

CL CargoLifter GmbH & Co. KGaA

Peter Lobner, 27 October 2023

1. Introduction

German firm CL CargoLifter GmbH & Co. KGaA is the successor firm to CargoLifter AG, which went into receivership in June 2002. Founded in Berlin in 2005, CL CargoLifter GmbH & Co. KGaA (henceforth referred to in this article simply as CargoLifter GmbH) owns the patents of the former CargoLifter AG and seeks to sell lighter-than-air (LTA) technology, services and products. Current products include modest-lift Balloon Crane Systems that are much smaller than, but analogous in function to, CargoLifter AG's CL75 AC AirCrane.



CargoLifter GmbH has developed advanced design concepts for a range of LTA vehicles, including:

- CL Airship – a large, heavy-lift, long-range rigid airship
- CL AirTruck – a mid-size, heavy-lift, shorter range rigid airship
- CL AirCrane – a tethered, spherical heavy-lift balloon system to operate at a fixed site
- CL AirBridge – a tethered, spherical heavy-lift balloon system to move loads between two sites
- CL AirBarge – a towable, spherical, heavy-lift balloon

The firm's website is here:

<https://www.CargoLifter.com/en/company/>

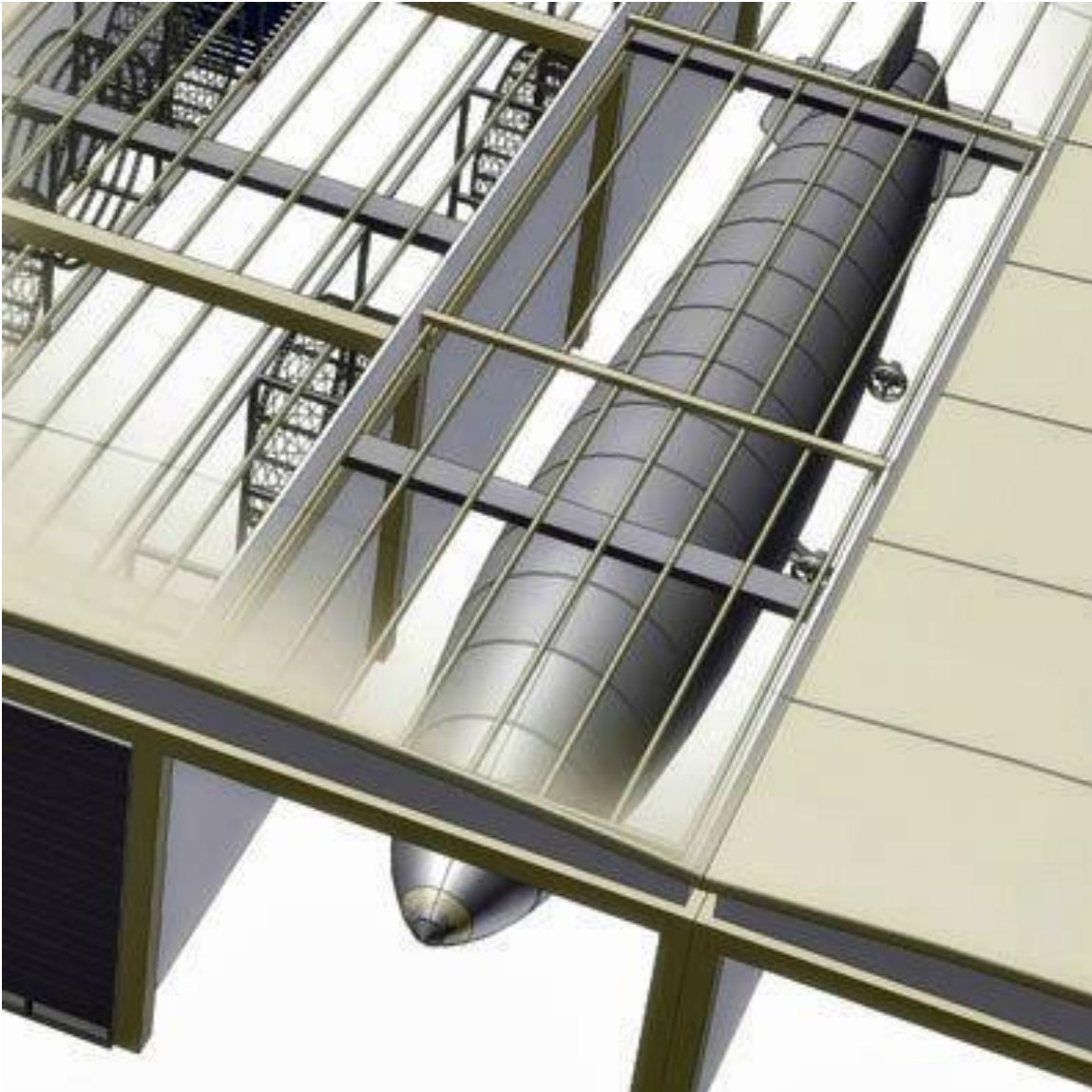
2. The heavy-lift, rigid CL Airship

On its website, CargoLifter GmbH reports, "Based on proven and certified components of the AirTruck product range, CargoLifter can develop and build a full-fledged Airship. Suited for extremely over-sized loads of more than 60 m (197 ft) and payloads of more than 80 (metric) tons (88 tons), with a flexible load bay for various industrial components. As a rigid airship, it would follow the proven design of the *Hindenburg*, still the largest airship in LTA history (apart of the sister ship LZ-130)."

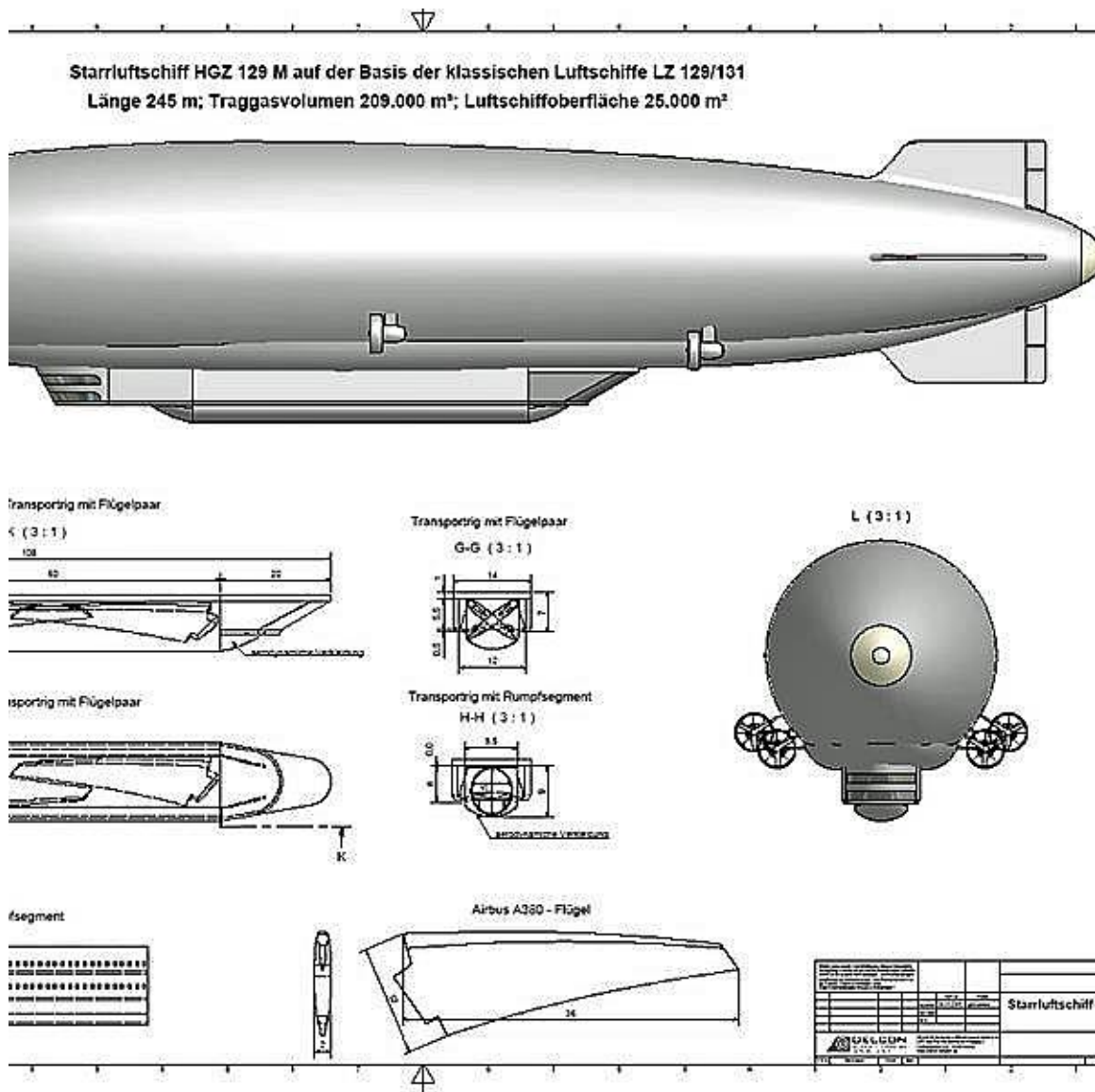


*Heavy-lift rigid CL Airship design concept HGZ-129 M.
Source: CargoLifter GmbH*

CargoLifter GmbH further reports, “The CargoLifter Airship will be optimized for long distances up to 10,000 km (6,214 miles), carrying any kind of cargo and components in its extremely large and flexible load bay. As an extended version with a special load frame, we will reach the level where we once started - the CL160 ‘flying crane’. This will be the top of a wide product range, starting from small to large and for short to long distance – as an ideal solution for each market segment.”

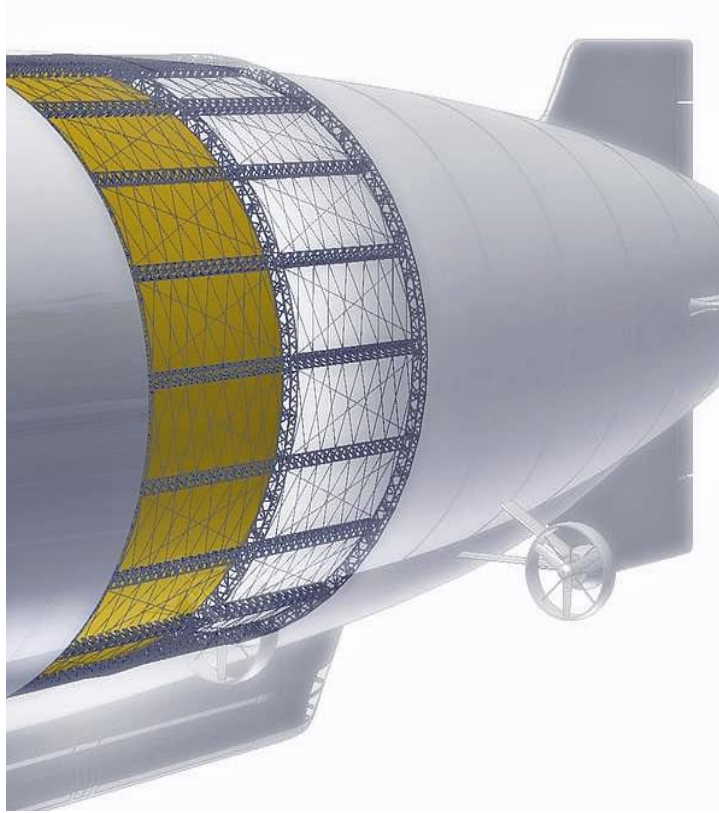


*CL Airship design concept HGZ-129 M in a construction bay.
Source: CargoLifter GmbH*



*Partial engineering drawings for the CL Airship HGZ-129 M design concept.
Note that the internal cargo bay is large enough to carry a pair
of fully-assembled wings (left & right wings) for an Airbus A380.*

Source: CargoLifter GmbH



*CL Airship HGZ-129 M hull rigid aerostructure design concept with truss structure transverse ribs and longitudinal longerons.
Source: CargoLifter GmbH*

General design characteristics of the CargoLifter GmbH CL Airship

Parameter	CL Airship HGZ-129 M
Airship type	Rigid, conventional
Length, overall	245 m (803.8 ft)
Diameter, max	Estimated at about 41.2 m (135.1 ft)
Hull aspect ratio	Estimated at about 5.9
Lifting gas	Helium
Envelope volume	209,000 m ³ (7,381,000 ft ³)
Surface area	25,000 m ² (269.098 ft ²)
Gondola length	108 m (354 ft)
Payload	80 metric tons (88 tons)
Propulsion / maneuvering system	4 x flank-mounted, shrouded, thrust-vectoring propellers
Aerodynamic control surfaces	Cruciform tail with movable elevators and rudder control surfaces
Range	10,000 km (6,214 miles)

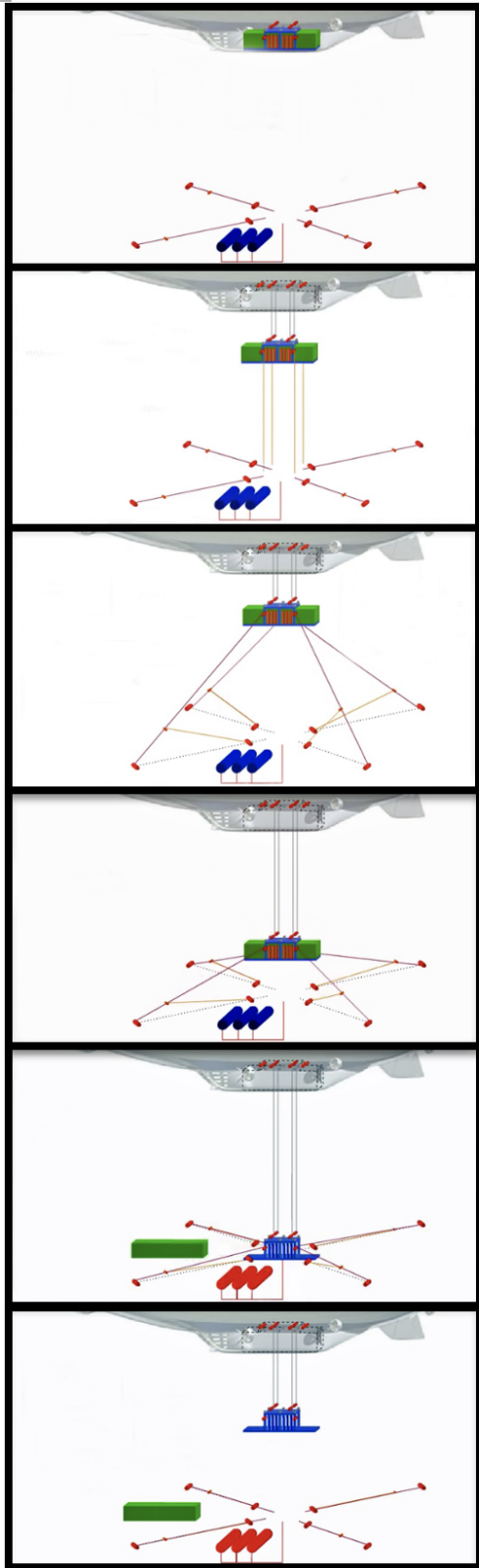
CargoLifter GmbH's CL Airship is designed for conducting airborne, tethered load exchanges using the same process developed and patented in 2001 by CargoLifter AG for their CL160 heavy lift airship.



*Load exchange in progress from an airship hovering at about 100m (328 ft).
Source, both graphics: CargoLifter AG*

The airship does not land to pick up or drop off cargo. Instead, cargo carried in the internal cargo bay, is lowered to the ground on a load frame from a hover altitude of about 100 m (328 ft). A water ballast exchange occurs before the tethers can be released and the load frame can be hoisted back to the airship.

This sequence of events is shown in the following diagram.



The airship arrives above the delivery site with cargo . The ground anchor system and ballast water on the ground are ready.

The airship lowers its load frame with the cargo and empty ballast tanks. Haul-down cables are dropped to the ground.

The airship haul-down cables are secured to the ground anchor system. The CL160 is now tethered to the ground via the load frame.

The load frame is hauled down to the ground while the tethered airship hovers above.

The load frame is ballasted from the ground storage tanks with water equivalent in weight to the cargo. Then the cargo is removed.

The ballasted load frame is released from the ground anchor system and is lifted back up into the airship. The airship can depart the site.

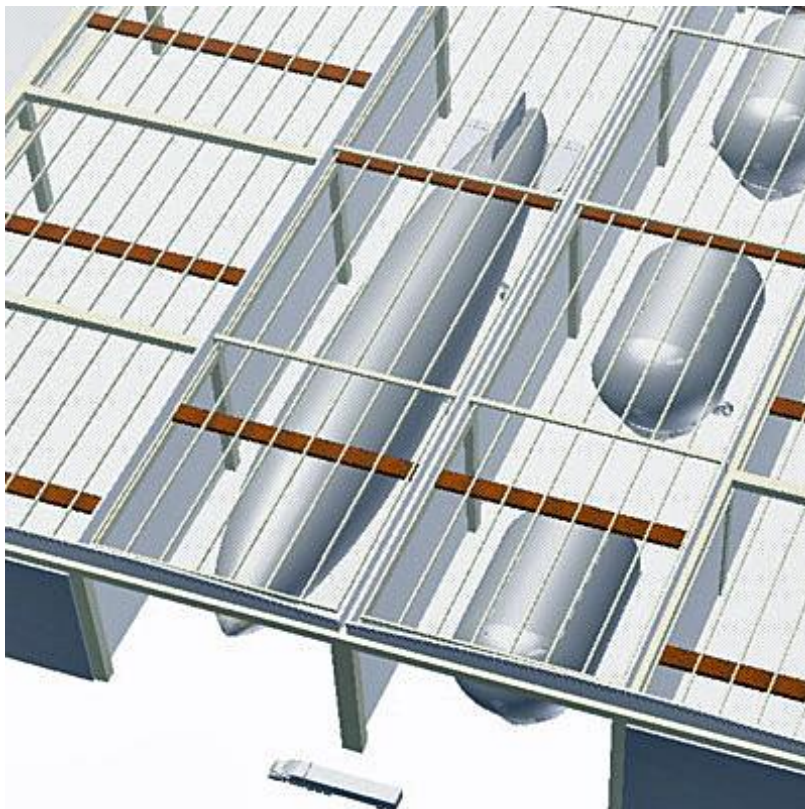
*Airborne load exchange sequence of events.
Screenshot from CargoLifter AG video (2006)*

3. The CL AirTruck

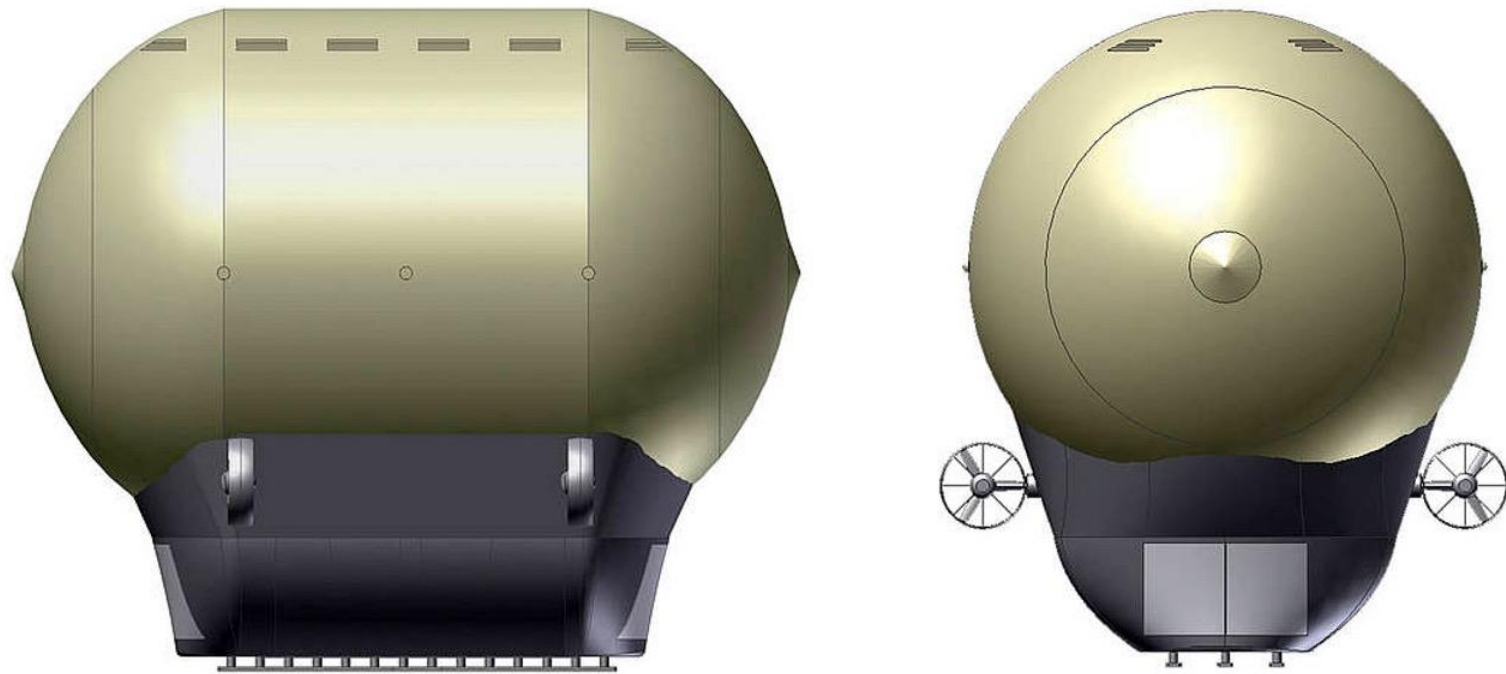
The CargoLifter AirTruck is a conventional rigid cargo airship that is designed for short-to-medium haul operation into remote areas that are underserved or inaccessible to other modes of transportation. Its hover and vertical takeoff and landing (VTOL) capabilities enable it to operate from small, unprepared sites.

The airship's simple, modular, rigid structure is designed for efficient factory production of an airship that can be readily scaled to meet a variety of cargo / range requirements. CargoLifter GmbH reports that the basic AirTruck is capable of carrying metric 20 metric tons (22 tons) in an internal cargo bay, over a range of 500 km (311 miles). This model can be scaled up with larger or additional hull segments to carry 40 metric tons (44 tons) up to 1,000 km (621 miles).

CargoLifter GmbH reports, "Various studies indicate a global market of hundreds of airships of this class. In a period of five years after sufficient funding, we can develop, build and certify the AirTruck. As a global product, it needs an international consortium to secure funding, certification and insurance."



*Relative sizes of the CL Airship and the CL AirTruck on parallel production lines.
Source: CargoLifter GmbH*



*Heavy-lift rigid CL AirTruck design concept.
Source: CargoLifter GmbH*

4. CL AirCrane

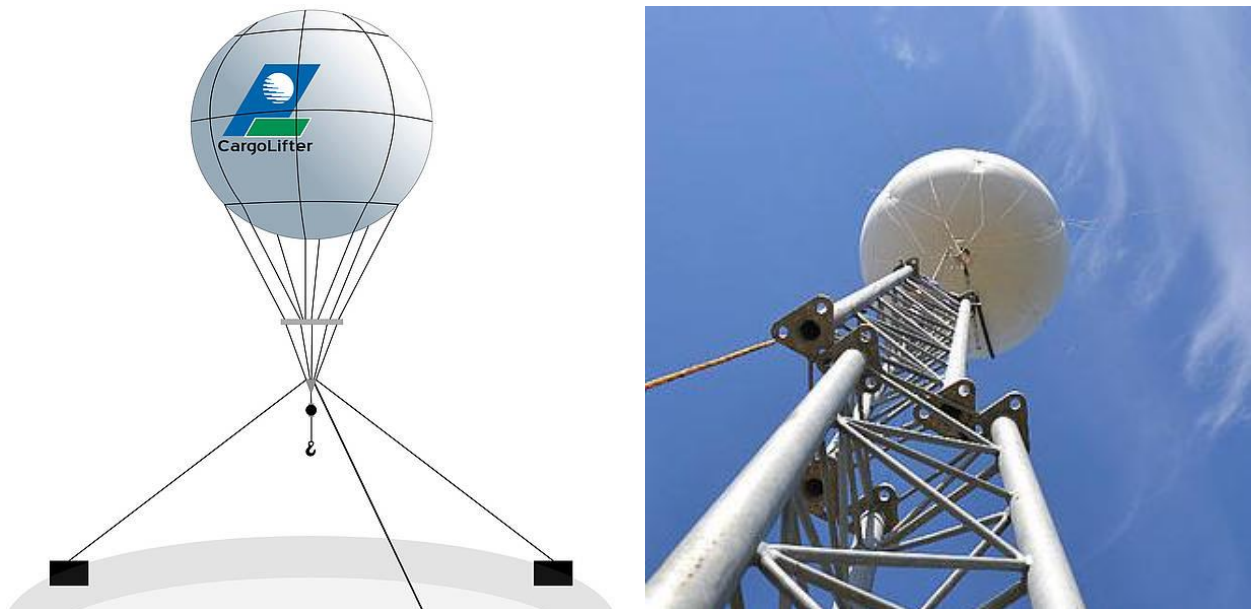
CargoLifter GmbH has three patents for spherical, tethered LTA cargo transport systems. These patents are the basis for the AirCrane product line as well as the AirBridge and AirBarge.

Their AirCrane balloon system current products and advanced concepts are briefly described in this section.

AirCrane CL BCS1 – Balloon Crane System

The CL BCS1 is based on a balloon of 15 meters (49 feet) in diameter with a maximum payload of one metric ton (1.1 tons). It is capable of vertically lifting loads up to 200 m (656 ft) and, with the aid of CL software for steering 3 or 4 winches, positioning the load precisely. As with conventional construction cranes, the CL BCS1 can be operated as an AirCrane at wind speeds up to 10 m/s (36 kph, 22 mph).

Configured as a AirBridge, the CL BCS1 can lift and transport loads horizontally over several hundreds of meters.



(Left) Balloon Crane System general arrangement, in this case with three anchored winches. (Right) CL BCS1 lifting a tower segment into place and precisely positioning it above an already installed segment. Source: CargoLifter GmbH

AirHook CL MK250



CL MK250. Source: CargoLifter GmbH

The CargoLifter AirHook CL MK250 is a “mini-crane” that enables one person to horizontally lift up to 250 kg (551 lb) and transport it over hundreds of meters. The MK250 is tethered on a guiding system and is remote controlled. It is based on a certified passenger balloon with a diameter of 10 m (33 ft). Without any complex electrical or mechanical components, this is a robust, reliable lifting and transportation tool for modest loads.

Larger AirCranes

The feasibility of AirCranes capable of lifting much larger loads was demonstrated from 2000 to 2002 by CargoLifter AG with their CL75 AC AirCrane, which had a design load capacity of up to 75 metric tons (75,000 kg, 165,347 lb). The basic design and operation of this type of transport balloon is described in patent application US2002/0109045 (published in 2002).



That patent application has been assigned to CargoLifter GmbH. They report, “The spherical balloons allow different configurations for a variety of tasks, for loads up to 60 (metric) tons (66 tons), heights up to 200 m (656 ft) and distances up to 50 km (31 miles). In order to realize such a project, it will take about one year of planning and preparation.”

*CL75 AC aloft on tethers during May 2002 load exchange test with 55 metric ton (60.5 ton) German mine-clearing tank.
Source: CargoLifter AG*

One possible application of a large AirCrane is the final assembly of a large wind turbine. As shown in the following patent diagram, the AirCrane would be anchored and controlled with three winches on the ground, operating within the same windspeed limits that apply to conventional large construction cranes, typically 10 m/s (36 kph, 22 mph). The AirCrane would lift a large wind turbine blade into position for final assembly. This assembly concept is described in detail in CargoLifter GmbH patent US2011/0116905A1.

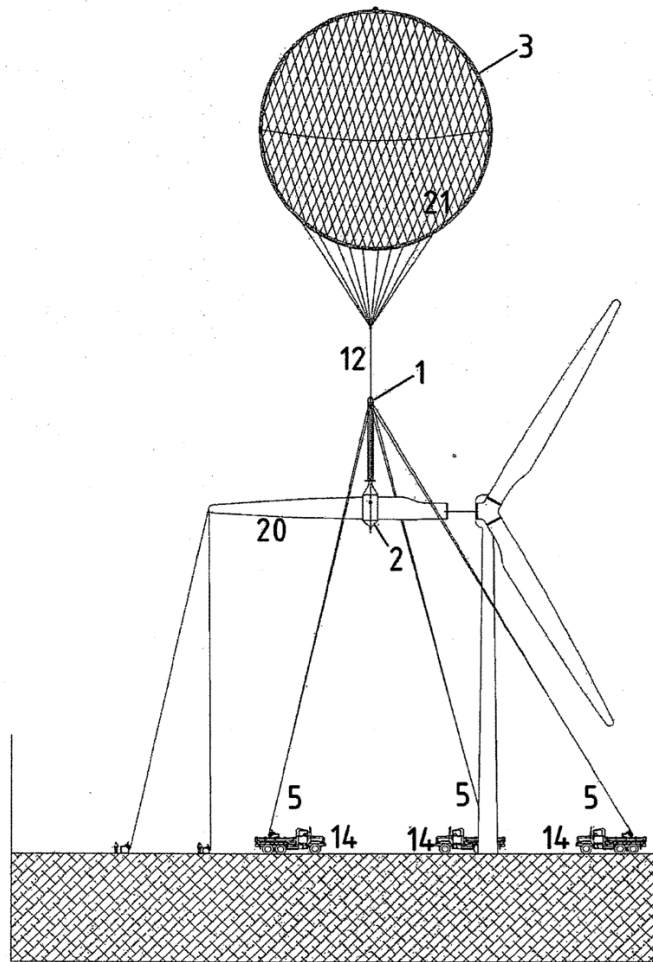


Fig.6

Legend

Heavy lift balloon (3) is contained within a balloon net (21) that distributes loads over the surface of the balloon. The balloon net is gathered at balloon nodal point and connected via the carrying cable (12) through the crane nodal point (1) to support the load (20) via the suspension unit (2). Control winches (14) on the anchored vehicles manage the tethers (5), which join at the crane nodal point (1) above the load.

AirCrane concept for assembling the blades on a large wind turbine tower.

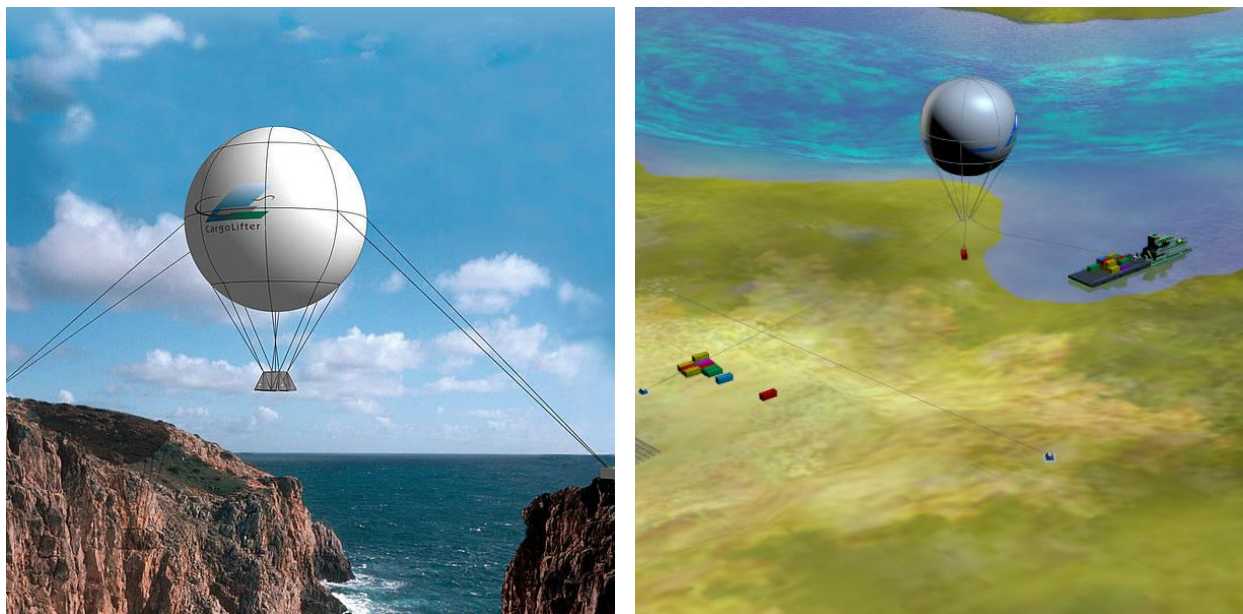
Source: Patent US2011/0116905A1, Fig 6

5. CL AirBridge

The CL AirBridge creates the opportunity to temporarily bridge canyons and rivers or to transport goods in areas where a severe event (e.g. flood, earthquake or other catastrophe) has destroyed a section of the normally available transportation infrastructure.

For example, an AirBridge can be established using two or three winches to guide a lifting balloon and its load horizontally across gaps of several hundreds of meters. The AirBridge concept also applies to moving loads uphill and downhill, with precise landing of the cargo at a specified point.

If a harbor is blocked, too shallow, cargo is oversized or there is insufficient cargo handling equipment available, an AirBridge could be established to unload cargo from ship-to-shore or vice versa.



Examples of AirBridge applications: Source: CargoLifter GmbH

6. CL AirBarge

An AirBarge is a heavy-lift cargo balloon that is towed with its cargo at low altitude by some other vehicle(s), potentially over long distances. The tow vehicle(s) could be a heavy truck on land, a vessel on a body of water, or a helicopter.

If the load is too heavy for the road infrastructure, or there are obstacles making any other mode of transportation too costly or even impossible, a CL AirBarge might be a viable solution. For example, an AirBarge could be used to transport heavy loads along ice roads in the Arctic or along rivers into remote areas lacking adequate port, road or air access.



Examples of AirBarge applications: Source: CargoLifter GmbH

With an AirBarge, a large rotor blade for a wind turbine can be transported above roads that are large enough for heavy trucks, but not suitable for ground transportation of a very long wind turbine blade (i.e., winding mountain roads leading to a mountain top wind turbine site). In this example, the AirBarge would be towed by multiple heavy trucks. This transportation technique would greatly expand the area that would be suitable for installing wind turbines on land. In addition, larger wind turbines could be installed on land, perhaps approaching or equaling the size of the largest offshore wind turbines. This transportation concept is shown in the following diagram and is described in detail in CargoLifter GmbH patent US2011/0116905A1.

After reconfiguring the AirBarge to an AirCrane at the delivery site, the AirCrane could lift each blade into position for final assembly, as described previously.

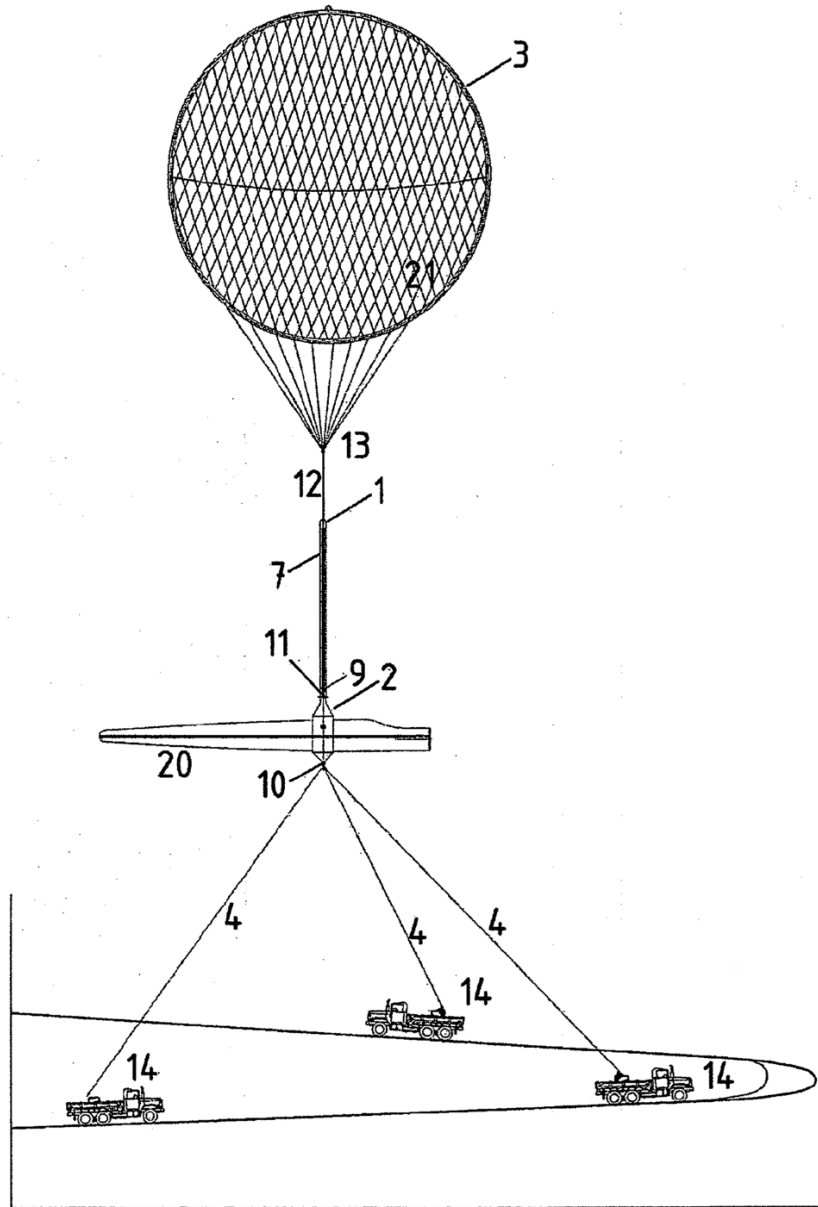


Fig. 1

Legend

Heavy lift balloon (3) is contained within a balloon net (21) that distributes loads over the surface of the balloon. The balloon net is gathered at balloon nodal point (13) and connects via the carrying cables (7 & 12) through the crane nodal point (1) to the upper swivel (11) and the suspension unit (2), which supports the load (20). Control winches (14) on the tow vehicles manage the tethers (4), which join at the lower swivel (10) beneath the load (the wind turbine blade) (20).

AirBarge concept for transporting a large wind turbine rotor blade on a serpentine mountain road. Source: Patent US2011/0116905A1, Fig 1

7. For more information

Video

- “Prinzip des CargoLifter-Lastaustauschs (Principle of the CargoLifter load exchange),” (2:14 min), originally posted by CargoLifter AG in 2006, reposted by CL CargoLifter GmbH & Co. KGaA, 24 July 2014: https://www.youtube.com/watch?v=sedQ_9RdKVM
- “Der erste Ballonkran der CL CargoLifter GmbH & Co. KGaA (The first balloon crane of by CL CargoLifter GmbH & Co. KGaA),” (7:46 min), posted by CL CargoLifter GmbH & Co. KGaA, 20 April 2011: https://www.youtube.com/watch?v=QdrXGo_AOGw
- “CargoLifter CL-75 - Demonstration des Lastaustauschs,” (5:19 min), posted by CL CargoLifter GmbH & Co. KGaA, 5 May 2011: <https://www.youtube.com/watch?v=lralh-LwcJQ&list=PLC0639C9A46DA71BA>

CargoLifter AG patents (now assigned to successor firm CL CargoLifter GmbH and Co KGaA)

- US2002/0109045, “Spherical LTA cargo transport system,” Filed 19 November 2001; Published 15 August 2002; Assigned to CargoLifter Inc.: <https://patents.google.com/patent/US20020109045A1/en>
- US6231007, “Method for the precise setting down or picking up of cargo from airships,” Filed 16 June 1998; Granted 15 May 2001; Assigned to CargoLifter AG: <https://patents.google.com/patent/US6231007B1/en>

CL CargoLifter GmbH and Co KGaA patents

- US2011/0057158, “Method and arrangement for transporting of elongated, bulky products,” Filed 9 March 2009; Published 10 March 2011; Assigned to CL CargoLifter GmbH and Co KGaA: <https://patents.google.com/patent/US20110057158A1/en>
- US2011/0116905, “Method and arrangement for transporting of elongated, cumbersome loads,” Filed 14 July 2008; Published 19 May 2011; Assigned to CL CargoLifter GmbH and Co KGaA: <https://patents.google.com/patent/US20110116905A1/en>

Other Modern Airships articles

- *Modern Airships - Part 1:* <https://lynceans.org/all-posts/modern-airships-part-1/>
 - CargoLifter AG – Joey, CL75 AC & CL160
 - LTA Research and Exploration – Pathfinder rigid airship
- *Modern Airships - Part 2:* <https://lynceans.org/all-posts/modern-airships-part-2/>
 - Euro Airship – 10T, 50T, 400T & Solar One rigid airships
 - Flying Whales – LCA60T rigid airship
- *Modern Airships - Part 3:* <https://lynceans.org/all-posts/modern-airships-part-3/>