

# AIRSHIP

THE JOURNAL OF THE AIRSHIP ASSOCIATION

DECEMBER 2011

ISSUE 174 - FREE TO MEMBERS - RETAIL PRICE £7 - ISSN 1353-1891



[www.airship-association.org](http://www.airship-association.org)



## HOT AIR AIRSHIPS FROM GEFA-FLUG

by Karl Ludwig Busemeyer, GEFA-FLUG  
Aachen, Germany

In the first half of the last century Germany's rigid airships introduced by Count von Zeppelin have been world famous and still are. A regular passenger service existed between Germany and North and South America, including an around the world flight in 1929 and a polar expedition in 1931. With great success the US Navy used 200 non-rigid airships for coastal patrol duties until the early 1960s. Since then the world has only seen a few airships, like the Goodyear Blimps and a few others.

In the mid-1990's the Zeppelin Company began to build medium sized airships for passenger flights. At the same time another 'German Airship Story' started with less publicity which includes on a lot of 'hot-air' but is in fact much more than that. Mucky Busemeyer, boss of GEFA-FLUG in Aachen has spent 35 years with airships and has designed, build and flown more types of hot-air airships, than anybody else. For his outstanding work he received the 'Santos Dumont Airship Gold Medal', one of the highest awards of the *Federation Aeronautique Internationale*.

### The History of Hot Air Airships

Along with the general renaissance of hot air balloons, a new type of airship, made by world famous balloon designer Don Cameron, entered the scene using hot-air as its lifting medium. Shape and stability solely depend on static hot-air pressure. Simple to build and operate they derive many features from hot-air balloons. The burner is positioned under the open belly of the envelope. Horizontal manoeuvrability is realised by a rudder, climb and descent by burner input. Due to a very low envelope pressure, the use of these airships is restricted to windless conditions.

At the beginning of the 1980's Thunder & Colt Balloons produced the first pressurised hot-air airship, using an engine-driven fan to pressurize the envelope. Using high-strength nylon fabrics allows the envelope pressure to be significantly increased, thus increasing the performance of the airship. In the mid-80s Cameron also brought a pressure airship on the market, followed by Lindstrand in 1995.

### GEFA-FLUG Airships

GEFA-FLUG has been designing airships since the mid-1970'. The first ten years were spent with development and operation of remote controlled airships. Since 1985 experiences gained with remote-controlled airships for environmental purposes led to the research of

The GEFA-FLUG AS 1056 GD six seat hot-air airship.





manned systems. The first twin-seat airship was built in 1990 using a Thunder & Colt gondola with an envelope entirely designed and build by GEFA-FLUG. This envelope type is more streamlined than existing hot-air airships and has been certified as a four seat for passenger operation in 1999.

The general manoeuvrability has been improved. Pitch control is possible with the help of a V-form twin burner arrangement and the resulting heat distribution in the envelope fore and aft. Flight characteristics are much improved. The speed is higher due to the slimmer fineness ratio compared with traditional hot-air airships. GEFA-FLUG airships have been successfully used in more than twenty five countries.

The development has been both government and industry funded. The AS 105 GD as a four seat is certified under EASA Part 21 after a five year scientific program. At the time of writing airship SN 0061 is under construction. The highlight of GEFA-FLUG's scientific research 2005 to 2010 is the EASA certification of a six seater hot air airship with a volume of 5.000 m<sup>3</sup>.

Operational Characteristics:

A big advantage is the ease of transporting hot-air airships to their place of operation. Helium airships have to fly there, which is very expensive depending on the distance. Hot-air airships however travel on the road including their three to four crew members. Hot-air airships will only be operated in good flying weather with a crew of three plus pilot. Crew size of helium airships varies from 10 – 20 depending on type and size of ship. (The only exemption is the Zeppelin NT with its swivelling propellers and tail thruster)

Hot-air airships are always inflated outside, and therefore the weather limits will be lower than with helium airships. A professional crew operating an advanced hot-air airship like the AS 105 GD, can stretch the wind limit up to 10/12 kts. A simple and cheap aircraft will never

have a performance as high as an expensive one. However the efficiency might be good in both cases, as long as both do not compete in the same market niche. A four-seat hot-air airship costs only 10-15% of its four-seat helium brother. It seems likely that there is a market share for both, but in different market places.

Advertising, Passenger Flights and Environmental Monitoring

The main market for hot air airships is aerial advertising, with the majority being operated by hot-air balloon companies. One can still define a hot-air airship as a powered, steerable hot air balloon and without the engine running, it can be flown like a balloon. The big advantage over the hot-air balloon is the ability to hover over a defined area.

There is a good market in visiting fairs, exhibitions, open air and sporting events, etc. in the evenings. Another possibility is patrolling flights over motorways and trunk roads to monitor traffic in the early morning and the evening. In wintertime, hot-air airships can be operated over ski resorts and big winter games. Combined with aerial advertising, passenger flying with hot-air airships is a viable submarket making them even more attractive when not in use for promotional contracts.

GEFA-FLUG has proved for more than 25 years that hot-air airships are very suitable for environmental survey projects and they are very cost effective. They take off and land vertically; they only need small launch fields which can always be found close to the flying area. This means it is inexpensive to get them to these areas and no expensive flight time is lost in just getting there.

Worldwide Operational Experiences

Since the early 1980's GEFA-FLUG has successfully used various hot-air airships in approximately twenty five countries in various roles such as aerial photogrammetry. An early

example was a four month survey of a 5000 year old city in Pakistan during 1982/83. Similar projects have been undertaken in Oman, Yemen, Syria, Greece, Turkey, Yugoslavia, Egypt, Spain, Israel and Tanzania, and many other locations. Other significant projects have been the documentation of the world famous castles of Neuschwanstein, and surveys of the Rhine and Danube valleys in Austria and Germany with biologists from the *World Wide Fund for Nature*.

One of many highlights for the company was *Arctic Sky 94*, a winter expedition to Vadsö, the most northern point of Europe, to fly next to the airship mooring mast used by Amundsen and Nobile during their polar airship expeditions in 1926/28. It was the first time an airship had flown in the European Arctic skies since the original expeditions.

Another was *Serengeti Shall Never Die* to commemorate the 40th anniversary of famous German professor Grzimek's expedition in Tanzania in 1958, where he and his son Michael counted masses of Zebra and Wildebeest using a light aeroplane. GEFA-FLUG used the ADLER airship, which proved to be an excellent TV camera platform, and created minimum disturbance of the wildlife. In

1994 GEFA-FLUG obtained a development budget of one million US dollars, which was partly government funded by the Ministry of Commerce. The programme ran over a period of five years with scientific work being conducted by institutes of the Technical University Aachen. The objective was to develop a four-seat hot-air airship. The development and certification of a six-seat hot-air airship followed between 2005 and 2010.

Pilot Licences

In general aviation authorities agree to fly these aircrafts with a hot-air balloon licence plus a rating on hot-air airships. Depending on national regulations a minimum of 5-6 hours flying with an instructor are necessary to pass the checkout flight. Some theory on engines, propellers, aerodynamics and maintenance is also required. GEFA-FLUG has established a training school at Lake Constance, the historical birthplace of the Zeppelin airships.

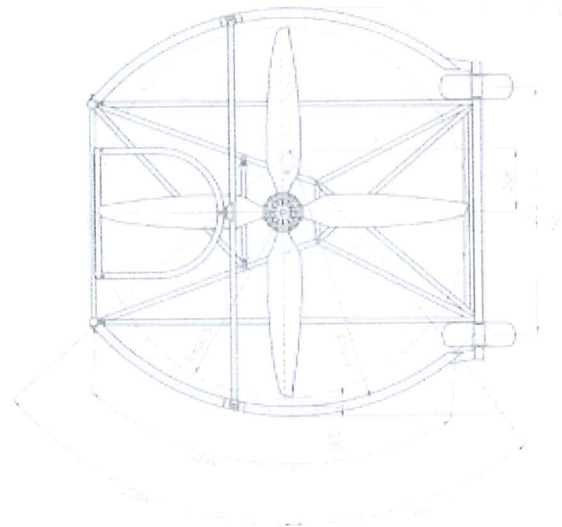
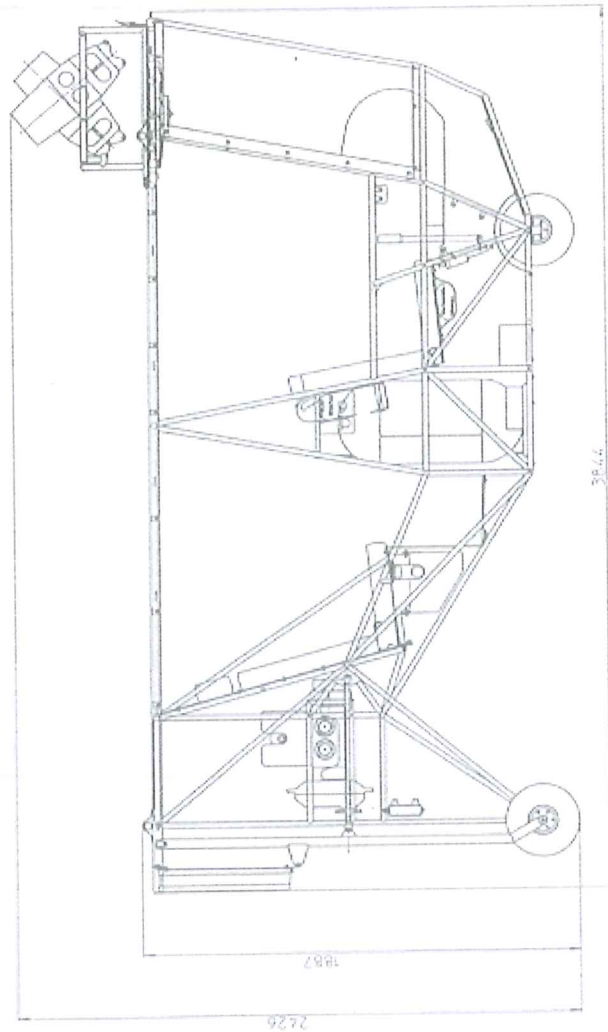
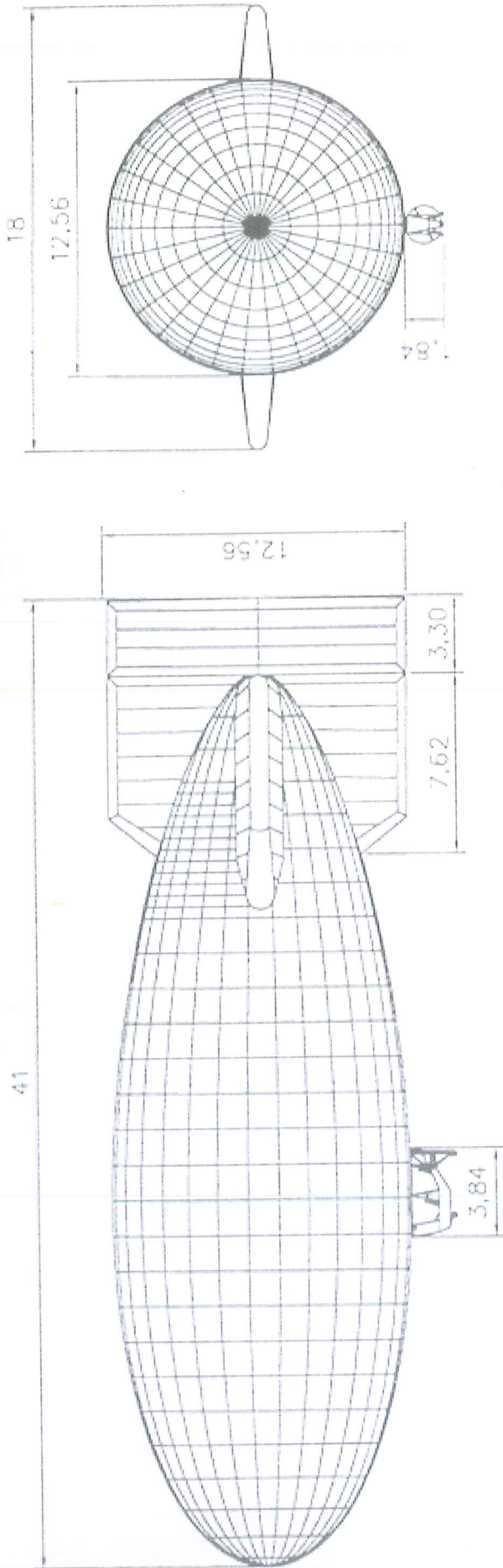
*Addendum: This article is a shortened version of a report, including many illustrations, included in the book Airship Technology 2nd edition to be published by Cambridge University Press in February 2012.*



GEFA-FLUG AS 1056 GD six seat gondola.



# Feature



**GEFA-FLUG 4 Seat Hot Air Airship**