

DKBA (ДКБА) – conventional airships

Peter Lobner, 11 February 2022

1. Introduction

Public corporation Dolgoprudnenskoe Konstruktorskoe Bureau of Automation (DKBA, or ДКБА in Russian) also is known as JSC Dolgoprudnenskoe Design Bureau of Automatics (DDBA), and the acronyms DKBA and DDBA seem to be used almost interchangeably.



DKBA was established as OKB-424 on 26 November 1956, under the leadership M.I. Gudkov and Chief

Designer P.P. Dementyev, in the city of Dolgoprudniy, just north of Moscow. It is the successor to the pre-WW-II Soviet state firm Dirigiblestroy Combine of the USSR, which operated from 1932 until it was closed in 1940. When DKBA was formed sixteen years later as OKB-424, it became the only state-owned company that was engaged in the design and manufacture of all types of lighter-than-air vehicles, including airships and free/moored balloons.

Since DKBA was formed, they developed designs for a variety of airships, including several conventional airships and unconventional lenticular airships. Sergei Bendin, writing for the Russian Aeronautical Society in 2002, reported that the Soviet Air Force placed an order with DKBA in the late 1970s, for a lenticular airship. As part of this project, a 15-meter (49.2-ft) diameter lens-shaped prototype airship was built and tested before the project was terminated. In the early 1980s, DKBA supported the Soviet Navy's interests in airships for patrol, anti-mine warfare and other applications. Due to funding issues that began during the perestroika reforms of the 1980s, the airship projects for the Soviet Navy were terminated.

After the collapse of the Soviet Union in 1991, DKBA became a Russian Federal State Unitary Enterprise (FSUE). Their website is here: <https://www.dkba.ru/who-we-are>

In 2002, Sergei Bendin reported on the then-current status of DKBA airship development and noted that designs for airships with carrying capacities of 20, 30, 55, 70 and 200 metric tons were being developed.

“A significant part of the work has been carried out on the project of the DP-70T lenticular airship, which is intended for the transportation of goods with year-round operation in all climatic zones. On the constructive basis of this airship, variants of an airship with carrying capacity of 200 to 400 (metric) tons have been worked out.

The development of a multi-purpose airship of semi-rigid structure DP-4 with a carrying capacity of 4-5 (metric) tons is also underway. For greater competitiveness, FSUE DKBA is developing airship projects using standard aviation components and assemblies, including chassis, engines, avionics, which ensures high quality products with a significant reduction in production costs.”

This article addresses DKBA’s work on the 2DP (DP-800), DP-160, DP-200, DP-6000 and DP-29 conventional airships. Their work on lenticular airships is covered in a separate article.

2. 2DP (DP-800) multi-role blimp (circa 1988 - 2004)

In 1988, the USSR State Commission of the Council of Ministers assigned DKBA the task of developing an experimental non-rigid airship, based on design information obtained on the successful Skyship 500 developed by the UK firm Airship Industries and first flown in 1981. This project was intended to demonstrate in a Soviet airship several modern features that had flown successfully on the Skyship 500, including:

- Modern materials (i.e., lightweight fabrics for the gas envelope, composite structures for the gondola, and composite catenary support system)
- Modern onboard systems (i.e., high power-to-weight ratio engines, fly-by-wire controls)
- Vectored thrust

- Capable of vertical takeoff and landing (VTOL) and hovering in some loading conditions

This project was known by two names, DP-800 and the more common designation 2DP (2ДП in Russian). It was intended to be a multi-mission airship that was suitable for applications such as tourist flights, patrol and surveillance, scientific research, light cargo hauling and commercial advertising.

The original goal was to build a static test article and two flying prototypes, and test them by the end of 1994. DKBA selected the Myasishchev Design Bureau as the lead enterprise for the design, manufacture and testing of the 2DP airship, with this business arrangement being finalized in September 1989.

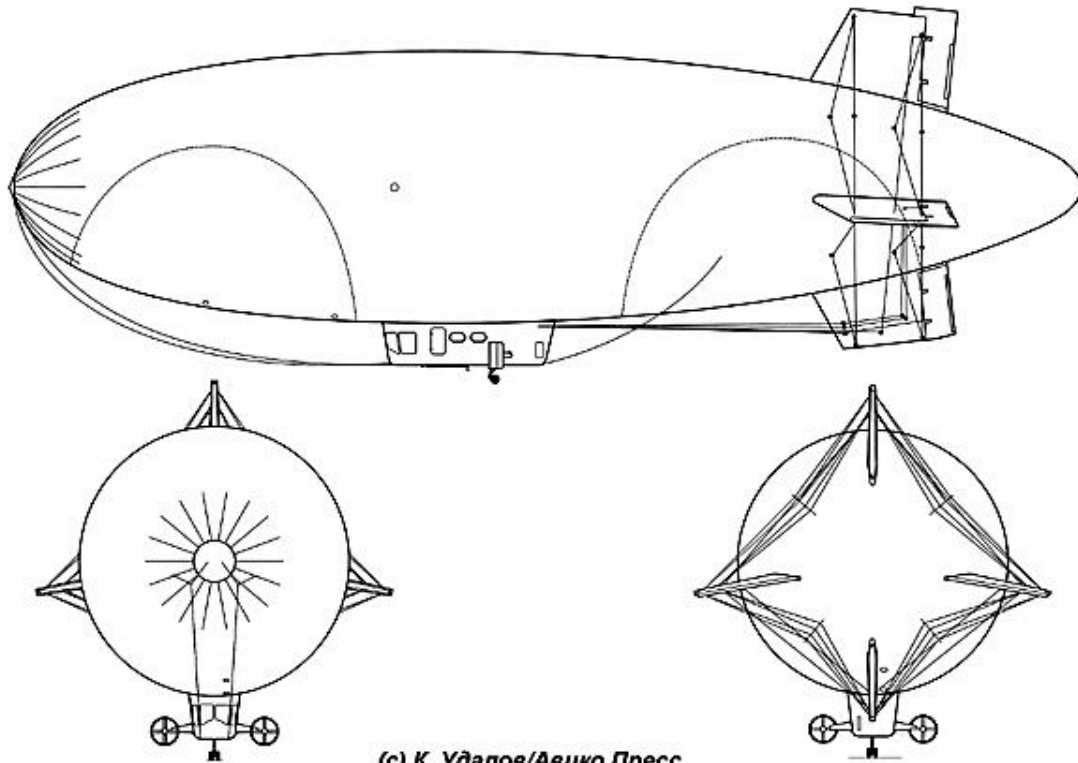
The project was complicated by the unavailability in the USSR of the Porsche engines used on the Skyship 500. In their place, larger, heavier Czech Walter M-601 turboshaft engines were to be used. This required a significant redesign of the gondola, transmission, drive shafts, and outriggers that connected the ducted fan propulsors to the engines inside the gondola.

The 2DP was designed to take off and land at sites with a diameter of at least 700 m (2,297 ft). At a low takeoff weight, the DP-800 could take off and land vertically and hover. At higher takeoff weights, the airship required short takeoff and landing runs on its single landing gear mounted under the gondola.

Between flights, the airship could be parked outdoors at a fixed or mobile mooring mast in winds up to 40 m/sec (144 kph / 89.5 mph) while feathering (weather cocking) into the wind. Berthing and mooring operations could be performed at wind speed of 10 m/sec (36 kph / 22.4 mph) with a ground crew of 3 to 5 people. The mooring mast supplies electric power to the airship while it is parked. Routine maintenance can be performed while moored outdoors. Repair work would be conducted in a hangar.

Comparison of the general characteristics of the DKBA 2DP (DP-800) and Airship Industries Skyship 500

Parameter	2DP (DP-800)	Skyship 500
Airship type	Non-rigid	Non-rigid
Length	62 m (203.4 ft)	52 m (170.7 ft)
Diameter, max	15.75 m (51.7 ft)	14 m (45.9 ft)
Height, overall	22 m (72.2 ft)	18.7 m (61.2 ft)
Envelope volume	8,040 m ³ (283,930 ft ³)	5,153 m ³ (182,000 ft ³)
Envelope material	Domestic two-layer diagonally dubbed rubberized fabric on a with an aluminized coating	Polyester load carrier spray coated externally with titanium oxide impregnated polyurethane & sealed internally with polyurethane bonded Mylar gas retention film
Ballonet volume	26% gross volume: 2,092 m ³ (73,822 ft ³)	26% gross volume: 1,334 m ³ (47,110 ft ³)
Max gross lift	~8,000 kg (17,637 lb)	4,500 kg (9,990 lb)
Maximum takeoff weight	8,400 kg (18,519 lb)	4,430 kg (9,766 lb)
Empty weight	5,150 kg (11,354 lb)	3,185 kg (7,022 lb)
Payload	3,000 kg (6,616 lb)	2,000 kg (4,409 lb)
Propulsion	2 x Czech Walter M-601 turboprop engines rated @ 490 kW (666 shp) each, driving pylon-mounted, shrouded, 4-bladed, 1.5 m (4.9 ft) in diameter propellers, vectorable 120° up to 120° down	2 x normally aspirated 6-cylinder Porsche 930/01/A1/3 engines rated @ 152 kW (204 hp) each, installed in the gondola, driving pylon-mounted, shrouded, 5-bladed, Hoffmann reversible pitch propellers, 1.4 m (4.5 ft) in diameter, vectorable 90° up to 120° down
Gondola material	All metal semi-monocoque	Kevlar-reinforced plastic composite monocoque
Catenary cable material	Steel	Kevlar
Gondola dimensions	10.05 L x 2.95 W m (33.0 L x 9.7 W ft)	9.2 L x 2.4 W m (30.3 L x 7.9 W ft)
Accommodations	2 crew + 12 passengers	2 crew + 8 passengers
Speed, max	110 kph (68 mph)	93 kph (58 mph)
Speed, cruise		56 kph (35 mph)
Range	1,340 km (833 miles)	870 km (540 m) @ 74 kph (46 mph)
Ceiling, max	2,700 m (8,858 ft)	2,980 m (9,770 ft)
Endurance	44.7 hours	12 hours



(c) К. Удалов/Авиго Пресс

*General configuration of the 2DP / DP-800 non-rigid airship.
Source: K. G. Udalov / Avico Press via Secret Projects*

Development of the 2DP was delayed by weak economic conditions in the USSR in the late 1980s and after the Russian Federation was formed in December 1991. The project advanced to the point of engaging subcontractors to supply engines, structures and airship systems before the project was terminated in the early 1990s.

Russian author Y.S. Boyko reported in 2001, “The DP-800 (2DP) airship project was the closest to implementation of all the projects of Soviet airships of the 70s and 80s..... the production of the airship shell was worked out, a model of the nacelle (gondola) was built, (and) stands for testing individual airship units were installed.”

DKBA continued developing the basic 2DP design in the form of a larger non-rigid airship known as the DS-3, for which a preliminary design was completed in 2007. The DS-3 was not built.

By 2002, the development of a multi-purpose, semi-rigid airship known as DP-4, with a carrying capacity of 4 to 5 metric tons, was underway but, it too, was not built.

The Myasishchev Design Bureau also continued their own development of several 2DP variants into the early 2000s.

3. DP-160 Sadko and DP-200 Rus

The DP-160 and DP-200 were two similar designs for small, non-rigid, multi-role airships intended for applications such as tourist flights, patrolling, scientific research, and commercial advertising. The larger DP-200 also could be used for light cargo delivery.

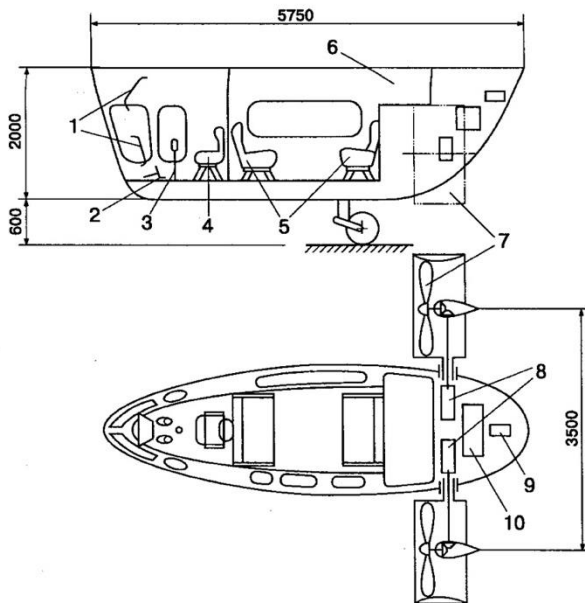
The small gondola was supported from the gas envelope by a system of internal catenary curtains and cables that distributed the load into the upper surface of the envelope. The landing gear consisted of a single strut and wheel under the gondola.

Both airships were propelled by two engines housed inside the gondola and driving shrouded propellers that were capable of vectoring from horizontal (0°) to vertical (90°), in a configuration similar to the 2DP (and the Skyship 500).

The airships had cable-operated, cruciform tail fins with conventional rudder and elevator aerodynamic control surfaces. The fins were supported by a light metal frame that was attached over the tail of the gas envelope.

General characteristics of the DKBA DP-160 and DP-200

Parameter	DP-160	DP-200
Length	36.7 m (120.4 ft)	39.5 m (129.6 ft)
Diameter, max	9.2 m (30.2 ft)	9.9 m (32.5 ft)
Width, max	12.1 m (39.7 ft)	13.2 m (43.3 ft)
Height, overall	13.4 m (44.0 ft)	14.3 m (46.9 ft)
Envelope volume	1,600 m ³ (56,503 ft ³)	2,000 m ³ (70,629 ft ³)
Ballonet volume	Fore and aft ballonets, < 25% total volume	Fore and aft ballonets, 25% total volume
Takeoff weight	1,300 kg (2,866 lb)	
Payload, max	300 kg (661 lb)	520 kg (1,146 lb)
Crew	1	1
Passengers	2	4
Propulsion	2 x RMZ-640 snowmobile engines or Rotax-503 rated @ 26.5 kW (34.7 shp) each, driving shrouded propellers	2 x IZhD-02 engines rated @ 47 kW (63.9 shp) each, driving shrouded propellers
Speed, cruise	70 kph (43.5 mph)	80 kph (49.7 mph)
Altitude, operating	1,000 m (3,281 ft), limited by ballonet volume	2,000 m (6,562 ft), with a reduced payload of 350 kg (772 lb)
Range		350 km (217 miles)
Endurance	4 hours	4 hours



Legend (dimensions in mm)
 1 - dashboard; 2 - foot pedals;
 3 - control stick; 4 - pilot's seat;
 5 - passenger bench seats;
 6 - luggage space; 7 - shrouded, thrust vectoring propellers;
 8 - engines; 9 - battery;
 10 - fuel tank

*Layout of the DP-200 gondola.
 Source, graphic & table data:
 Boyko (2001)*

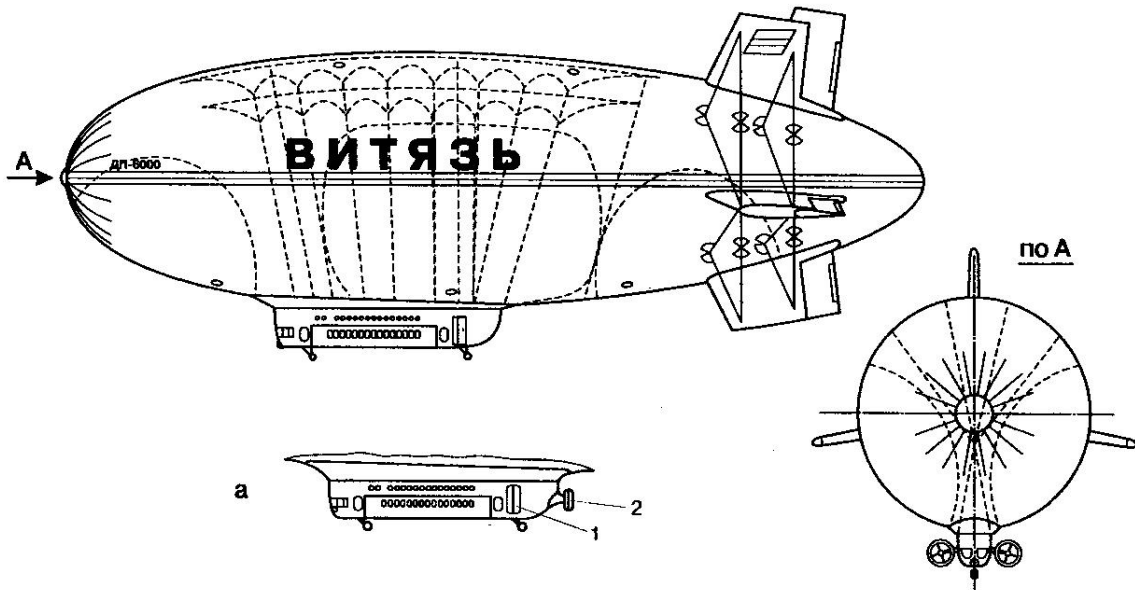
4. DP-6000 Knight (Vityaz)

The DP-6000 was a design concept for a large, multi-purpose, non-rigid airship intended primarily for passenger and cargo service, but adaptable for a variety of other roles, including firefighting and emergency medical service.

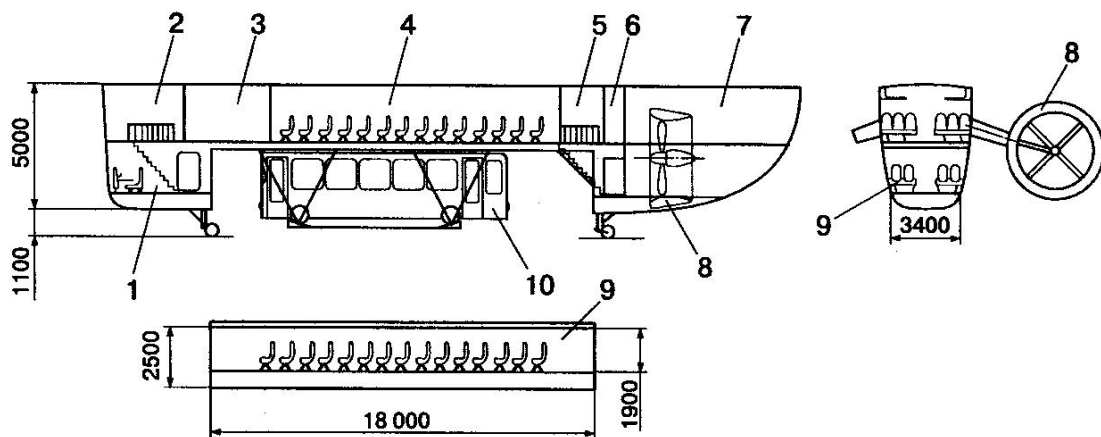
An uncommon feature of the DP-6000 was its two level gondola with passenger seating on the upper level and a reconfigurable lower level that could accept a passenger module or cargo attached under the main hull.

General characteristics of the DKBA DP-6000 Knight (Vityaz)

Parameter	DP-6000
Airship type	Non-rigid
Length	125.5 m (411.7 ft)
Envelope diameter	31.5 m (103.3 ft)
Width, overall	42.3 m (138.8 ft)
Height, overall	44 m (144.4 ft)
Volume	64,000 m ³ (2,260,000 ft ³) in three compartments, each with an air ballonet
Propulsion system	Two different gondola-mounted propulsion system configurations with engines housed in the gondola aft compartment. <ul style="list-style-type: none"> • Four diesel engines rated @ 590 kW (791 shp) each, driving two thrust vectoring shrouded propellers • Two diesel engines rated @ 1,178 kW (1,580 shp) each driving two thrust vectoring shrouded propellers, plus one TV7-177 turboprop engine rated @ 1,840 kW (2,467 shp) driving a shrouded cruise propeller at the aft end of the gondola
Payload, max	<ul style="list-style-type: none"> • 20,000 kg (44,092 lb) at operating altitude • 12,000 kg (26,455 lb) at max. altitude
Accommodations	<ul style="list-style-type: none"> • 8 crew + 84 passengers in the main cabin • 60 passengers in a removable passenger module.
Speed, max	130 kph (80.8 mph)
Speed, cruise	100 kph (62.1 mph)
Altitude, operating	1,000 m (3,281 ft)
Altitude, max	3,000 m (9,843 ft)
Range	3,500 km (2,175 miles) with 20,000 kg (44,092 lb) payload at cruise speed at operating altitude



General view of the DP-6000 with two thrust vectoring propellers (above) and three propellers (below, two thrust-vectoring and one cruise propeller). Source: Boyko (2001)



Legend

- 1 - crew compartment; 2 - wardrobe; 3 - office space; 4 - passenger compartment for 84 seats; 5 - buffet; 6 - toilet; 7 - engine compartment; 8 - thrust-vectoring shrouded propeller; 9 - removable passenger cabin for 60 seats; 10 - transportable cargo (bus)

DP-6000 two level gondola and modular, removable lower section. Source: Boyko (2001)

Airship loads are concentrated in the two-level gondola, which carries the engines, fuel, ballast, crew, passengers and/or cargo. The gondola is supported via internal catenary curtains and cables that distribute the load broadly into the upper surface of the pressure-stabilized, fabric gas envelope.

The thrust-vectoring propulsors improve takeoff and landing performance relative to a conventional blimp by reducing short takeoff and landing (STOL) runs and allowing the airship to operate safely over a wider range of “light” and “heavy” loadings. When carrying out loading and unloading operations, the vertical thrust of the propellers can be used to hold a “light” airship down and reduce the need for immediate ballast compensation.

Cruciform rudders and elevators operated by a fly-by-wire control system provide aerodynamic control in forward flight.

5. The DP-29 unmanned airship (2014 - 2021)

The DP-29 is a small, unmanned, semi-rigid airship with a classical ellipsoid hull shape. It is capable of vertical takeoff and landing (VTOL), hovering, and flying autonomously or under remote control on low-altitude flights of up to one hour duration with a 5 kg (11 lb) payload.

DKBA Deputy Director General, Alexander Kolesov, reported that the airship can be configured to support a wide range of users, such as the Emergencies Ministry, the Ministry of Internal Affairs, the Armed Forces, and natural resource management agencies. Factory tests of the airship were successfully conducted in 2014 at the testing grounds in Krasnoarmeysk and in the Vladimir region east of Moscow.

The DP-29 was on display at the Russian airshow MAKS 2015, where it was promoted primarily for military tasks: high-altitude reconnaissance, aerial photography and mapping, delivery and automatic drop of cargo.



DP-29 on display at MAKS-2015. Source:
<https://sdelanounas.ru/blogs/?search=дурижаблү>

In 2020 the firm Rostec offered modular semi-rigid airships, based on DKBA's DP-29 that could be enlarged with one or more additional center hull modules to carry heavier payloads. Rostec claimed that, "Adding one module allows you to increase the carrying capacity by 4 (metric) tons." Rostec further noted that "...these versatile airships can be used to deliver any cargo, including heavy and oversized, to any areas inaccessible to ground vehicles. It does not require the creation of complex ground-based infrastructure." A demo model of the modular airship was expected to be developed in 2021.

General characteristics of the DKBA DP-29

Parameter	DP-27
Airship type	Semi-rigid
Length	12.8 m (50 ft)
Envelope diameter, max	4.3 m (14.1 ft)
Envelope volume	70 m ³ (2.472 ft ³)
Lifting gas	Helium
Propulsion	Two electric motor driven, thrust vectoring propellers
Payload	5 kg (11 lb), for a 1 hour flight
Speed, max	54 kph (33.5 mph)
Vertical speed	3 m/sec (9.8 ft/sec)
Operating altitude	Up to 300 m (984 ft)
Range	10 km (6.2 miles)
Endurance	Up to 1 hour
Operating ambient temperature	-20°C to +30°C (-4°F to +86°F)



DP-29. Source: rustechnologies via The LTA Society



DP-29 in free flight. Sources: DKBA (above), TopWar (below).





DP-29 in free flight. Source: DKBA



Close-up of DP-29 propulsion and payload modules, attached to the envelope via twin rails supported from reinforced areas of the envelope. Source: DKBA

6. For more information

2DP, DP-160, DP-200 & DP-6000

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- K. G. Udalov, V. I. Pogodin, "Myasishchev Design Bureau – Aircraft MDB, Book 2," Avico Press, circa 2011
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- Konstantin Udalov & Josef Gatyal, "Aircraft of V.M. Myasishcheva – Aircraft and Vertostats, Record Aircraft," Avico Press, 2019

DP-29

- Tanyana Rusakova, "Defense Ministry enlists unmanned dirigibles to patrol Russian skies," sUAS News, 16 October 2014: <https://www.suasnews.com/2014/10/defense-ministry-enlists-unmanned-dirigibles-to-patrol-russian-skies/>
- "The first Russian unmanned airship presented at MAKS-2015," TASS, 25 August 2015 (in Russian): <https://tjournal.ru/flood/12752-pervyy-rossiyskiy-bespilotnyy-dirizhbl-predstavili-na-maks-2015>
- "Rostec announced the development of modular 'airship transformers'," TopWar, 19 April 2020: <https://en.topwar.ru/170377-rosteh-zajavil-o-razrabotke-modulnyh-dirizhablej-transformerov.html>

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- *Modern Airships - Part 1:* <https://lynceans.org/all-posts/modern-airships-part-1/>
- *Modern Airships - Part 2:* <https://lynceans.org/all-posts/modern-airships-part-2/>

- DKBA (ДКБА) – lenticular airships
- Airship Industries (Skyship 500)
- Myasishchev Design Bureau - airships (2DP & derivative airships)
- *Modern Airships - Part 3*: <https://lynceans.org/all-posts/modern-airships-part-3/>