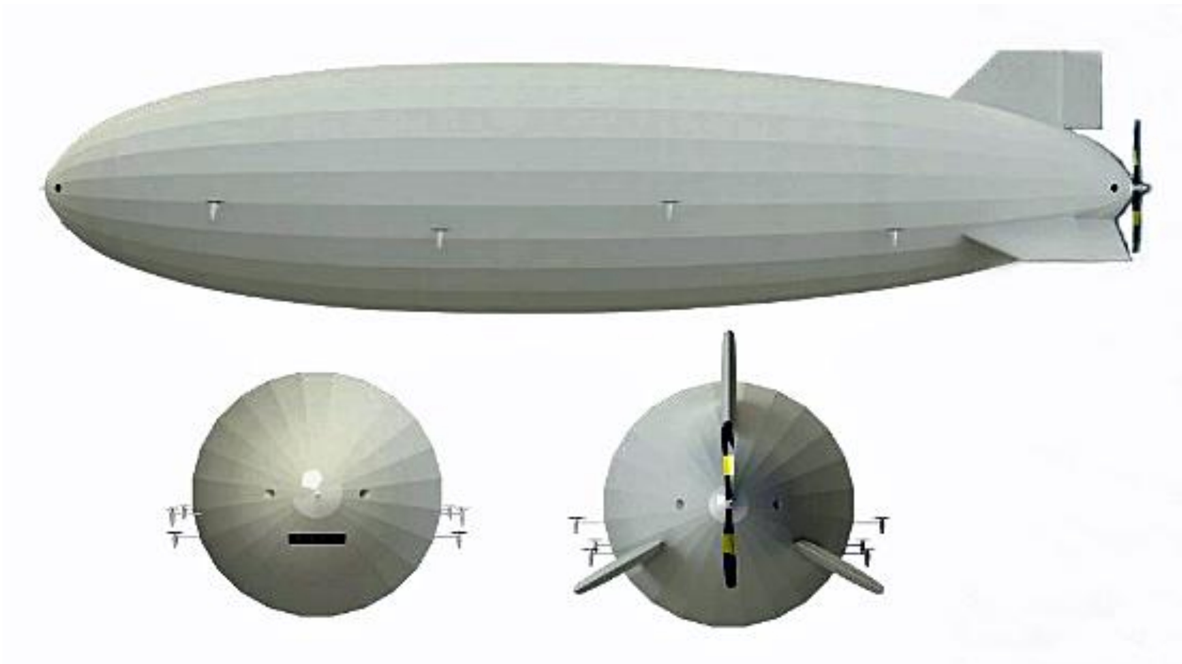
Bow quarter and stern views of the airship showing the general layout of engines (30), tail fins (35), and cockpit (45). The rigid airframe (15) is comprised of a regular array of closely-spaced high-pressure inflated structural tubes in the form of circular hoop sections (22) and longitudinal strut sections (23) with the gas bags (25) inside this framework and the airship's skin (20) outside.
Source: Patent WO 2015/065433A1



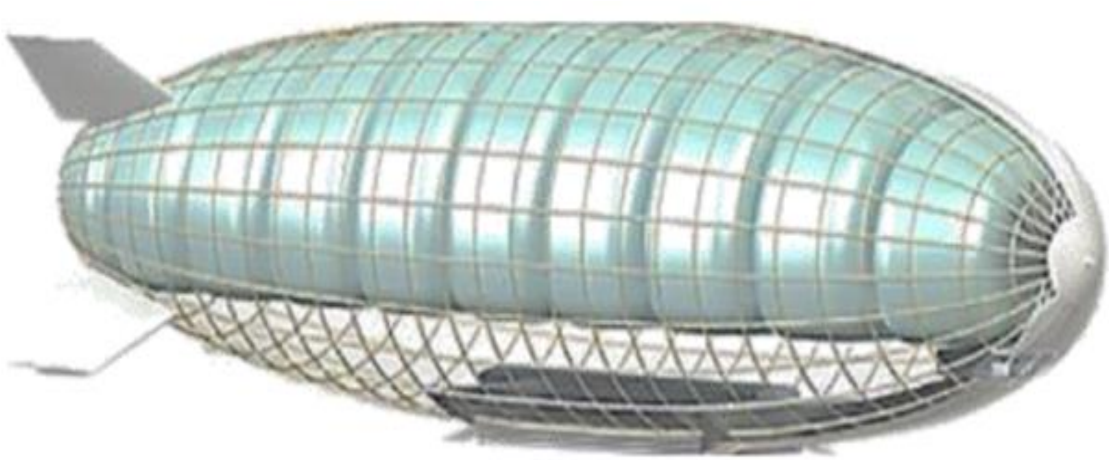
This is an alternate design of a rigid airframe (15) with high-pressure inflated structural tubes (50). The rigid airframe, highlighted in blue, is comprised of circular hoop sections (22) and longitudinal strut sections (23) laid out in a different configuration than in patent Figures 1 and 2. Two closely spaced circular hoop sections reinforce the hull where the engines (30) attach.
Source: Patent WO 2015/065433A1

3. The Atlas 80 airship

This rigid airship had a conventional exterior layout that gave no indication of the novel structural design beneath the aeroshell.



Atlas 80 airship 3-view drawing.
Source: adapted from TP Aerospace, Inc.



Atlas 80 internal arrangement showing the placement of the lifting gas cells and a rigid airframe design similar to Figures 1 and 2 in patent WO 2015/065433A1. Source: TP Aerospace, Inc.

The rigid frames formed from the high pressure inflated tubes are intended to be inflated only once and then remain at the same pressure for years without needing any re-inflation. On-board monitoring systems would be provided to ensure that each of the high pressure inflated tubes in the rigid hull stays at the required pressure.

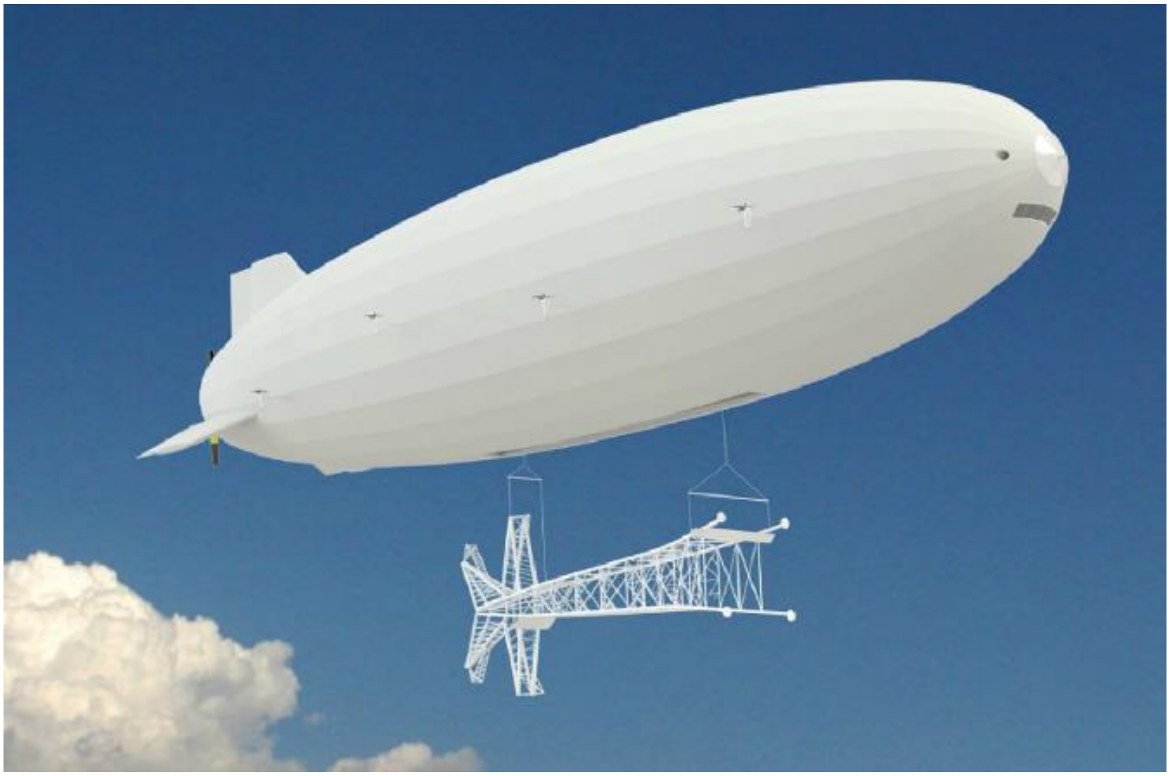
The airship was designed to transport an 80 ton (72.6 metric tons) payload over a range of 4,000 miles (6,400 km) at a cruise speed of 70 knots.   A longer-range version capable of 10,000 miles (16,000 km) flights also was contemplated.

The airship was designed with a large internal cargo bay with loading ramps that enabled “roll-on, roll-off” (Ro-Ro) operations. The cargo bay nominally measured 300 x 30 feet (91 x 9 meters). When equipped as a flying crane, the airship was designed to pick up and deliver heavy cargo precisely from a hover, without the need for ground infrastructure.

TP Aerospace, Inc. did not describe the process for accomplishing a load exchange (a pick up or deliver heavy cargo), but it likely would have required the exchange of ballast between the airship and the pickup and delivery sites. There was no mention of a variable buoyancy control system to enable a load exchange without a ballast exchange.

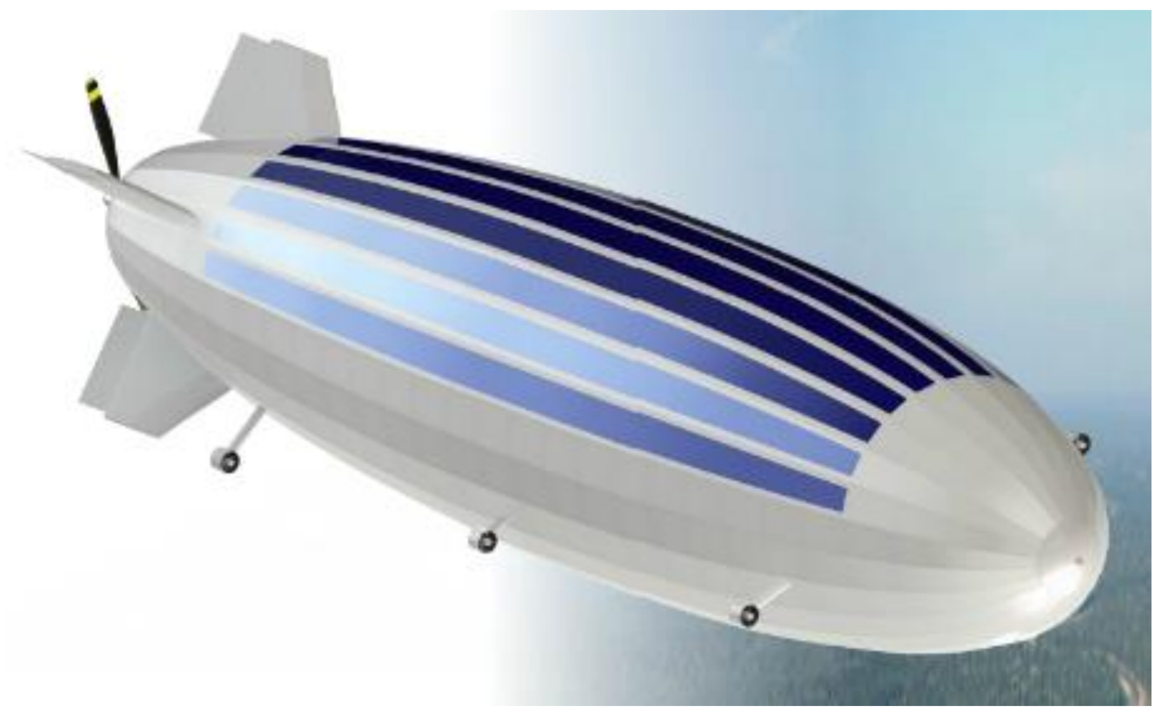
An undisclosed landing system enabled the airship “to operate from a wide range of surfaces, including water, dirt, sand and marsh.” This likely would have been some type of air-cushion landing system (ACLS), which has been used successfully on the Lockheed Martin P-971 and Aeroscraft *Dragon Dream* airships.

TP Aerospace, Inc. claimed that their airship could be equipped with “low and non-polluting systems enabling it to operate in sensitive locations with little or no impact on the environment.” The airship hull could have been equipped with thin-film solar panels to support a hybrid, or perhaps an all-electric, propulsion system.



Two renderings of an Atlas 80 operating as a flying crane carrying a large external load. Source: TP Aerospace, Inc.

Concept drawing showing an Atlas 80 on the ground at an austere site unloading via side cargo doors. Source: TP Aerospace, Inc.



An Atlas 80 airship equipped with thin-film solar panels on the hull. Note the six flank thrust vectoring propulsors and the one large stern propulsor. Source: TP Aerospace, Inc.