Airship do Brasil (ADB) airships & aerostats

Peter Lobner, updated 9 January 2023

1. Introduction

Airship do Brasil (ADB) was founded by former Brazilian Army officer Dr. Marcelo Felippes, in association of Grupo Engevix and Transportes Bertolini. The firm originally was incorporated in July 2005 in the city of Barueri. In 2010, ADB moved to São Carlos, where it built its present headquarters and manufacturing facility, which was inaugurated in 2015. ADB also maintains an institutional relations office in the Federal capital, Brasília.

The firm's initial products were two unmanned, radio-controlled blimps designated ADB-1 and ADB-2, which were tested in 2009, and tethered surveillance aerostats, which were employed for event security during the 2016 Olympic Games in Rio de Janeiro.

Work on a large cargo blimp designated the ADB-3-30 was approved in 2012 and continued through 2019.

In 2017, ADB flew its ADB-3-X01 prototype blimp, which became the first indigenous, manned airship built, flown and type certified in Latin America. In December 2022, ADB received a type certificate for its ADB-3-3 commercial blimp, which is based on the ADB-3-X01 prototype.

ADB has other projects for manned and unmanned airships, including an "atmospheric satellite" blimp named SAGA, which is designed for long-term operation in the stratosphere.

ADB, which is a 100% Brazilian private capital company owned by Bertolini Group, has an important role in Brazil's national program to build an indigenous airship industry. Their website is here: http://www.airshipdobrasil.com.br

ADB factory. Source: Airship do Brasil

One unique ADB asset is the full-sized, functional airship hangar at the Bartolomeu de Gusmão Airport in Araraquara. The hangar was constructed in the 1930s, when it was used to support trans-Atlantic Zeppelin operations between Brazil and Germany. In those days, Zeppelins were successfully flying passengers and cargo across the ocean. ADB's hangar is about 900 feet (274 meters) long and 150 feet (46 meters) high and is large enough to build a large modern airship sized to carry 100 metric tons (110 short tons) of cargo.

ADB airship hangar. Source: https://www.cbc.ca/news/, 11 Mar 2018

In March 2018, Dr. Marcelo Felippes, CEO of ADB, announced that ADB and the Canadian airship firm Buoyant Aircraft Systems International (BASI) had signed a Memorandum of Understanding (MoU) under which the two companies would work together to produce Zeppelin-style rigid airships that eventually will be able to carry up to 100 metric tons (110 short tons) of cargo and serve remote areas in both countries.

2. ADB-1 & -2

The small, unmanned ADB-1 and -2 blimps developed by Airship do Brasil were among the firm's earliest lighter-than-air (LTA) products. These airships were first tested in 2009.

ADB-1. Source: ADB

ADB-2 envelope (not the complete blimp) on display at 2015 meeting of the Brazilian Society for the Advancement of Science (SBPC). Source: ADB

3. ADB-3-X01 prototype

The 48-meter (157-ft) long ADB-3-X01 prototype is a built-in-Brazil Model 138S non-rigid, manned blimp that originally was developed in 1989 by the firm US LTA Corporation. It originally received US Federal Aviation Administration (FAA) Type Certificate No. AS2NM on 24 July 1990. ADB purchased the Model 138S plans and type certificate from US LTA Corp., along with the tools to build the airship.

The ADB-3-X01 gondola at the new ADB factory in São Carlos in early 2015.
Source: http://www.aviacaopaulista.com/news/2015/marco/270315_10.htm

ADB manufactured the 3-X01 prototype at its factory in São Carlos. This blimp became the first indigenous, manned airship built and flown in Latin America when it made its inaugural flight in Brazil on 24 July 2017, with registration PR-ZOV.

The US FAA reassigned the Model 138S Type Certificate No. AS2NM to ADB and Brasil's Agência Nacional de Aviación Civil (ANAC) issued their Type Certificate 2018T01 and corresponding Data Sheet No. EB-2018T01 for the Model 138S on 24 May 2018. This ANAC type certificate is the basis for certifying the similar production model ADB-3-3 blimp.

ADB-3-X01. Source: ADB

The ADB-3-X01 gas envelope, manufactured by Lindstrand Technologies, Ltd., is made of polyester fabric coated with polyurethane. On the ground, the blimp is negatively buoyant. In cruise flight, about 90% of total lift is aerostatic lift from helium, while the remaining 10% is aerodynamic lift arising from the angle-of-attack of the specially-shaped gas envelope and control surfaces on the tail.

As explained by author Roberto Calafa (2017), the ADB-3-X01 also manages lift and envelope pressure control by means of engine exhaust gas heating:

> "A Lycoming engine exhaust manifold (mounted in a pusher configuration) serves to heat and inflate the internal "cuffs" arranged around the envelope. There is a valve at the entrance to the duct. When the pilot wants to inflate the balloons more (going up), the valve is opened and the flow of hot air from the engine is released into the interior of the balloons (into the ballonets), the opposite to be able to go down. With this procedure, pressure control inside the envelope and aerostatic control (ascent and descent of the airship) are obtained."

The ADB-3-X01 has a steel-framed, fiberglass-skinned gondola designed to carry one pilot and up to five passengers or loads of up to 1 metric tons (1.1 short tons, 2,200 lb).

In July 2019, ADB announced that ADB-3-X01 airship had been designated as a “Strategic Product of Defense” and was available to fulfill tasks of surveillance, civil defense, public security and support to isolated communities, when requested by a branch of Brazil’s military.

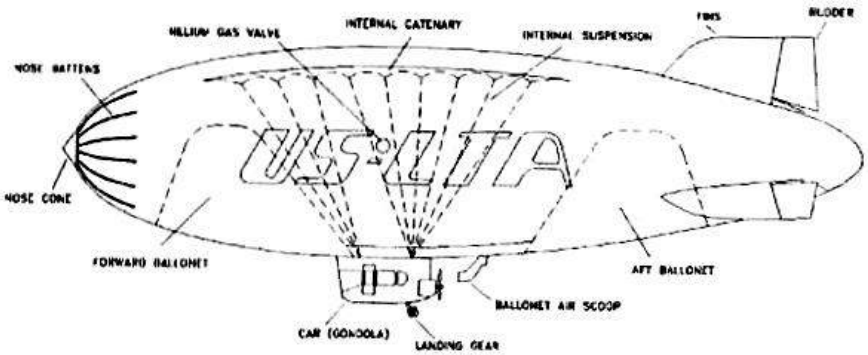
ADB-3-X01, registration PR-ZOV. Source, both photos: ADB

4. ADB-3-3 airship

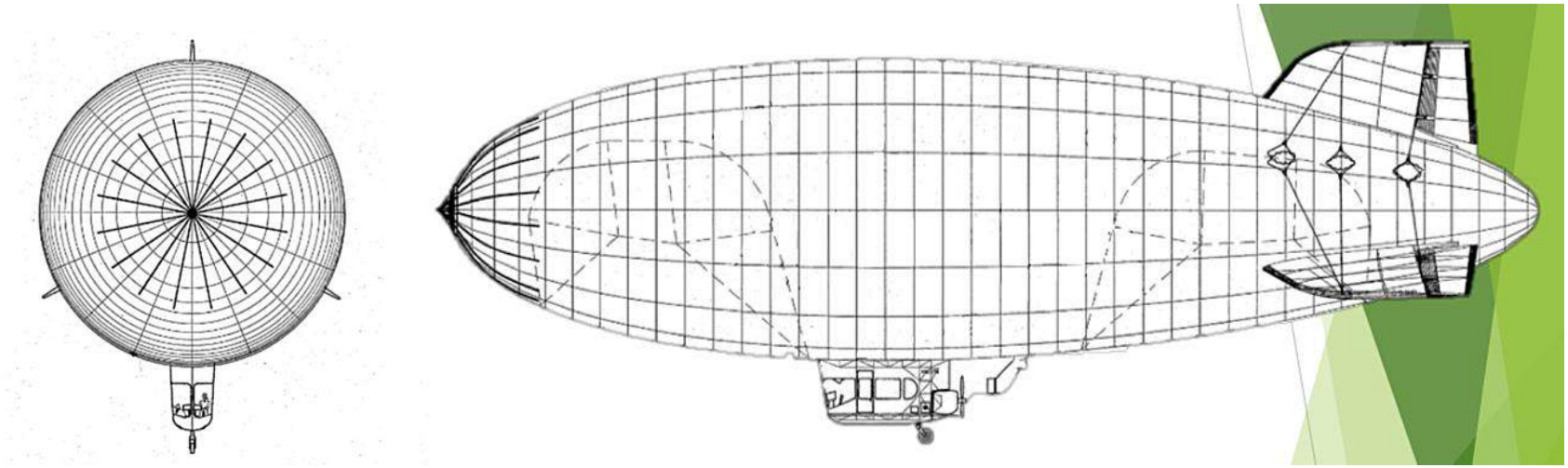
Airship do Brasil's non-rigid 3-X01 (Model 138S) prototype airship is the base model for certifying the production model ADB-3-3, which was certified via an amendment to the Model 138S Type Certificate 2018T01 approved by ANAC on 24 May 2018. The certification process included documentary evaluations, engineering data analysis, prototype manufacturing, design conformance checks, and performance of the necessary ground and flight tests to demonstrate compliance with the applicable requirements. ANAC re-issued the Type Certificate 2018T01 and the associated Data Sheet No. EB-2018T01-02 to include the ADB-3-3 airship on 22 December 2022. In parallel, ADB is working toward Production Certification by ANAC, with the goal of starting serial manufacture of the ADB-3-3 and sales to commercial airship operators.

The ADB-3-3 is designed for operation by a single pilot with five passengers or a useful payload of about 1 metric ton (1.1 tons, 2,200 lb). The airship's envelope is a low-permeability polyester fabric with a polyurethane coating. Aluminum fins with control surfaces are attached directly to the envelope and are braced with a series of guy wires secured to several reinforced points on the envelope. The gondola is a steel truss structure with a fiberglass skin supported under the envelope by internal catenary curtains and suspension cables that transfer and distribute the load of the gondola into the upper surface of the gas envelope.

ADB-3-3, registration PR-ZAD. Source: ADB



Left: US-LTA Model 138S general arrangement showing fore & aft ballonets & the internal catenary curtain & suspension cables supporting the gondola. Source: US-LTA, Hamley (1994)



ADB-3-3 general arrangement. Note the locations of the fore and aft ballonets. The internal catenary curtain & suspension cables supporting the gondola are not shown. Source: ADB

General characteristics of the ADB-3-3

Parameter	ADB-3-3
Type	Non-rigid
Length	48.8 m (160.1 ft)
Diameter, max	12.7 m (41.7 ft)
Height, overall	17 m (ft)
Envelope volume	3,908 m^3 (138,000 ft^3)
Weight, max	4,213 kg (9,288 lbs)
Weight, empty	2,673 kg (5,893 lbs)
Max in-flight weight variation	300 kg (661.4 lb)
Payload @ sea level	1 metric ton (1.1 tons / 2,200 lb)
Accommodations	1 x pilot & 5 passengers
Propulsion	1 x 300 shp (224 kW) Lycoming piston engine mounted at the aft end of the gondola driving a pusher propeller
Fuel	Aviation gasoline, consumption 60 liters/h
Speed	37 knots (70 kph)
Altitude / service ceiling	2,743 m (9,000 ft)

The ADB-3-3 can be configured for a variety of functions, including: surveillance (event security, military & border patrol), advertising, electric transmission line and oil & gas pipeline inspections, aerial geophysical surveys (scientific & commercial mineral exploration), agriculture (crop surveys & aerial spraying), pilot training and tourist flights.

In 2019, Brazil's Post Office (Correios) sponsored a feasibility study for the use of airships in Post Office operations. ADB reported that:

> "The study will be based on specific routes and with greater operational obstacles aiming at the reduction of the operational cost, increase of the quality of the services and security of the load, as well as the reduction of delivery terms."…."Initially the study will be based on the ADB-3-3 airship, the soon-to-be first certified airship in Latin America, due to its immediate availability and great maneuverability in small spaces. In a second moment, after the feasibility study with ADB-3-3 airship, the feasibility study will continue for the ADB-3-15/30 airship, which will carry larger volumes of cargo between the routes of interest of the Post Office."

Rendering of ADB-3-3 configured for crop spraying.

Rendering of ADB-3-3 configured for geophysical surveys.

ADB-3-3 stern quarter view. Source, all three graphics: ADB

5. The ADB-3-30 airship

The great majority of Brazil's roads are unpaved, making ground transportation very difficult even in areas of the country that have roads. Large remote areas of Brazil have no roads at all. ADB promoted the development of a cargo airship that would be capable serving remote areas and handling heavy cargo in an internal cargo bay or as an underslung load, making it useful to a wide range of industries and other applications.

In 2012, the National Development and Social Bank (BNDES) approves financing for ADB's concept for a large 30-ton cargo airship. Work began in 2013 on this airship, which was designated the ADB-3-30. Originally, this 120-meter (393-ft) long airship was designed to transport 30 metric tons (33 tons, 66,000 lb) at a cruising speed of 125 kph (78 mph) and an operating altitude between 400 and 1,000 meters (1,200 to 3,281 ft). During the design phase, airship grew in length to 150 meters (493 ft) with a cargo capacity of 54 metric tons (59.4 tons).

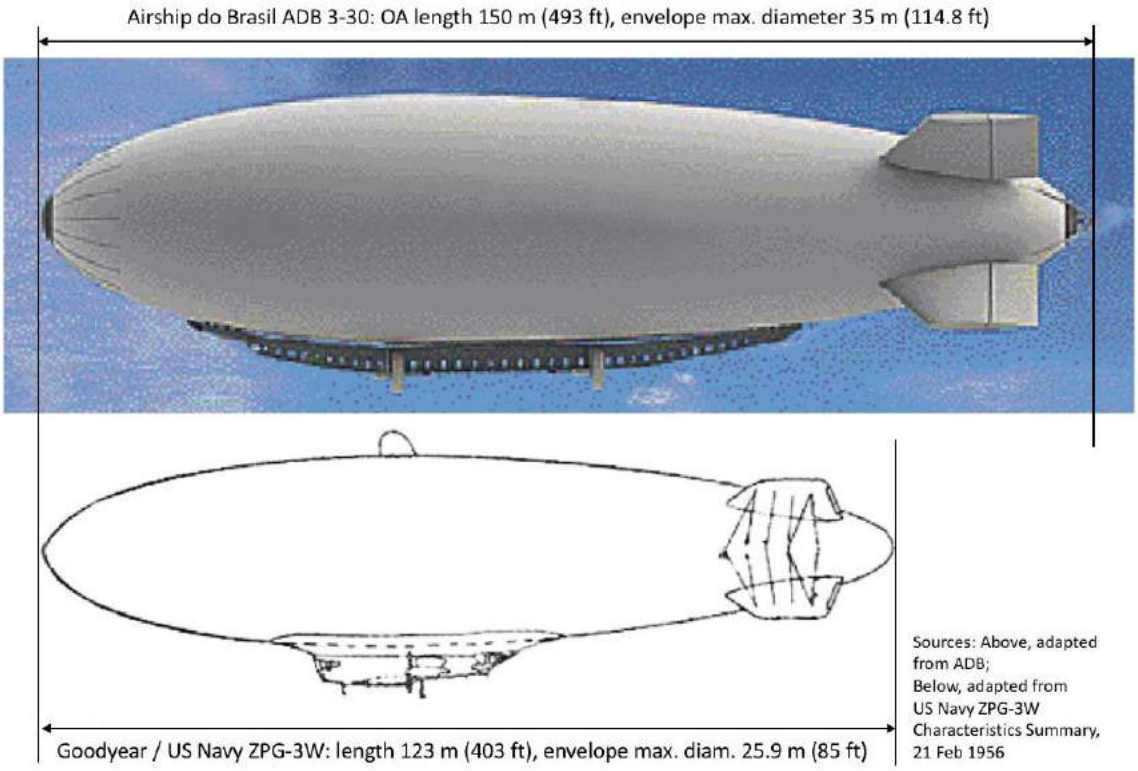
Rendering of an ADB-3-30 cargo airship carrying a cargo pallet as an external suspended load. Source: Airship do Brasil

It appears that this is a semi-rigid airship design. The above rendering of an ADB-3-30 shows a long gondola / keel under the envelope, with four thrust vectoring shrouded propellers and landing gear supported from that rigid structure. An electric motor-driven pusher propeller is mounted at the stern.

General characteristics of the ADB-3-30

Parameter	ADB-3-30
Type	Likely semi-rigid
Length	150 m (493 ft) *
Diameter, max	35 m (114.8 ft)
Height, overall	40 m (131.2 ft)
Fineness ratio	Length/Diameter = 4.28
Envelope volume	Est. 96,000 m^3 (3,390,000 ft^3)
Payload	54 metric ton (59.4 tons) *
Accommodations	4 x crew
Propulsion	• 4 x diesel engines, each driving a thrust vectoring shrouded propeller mounted to the gondola • 1 x electric motor driving a tail-mounted a pusher propeller, possibly shrouded, possibly thrust vectoring
Speed	125 kph (78 mph)
Altitude, operating	400 to 1,000 m (1,200 to 3,281 ft)
Altitude, max	3,000 m (9,842 ft)

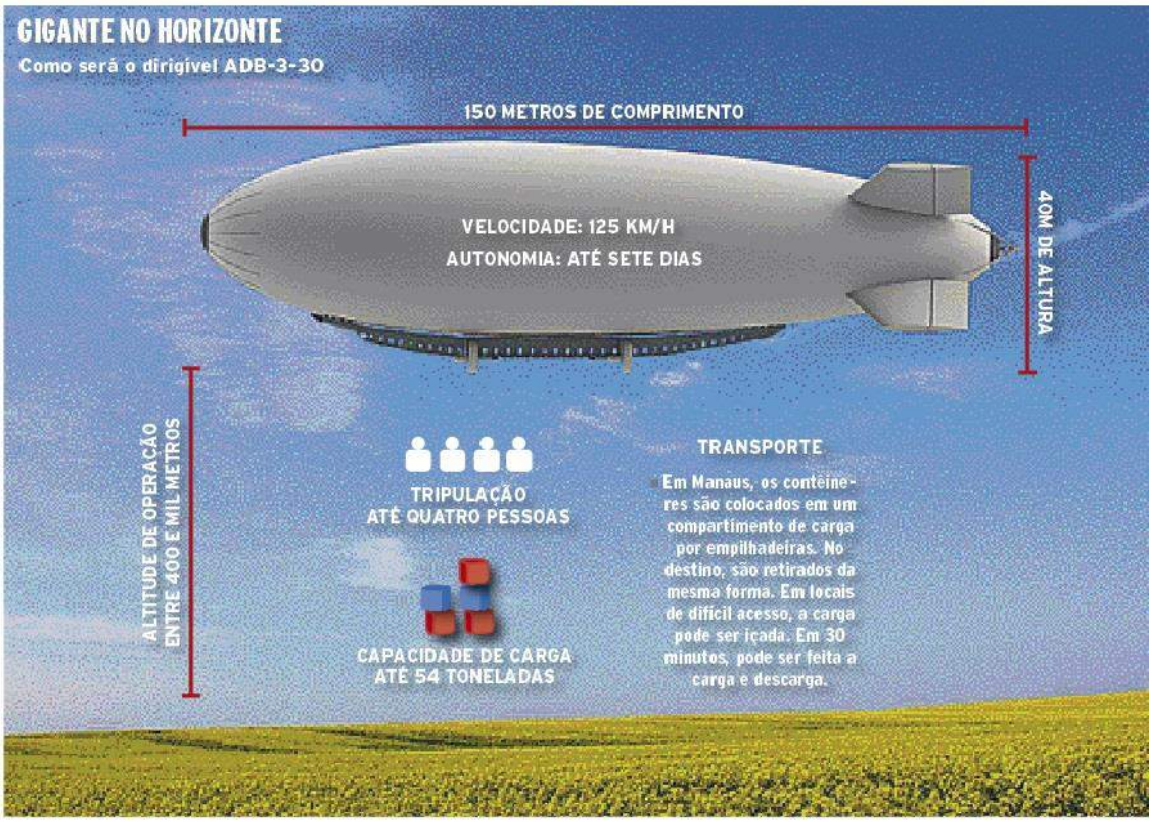
* Initial descriptions of the ADB-3-30 (circa 2013) cited a length of 120 m (393 ft) and a cargo capacity of 30 metric tons (33 tons).



Relative sizes of ADB-3-30 & Goodyear / US Navy ZPG-3W

A model of the ADB-3-30 cargo airship. It is shown carrying a scale model of an electrical transmission tower as an external suspended load (between the two model support pylons). Source: photo by Roberto Caiafa

A model of the ADB-3-30 with its four thrust vectoring propellers deflected down for vertical dynamic lift control. Source: Informativo Bertolini (April 2015)



ADB-3-30 cargo airship infographic. Source: Airship do Brasil

In mid-2014, first test flight of the ADB-3-30 freighter was expected to occur in July 2016, with sales to civil operators by the end of 2018. Bertolini Group itself was expected to be the launch customer, using the airship to move products from Manaus to the south and southeast regions of Brazil. ADB described the process: “In Manaus, containers are placed in a loading bay by forklifts. At the destination, they are withdrawn in the same way. In places with difficult access, the load can be lifted. In 30 minutes, it can be loaded and unloaded.”

By 2017, Paulo Caleffi, president of ADB, reported that at least five private and two state-owned companies were already negotiating the purchase or lease of ADB-3-30 airships. Potential applications included:

- State-owned company Eletronorte planned to use an airship to inspect high voltage lines in difficult-to-reach places such as mountains and forests.
- The Post Office intended to use the aircraft to deliver parcels.

ADB has discussed the role of the ADB-3-30 as a heavy-lift airship that can pick up and deliver cargo at remote sites that have little or no infrastructure to support the airship. However, ADB has not described the load exchange processes that will be used during cargo loading and unloading on the ground or when hovering above a fixed site. This likely will involve use of variable dynamic vertical thrust from the main propulsors coupled with the coordinated transfer of physical ballast between the airship and the ground as cargo items are exchanged.

Rendering of ADB-3-30. This graphic shows a shrouded tail propeller, possibly on a mount that allows thrust vectoring. Source: ADB

The originally announced schedules for first flight (2016) and commercial service entry (2018) were not achieved. By late 2020, the ADB-3-30 was no longer mentioned on the ADB website. It appears that its development has been superseded by a newer design concept, namely, the ADB-3-15/30.

Production of the ADB-3-30 would have required construction of a new and larger factory. Roberto Caiafa reported in 2017 that the existing laser CNC cutting machine at the ADB São Carlos factory can cut parts 50 meters (164 ft) long, still too short for the much larger parts envisaged for the ADB-3-30. ADB's manufacturing goal is to reduce the amount of seams, made by "hot welding," in the fabric of the envelope, so a larger facility would have been required for the ADB-3-30.

6. The ADB-3-15/30 cargo airship

In March 2018, Dr. Marcelo Felippes, CEO of Airships do Brasil, announced that ADB and Canadian airship firm Buoyant Aircraft Systems International (BASI) had signed a Memorandum of Understanding (MoU) under which the two companies would work together to produce Zeppelin-style rigid airships that eventually will be able to carry up to 100 metric tons (110 short tons) of cargo. The two businesses intend to work together to develop a cargo airship industry that will be able to serve the large remote regions of both countries that are without road access (about 70% of both Canada and Brazil). Airships do Brasil brings engineering expertise to their partnership with BASI as well as important airship manufacturing and operating infrastructure.

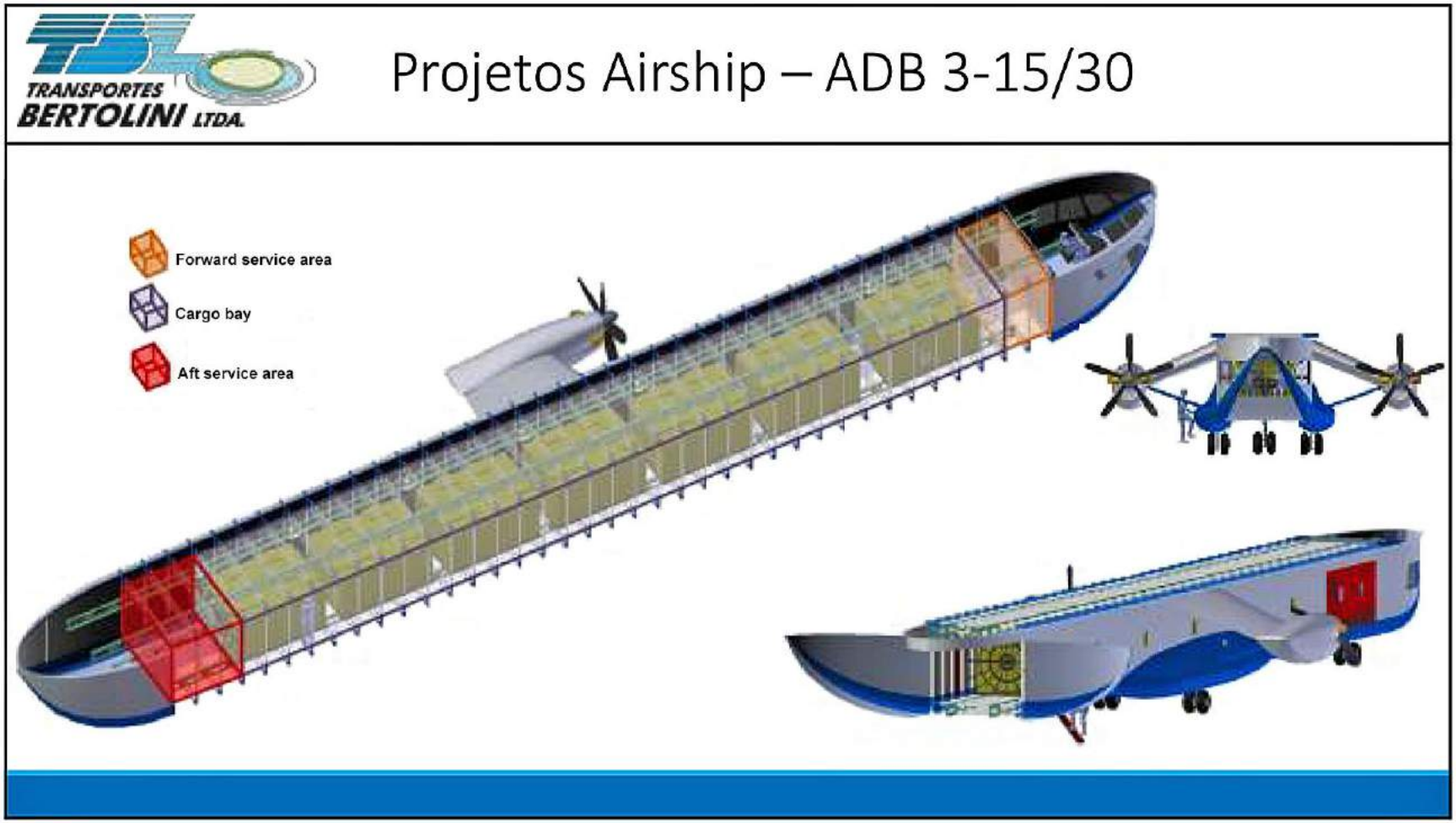
The first airship to be developed under the 2018 MoU is expected to be a 15 metric ton (16.5 short ton) cargo airship to be designated the ADB-3-15/30. A larger version capable of transporting a 30 metric ton (33 short ton) payload also may be developed. Typical cargo configurations include P1P cargo pallets carried internally, or a larger indivisible load suspended as a sling load under the gondola. BASI president, Dr. Barry Prentice, noted that an airship capable of carrying such payloads could cut the costs of moving perishable goods into remote communities in half.

Rendering of ADB-3-15/30. Source: ADB

Profile view

Stern view

ADB-3-15/30 general arrangement.
Source: Adapted from Transportes Bertolini (2019)



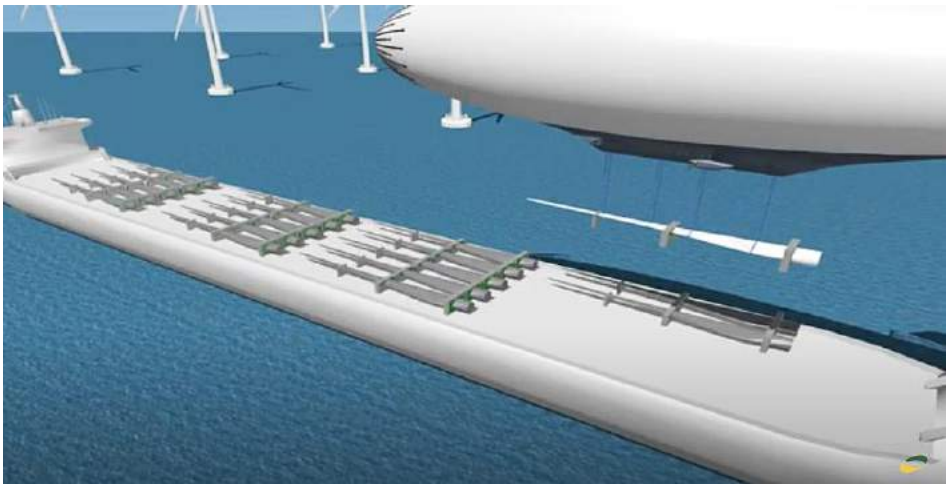
ADB-3-15/30 gondola general arrangement.
Source: Adapted from Transportes Bertolini (2019)

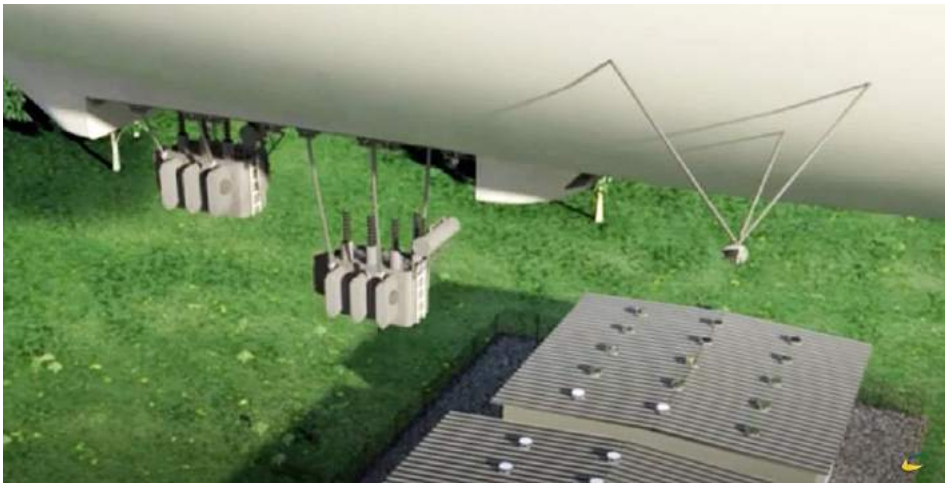
Bow quarter view. Crew station at right.

Engine nacelle & stub wing side view.

Engine nacelle & anhedral stub wing front view.

ADB-3-15/30 mockup, circa 2018.
Source: Screenshots from Airship do Brasil video





Renderings of an ADB-3-15/30 delivering a wind turbine blade to an offshore construction vessel (two, above) and transformers to an electrical substation (below). Source: Screenshots for Airship do Brasil video (2018)

General characteristics of the ADB-3-15/30, 30 metric ton model

Parameter	ADB-3-15/30, 30 metric ton model
Type	Likely semi-rigid
Length	120 m (393.7 ft)
Diameter, max	25.9 m (85 ft)
Height, overall	28.5 m (93.5 ft)
Fineness ratio	Length / diameter = 4.63
Envelope volume	Est. 42,000 m^3 (1,483,000 ft^3)
Payload	30 metric ton (33 tons, 66,000 lb)
Accommodations	Crew
Propulsion	• 2 x engines in nacelles cantilevered from the gondola on anhedral stub wings; each engine directly driving a large propeller
Fuel capacity	16,000 liters aviation fuel
Speed	90 kph (50 knots)
Altitude, ceiling	About 3,000 m (10,000 feet)

Like the ADB-3-30, the ADB-3-15/30 is designed to pick up and deliver cargo at remote sites that have little or no infrastructure to support the airship. However, ADB has not described the load exchange processes that will be used during cargo loading and unloading on the ground or when hovering above a fixed site. ADB has not described the thrust vectoring capabilities of the two main propulsion engines.

The ADB-3-15/30 airship initially will be powered by conventional, fossil-fueled engines, but is expected to operate with a lower carbon footprint than other competing modes of cargo transportation.

7. Advanced large airship concepts

In the future, ADB is expected to develop airship versions with advanced propulsion / power systems that operate with very low, or zero, carbon emissions. One possible long-term option may be a solar / hydrogen fuel cell hybrid power system for an all-electric airship.

Concept drawing, solar electric airship. Source: ADB

8. SAGA (Satellite Atmospheric High Altitude)

SAGA is ADB's high-altitude atmospheric pseudo-satellite program, which is intended to build Brazil's capabilities to develop High Altitude Platforms (HAPs) that can be adapted for a variety of applications, particularly for telecommunication and remote monitoring. At its operational ceiling in the stratosphere, SAGA will establish station-keeping in a low wind environment with little impact from adverse weather conditions in the troposphere.

SAGA concept drawing. Source: Airship do Brasil

A SAGA HAP offers the following advantages over orbital satellites: lower mission costs, larger payload capacity, recoverable and reusable payload, and higher data quality due to the much closer proximity to the user on the surface.

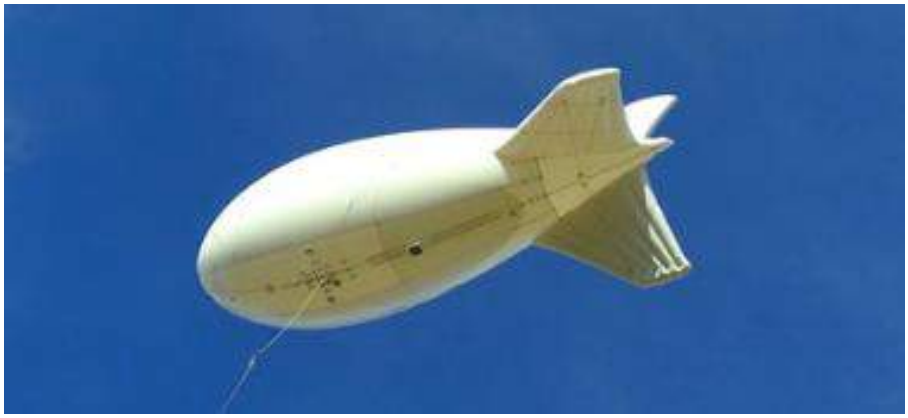
9. Aerostats

Non-rigid tethered aerostats were among ADB's earliest LTA products and they enabled the firm to gain experience in LTA vehicle manufacturing. Currently, ADB offers the A-150 and A-280 aerostats as standard products and they have the capability to develop custom aerostats as needed. These aerostats can be configured for a variety of missions, such as persistent surveillance, data collection, telecommunications relay and advertising.

Rendering of an ADB tethered aerostat at a large sporting venue. Source: ADB

A-150 aerostat

The A-150 aerostat is capable of carrying a 20 kg (44.1 lb) payload to an altitude of 300 m (984 ft) on missions lasting up to four days. Electric power, up to 2 kW, aerostat monitoring / control links, mission data links, and helium replenishment are supplied via the tether.



A-150 aerostat flying on its tether. Source: ADB

A-150 aerostat (left) & Controp EO/IR sensor turret (right). Source: ADB (2016)

In August 2016, ADB reported: “An airborne electro-optical/infrared (EO/IR) surveillance payload made by Controp Precision Technologies (Hod Hasharon, Israel) is being used for security at the 2016 Summer Olympics in Rio de Janeiro, Brazil……. Controp's SHAPO EO/IR payload is installed on the A-150 aerostat (a tethered blimp) that is deployed above the Olympics area and is supporting the Brazilian Air Force security mission.”

Images from the A-150’s SHAPO EO/IR system. Source: Screenshots from ADB video (2016)

General characteristics of ADB's A-150 aerostat

Parameter	ADB A-150 aerostat
Length	12.3 m (40.4 ft)
Diameter, max	5.3 m (17.4 ft)
Height, overall	6.3 m (20.5 ft)
Envelope volume	150 m^3 (5,297 ft^3)
Empty weight	60 kg (132.2 lb)
Payload	20 kg (44.1 lb)
Electrical power	2 kW
Wind speed, operational	33 knots
Wind speed, max acceptable	40 knots
Altitude, max	300 m (984 ft)
Mission duration, max	4 days

ADB-A-150 aerostat operating from open fields.
Sources: ADB (left), Military+Aerospace Electronics (2016, right)

A-280 aerostat

The A-280 aerostat is ADB's larger standard product and is capable of carrying a 30 kg (66.1 lb) to an altitude of 300 m (984 ft) on missions lasting up to four days.

ADB offers an Aerostat Launcher Vehicle (ALV) for use with its aerostats. The ALV has a ground winch, power supply, airship control and monitoring systems, mission data interfaces and a helium resupply interface.

ADB-A-280 aerostat
Source: ADB

General characteristics of ADB's A-280 aerostat

Parameter	ADB A-280 aerostat
Length	17.6 m (57.7 ft)
Diameter, max	5.8 m (19.0 ft)
Height, overall	7.0 m (22.8 ft)
Envelope volume	250 m^3 (8,829 ft^3)
Empty weight	300 kg (661.4 lb)
Payload	30 kg (66.1 lb)
Electrical power	2 kW
Wind speed, operational	40 knots
Wind speed, max acceptable	60 knots
Altitude, max	300 m (984 ft)
Mission duration, max	4 days

Aerostat Launcher Vehicle (ALV). Source: ADB

10. For more information

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- "Winnipeg airship business signs MOU with Brazilian company," CBC, 11 March 2018: https://www.cbc.ca/news/canada/manitoba/airship-manitoba-brazil-mou-1.4571955
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Type certificates

- FAA Type Certificate AS2NM, re-issued by the U.S. Federal Aviation Administration (FAA) to ADB for the Airship Model 138S, 12 June 2018: http://www.adb.ind.br/downloadInformativo?id=91
- FAA Type Certificate Data Sheet No. AS2NM, Rev. 4, re-issued by FAA to ADB for the Airship Model 138S, 12 June 2018: http://www.adb.ind.br/downloadInformativo?id=92
- ANAC Type Certificate 2018T01, issued by Brasil's Agência Nacional de Aviación Civil (ANAC) for ADB Model 138S, 24 May 2018: http://www.adb.ind.br/downloadInformativo?id=95
- Type Certificate Data Sheet No. EB-2018T01-01 (part of Type Certificate No. 2008T01), issued by ANAC for ADB Model 138S, 24 May 2018: http://www.adb.ind.br/downloadInformativo?id=102

- ANAC Type Certificate 2018T01, re-issued by ANAC for ADB Model 138S and updated for the ADB-3-3, updated 22 December 2022: http://www.airshipdobrasil.com.br/downloadInformativo?id=108
- Type Certificate Data Sheet No. EB-2018T01-02 (part of Type Certificate No. 2008T01), issued by ANAC for ADB Model 138S and updated for the ADB-3-3, updated 22 December 2022: http://www.airshipdobrasil.com.br/downloadInformativo?id=105

Videos

- "Airship Do Brasil nas Olimpíadas 2016," (2:38 min), Airship do Brasil, 2016: https://www.youtube.com/watch?v=cZaHr9aZ5RE
- "The airships are reborn in Brazil," (2:07 minutes), posted by New China TV, 24 February 2018: https://www.youtube.com/watch?v=MWq0ny-zxDk
- "Airship ADB-3-3 Certification Last Phase Campaign," (0.48 minutes), posted by Cyberlia, 14 January 2021: https://www.youtube.com/watch?v=4fmy_Bwx9mY
- "ADB-3-15/30 Heavy Lift Concept Part 1," (0.51 min), posted by Airship do Brasil, 4 April 2018: https://www.youtube.com/watch?v=ZI3KGicc4TI
- "Mock-up ADB-3-15/ 30," (1:31 min), posted by Airship do Brasil, 15 June 2018: https://www.youtube.com/watch?v=NTd714sbh90

Other *Modern Airships* articles

- *Modern Airships - Part 1*: https://lynceans.org/all-posts/modern-airships-part-1/
    - Goodyear N-class blimps – ZPG-3W
    - US-LTA Corporation - Model 138S blimp
- *Modern Airships - Part 2*: https://lynceans.org/all-posts/modern-airships-part-2/
    - Aerovehicles – AV-10 blimp
    - Buoyant Aircraft Systems International (BASI)
- *Modern Airships - Part 3*: https://lynceans.org/all-posts/modern-airships-part-3/