# UPship - semi-rigid airships

Peter Lobner, 12 February 2022

## 1. Introduction

UPship was a small airship firm founded by Jesse Blenn in 1989 in Alabama. Several beautiful semi-rigid airship designs with characteristic inverted V-tails were developed.

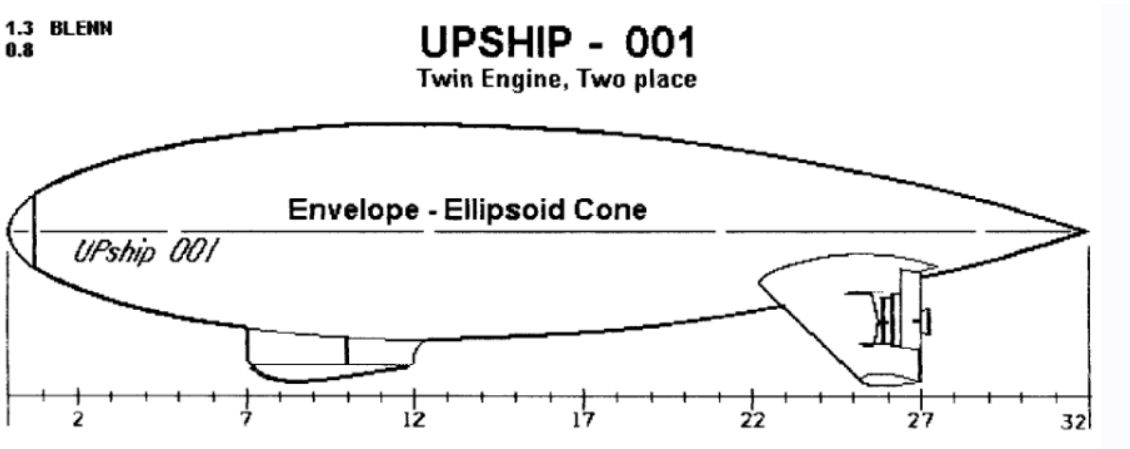
## 2. UPship 100

On his website *Airship and Blimp Resources*, Roland Escher describes the UPship 100 semi-rigid airship as follows:

> “Design work for the UPship prototype began under Jesse Blenn in 1989. The UPship 100 is a two passenger, homebuilt, helium airship intended to become a commercial venture. In 1996, UPship was incorporated in Elba, Alabama. Design was completed in 1997 and construction is expected to begin during 1998. Completion of the UPship 100 prototype and a first flight are planned for 2000.
>
> The UPship 100 is intended as a test bed for innovations that will be applicable to airships of all sizes in the future. Design features of the UPship include a shape of minimum resistance, two propulsion engines in inverted "V" tail fins and a nose mounted thruster for control at all speeds. Two patents are pending for technologies used in the UPship 100.”

**General characteristics of the UPship 100 airship**

| **Parameter** | **UPship 100** |
|---|---|
| Length | 32 m (105 ft) |
| Diameter, max | 6.4 m (21 ft) |
| Envelope volume | 630 m3 (22,250 ft3) |
| Accommodations | Pilot + 1 passenger |
| Speed, max | 111 kph (69 mph) |
| Range | 528 – 828 km (327 – 516 miles) |
| Endurance | 6 - 12 hours |




*Profile view of the UPship 100-001. Source: Robert Recks (1997)*

The design and operation of the inverted V-tail is described in patent US6019312A, which was granted in 2000. The tail fin are designed so that, under the influence of a very large aerodynamic load or a ground impact during landing, the tail fin will deflect, and not break. This design feature reduces the transient energy imparted to the hull.

The control surfaces on the inverted V-tail function as ruddervators (combined rudder and elevator) in the propeller slipstreams and can maintains control authority even at low speed.

It appears that the UPship 100 prototype was not built and flown.

## 3. Three-passenger UPship

Author and aeronautical engineer Michael Boyko (2001) reported, “The company UPship planned to build by the end of 1999 a three-seater semi-rigid airship, in the cockpit of which the pilot and two passengers are located in tandem. The airship is expected to be easy to operate. The starting ground crew will be no more than three people, and in some cases the pilot will be able to dock and anchor the airship on his own….. The cost of building and certifying the airship is $500,000. The cost of operation is $2,000 / day.”

Like the Upship 100, this larger airship had the characteristic inverted V-tail with fixed propellers in the tail planes, and ruddervator control surfaces in the propeller slipstream.

Also like UPship 100, the airship included an automatic pitch stabilization system. A thrust vectoring jet at the nose, driven by a separate engine inside the nose section of the hull, can direct its jet left-right, up-down and in reverse to provide. The thrust of the jet device was 75 kg. Similar jet devices were used in the Airship Industries R.150 and the Wren Skyships R.30 and RS.1 rigid airship designs in the early 1980s.

This semi-rigid airship had a hinged keel made of steel and carbon fiber. The keel was supported by an internal suspension system that distributed loads into the upper part of the envelope.

## General characteristics of the three-passenger UPship airship

| **Parameter** | **UPship three passenger airship** |
|---|---|
| Length | 35 m ( 114.8 ft) |
| Diameter, max | 7 m (23 ft) |
| Envelope volume | 825 $m^3$ (29,135 $ft^3$) |
| Ballonet volume | 247 $m^3$ ( 8,723 $ft^3$) (30% of envelope volume in fore & aft ballonets) |
| Aerostatic lift | 720 kg (1,587 lb) |
| Weight, empty | 432 kg (952.4 lb) |
| Payload | 288 kg (634.9 lb) |
| Gondola dimensions | 5 L x 1 W m (16.4 x 1.3 ft) |
| Accommodations | Pilot + 2 passenger in tandem |
| Propulsion and low speed control | • 2 x König engines rated @ 20.5 kW (27.5 shp) each installed in the inverted V-tail for propulsion<br>• 1 x König engine is installed in the bow of the hull to generate electrical power for on-board systems and power the thrust-vectoring jet device in the nose. |
| Speed, max | 110 kph (68.4 mph) |
| Speed, cruise | 70 – 88 kph (43.5 to 54.7 mph) |
| Range & endurance | • 10 hours @ 88 kph, range 880 km (547 miles)<br>• 20 hours @ 70 kph, range 1,400 km (870 miles) |

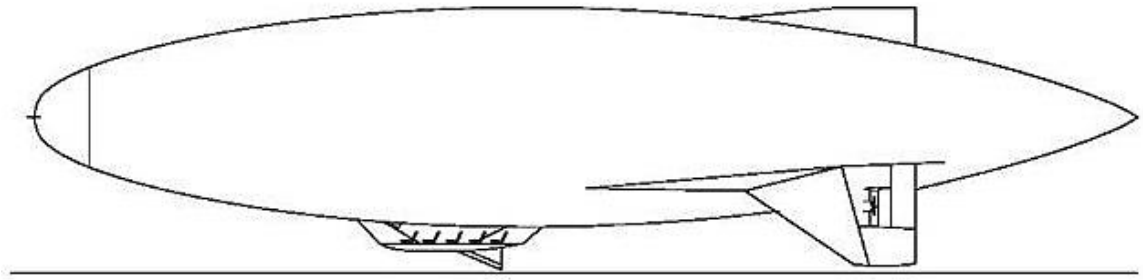
König engines are lightweight, compact, radial aircraft engines commonly used in powered paragliders and parachutes. The model SD 570 most closely fits the power output stated for the three-

passenger UPship. Earlier versions of the SD 570 four-cylinder, two-stroke engine are reported to have produced 21 kW (28 hp) at 4,200 rpm. The engine originally was produced in Germany. Currently that engine business is owned by Compact Radial Engines of Surrey, British Columbia, Canada.

## 4. Larger UPship designs

### 60 meter passenger airship

Jesse Blenn produced the following elegant design for the 60 meter (196.9 ft), 10 passenger semi-rigid UPship airship, with an overall configuration directly traceable to the original homebuilt UPship 100-001 design. This airship was not built.



UPship 60 m 10 passengers 

### 274 meter sightseeing airship, circa 1996

In the August 1991 issue of *Popular Mechanics*, it was reported that UPship was developing plans to build a 274.3 meter (900 foot) semi-rigid sightseeing airship in time for the 1996 summer Olympics in Atlanta. This airship was not built.

### 150 meter natural gas carrier, circa 2006

In May 2006, an article by the Green Car Congress reported on a project by the Bolivian company Reparando SA to develop, with Jesse Blenn, a preliminary design of an airship for delivering natural gas (NG) to remote areas of the country. The article is reproduced below.

“A small Bolivian company, Reparando SA, is exploring the delivery of natural gas (NG) delivery to remote areas by using an airship, rather than a pipeline. Reparando is a heavy equipment repair and road construction company that moved into selling and installing bifuel natural gas conversion systems for heavy-duty diesels (running the engines on 70% NG).

The company worked with Jesse Blenn, a US airship expert, on a preliminary design for a 150-meter airship capable of carrying about 35,000 $m^3$ of natural gas. The basic design is extensible up to a length of around 300 m, which would result in a ship capable of carrying about 300,000 $m^3$.

At 35,000 $m^3$, the volume is approximately equivalent to the compressed gas carried by three natural gas tank trucks. But in many areas of Bolivia, as in many parts of the developing world, roads are so bad that it could take a truck up to one week to go 500 miles.

The ship as designed uses twelve internal inflatable gasbags: six for helium (the ship requires about 40% helium volume to lift the empty structure) and six for natural gas. The upper six bags hold the helium, the lower six the natural gas.

This, Blenn points out, is very similar to the design of the system used by the zeppelin Graf Zepplin I (LZ 127), in which the lower bags carried fuel gas which weighed nearly the same as air, and deflated as the fuel was used. The LZ 127 racked up nearly 1 million kilometers in flight.

With the natural gas on board, the ship has additional lift to carry diesel fuel, although the goal is to convert the airship engines to run primarily on natural gas. The diesel serves as ballast and backup. When running on natural gas, the four engines would consume about 3% of the natural gas payload in a round trip of 1,000 kilometers at a speed of 100 km/h.

Discharge of the natural gas occurs through the mooring tower. The airship carries a normal operating pressure of about 35 mm

water column, which will push the natural gas out within about 20 minutes through the twin NG valves.

The twin nose engines supply the pressure and the 35,000 cubic meters of replacement internal air volume). (Four other natural gas engines provide propulsion.)

The mooring tower will include a proprietary automatic valve connection (purged with $CO_2$), and a seal and bearing system which conduct the gas down to a duct where an auxiliary fan maintains the flow to storage. The reverse process handles the filling, but the inflation pressure is supplied from the tower base, not the engines.

Blenn estimates that the airship could be built for around $US3 million (in South America). Airships, according to Blenn, have an operational life of about 10 years to first replacement of the outer fabric, and several decades for hard structures if refurbished."

This natural gas transport airship was not built.

## 5. Patents

Jesse Blenn was granted patent US6019312A, "Airship tail fin construction for improved control," in 2000. This patent described the tail fin configuration incorporated in the UPship 100-001.

In patent US6019312A Figure 1, the port tail fin (20) is shown attached to the airship hull at three points (44, 46 & 48). These attachment points are elastic and are designed to stretch and absorb energy by deflecting and rotating the tail about the leading attachment point (44) during a load transient.

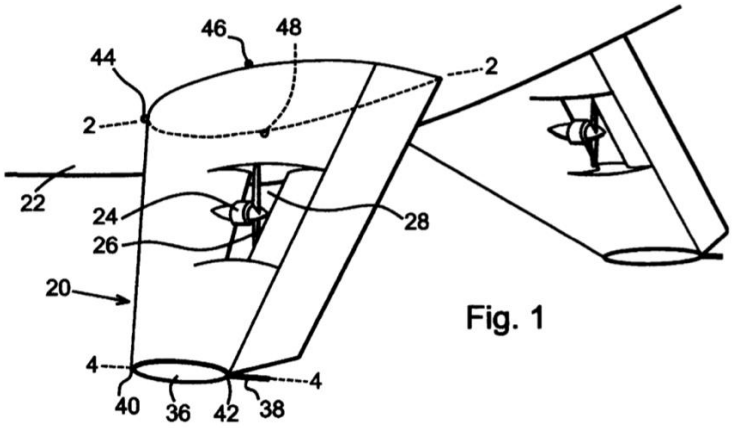



Fig. 1

A compact driving engine (24) installed in the tail fin drives a pusher propeller (26) that rotates in a gap in the tail fin (28). A landing roller (36) installed at the tip of the tail fin serves as a landing skid in the longitudinal direction and as a roller on axis 4-4 to allow the tail of a moored airship to roll sideways on the ground to keep the nose of the airship pointed into the wind. The tail fin structure is designed to deflect and absorb high tail fin aerodynamic or ground contact forces, while protecting the propellers from ground strikes during takeoff and landing. The starboard tail fin is similar.

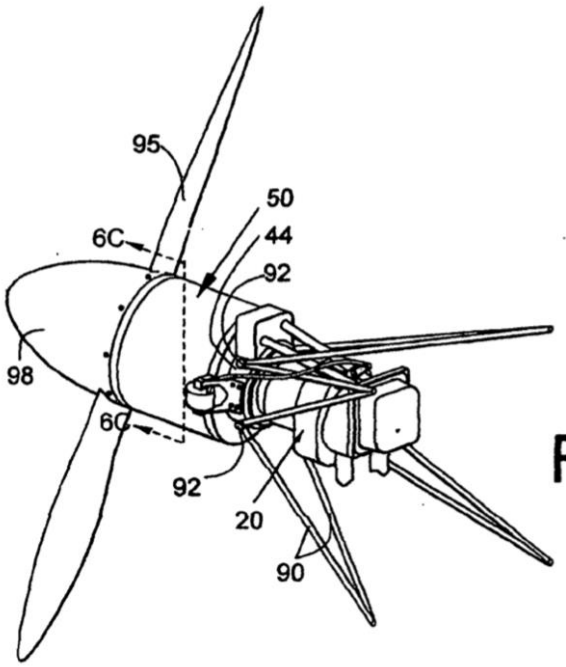



Fig. 1

In 2006, Jesse Blenn filed patent application US2006/0219193, “Optimized linear engine,” for a compact engine that could be suitable for use in the limited space available in an UPship tail assembly. Patent Figure 1 shows this compact engine, which is designed to transform piston linear reciprocating

motion to rotary motion for driving the propeller. The reciprocating engine (44) drives a rotor (50) attached to the propeller (95). The compact engine assembly is mounted to the airframe with four supports (90).

## 6. For more information


- Robert Recks, “A Practical Guide to Building Small Gas Blimps,” CreateSpace, ISBN 0-937568-28-7, 1977, Rev. 1997
- “König SD 570,” Wikipedia, https://en.wikipedia.org/wiki/König_SD_570
- Yu.S. Boyko, “Aeronautics: Tethered, Free, Managed,” pp. 361-362 (in Russian), ISBN 5.8122-0233-8, Publishing house MGUP, Moscow, Russia, 2001
- Roland Escher, “UPship Corporation,” Airship and Blimp Resources, 2003: http://www.myairship.com/database/upship.html
- “Concept: Natural Gas Delivery Via a NG-Powered Airship,” Green Car Congress, 14 May 2006: https://www.greencarcongress.com/2006/05/concept_natural.html
- “Biogas delivery in a bio-gas powered airship?” Biopact, 19 September 2006: https://global.mongabay.com/news/bioenergy/2006/09/biogas-delivery-in-biogas-powered.html


### Patents


- US6019312A, “Airship tail fin construction for improved control,” inventor Jesse Blenn, filed 28 February 1997, granted 1 February 2000, available here: https://patents.google.com/patent/US6019312A/en
- US2006/0219193A1, “Optimized linear engine,” inventor Jesse Blenn, filed 31 March 2005, published 5 October 2006, available here: https://patents.google.com/patent/US20060219193A1/en

## Other *Modern Airships* articles

- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
    - Shell / Aerospace Developments (AD) - methane gas carrier
- *Modern Airships - Part 2*: https://lynceans.org/all-posts/modern-airships-part-2/
    - H2 Clipper – hydrogen carrier
    - Kiev OKBV - Aerostatic fuel transportation system (SATT)
    - Novosibirsk OKB - Natural gas carrier airship
- *Modern Airships - Part 3*: https://lynceans.org/all-posts/modern-airships-part-3/