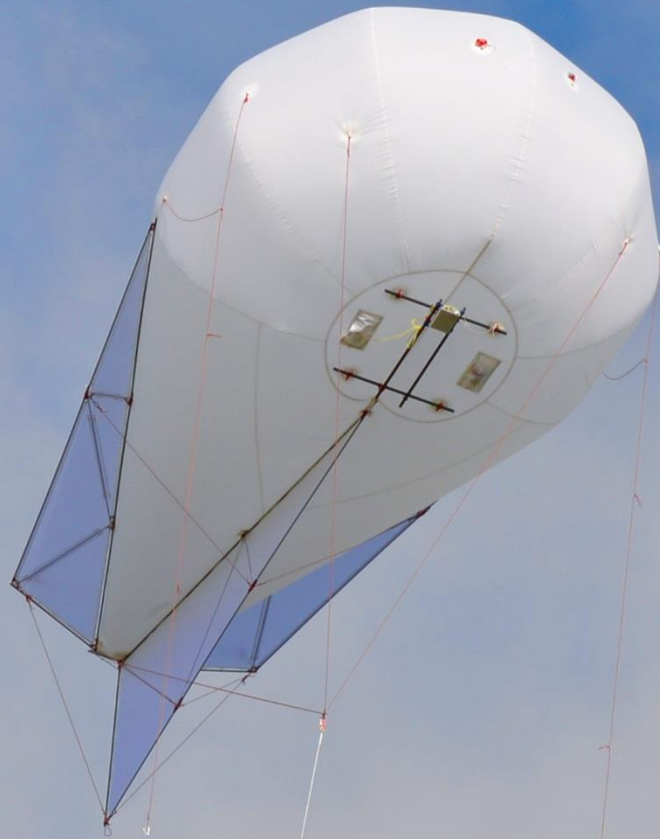




Moscow Aviation Institute
(National Research University)

*Multi-functional
aerostatic
complex*



*based on
hybrid captive balloons*

Colibris



The Design Bureau of Moscow Aviation Institute (OSKBES MAI) and PRO-AVIA Company offer the Colibris – multi-functional aerostatic complex based on hybrid captive balloons.

Classic small volume captive balloons, during the wind of 5 m/s and more, since the height of 20–30 meters, instead of lifting, is placed on the ground (because of the relatively high value of aerodynamic drag of the tether). Thus, the tethered balloon less than 30 m³ (this capacity can be compared to half of the capacity of railway tank) may be constantly in the air only in calm weather.

Hybrid captive balloons do not have this disadvantage because they combine the properties of a captive balloon and a kite. During the wind, the aerodynamic lift acts on the balloon in addition to the aerostatic force.

Moreover, when the wind, maximum lifting height of hybrid captive balloons more, than the calm, and their behavior in the air in a wind incomparably more stable than the behavior of classic tethered balloons.

Use of the **Colibris** hybrid captive balloons is suitable for video surveillance; reception, transmission and retransmission of radio signals; carrying out of research work; the efficient lifting of flags, pennants, banners.

The **Colibris** hybrid captive balloon can be constantly in the air. It requires only a short-term down-trip for replenishment of helium.

Description



The K-25M Colibris aerostatic complex

The **Colibris** is a family of small-sized hybrid captive balloons of different volume and are designed to various payload lifting.

Balloons can be delivered as separate items, and as aerostatic complexes.

An equipment for panoramic video surveillance, aerial photography, meteorological observations, air pollution control, scientific research etc. can be installed on the platform.



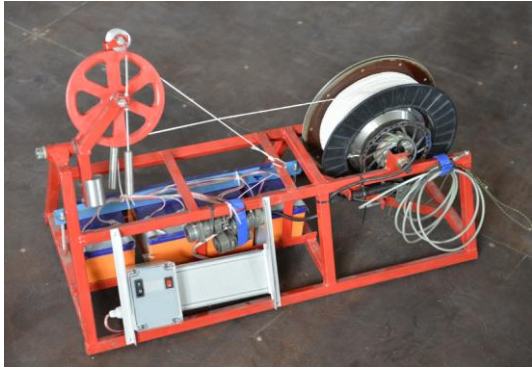
The K-25M Colibris hybrid captive balloon (25 m³)

The **Colibris** hybrid captive balloons have a slightly flattened envelope with helium and a skeleton empennage.



The K-25M Colibris before lifting

Payload can be attached directly to the balloon envelope, or suspended under it at rigging or tether. During the flight, an angle of attack is 15–25° and an angle of drift is about 20–35°.



Compact winch powered by a battery

Plaited Kevlar cords used as a tether of the **Colibris** balloons.

Digital data can be transmitted over the air, including the use of WiFi networks or using fiber-optical communication line, attached to the tether.

Power is supplied via the onboard battery or via the cable-rope.



A flag lifting at the M.A.K.S. 2015 airshow

An operating altitude when flags lifting is about **70–100 m**. An operating altitude when panoramic video surveillance and aerial photography is about **70–500 m**. Helium is used as a lifting gas, but in compliance with safety requirements hydrogen is possible to use.

Specifications of some **Colibris** balloons are shown in the table below.

Balloons with another volume, payload or operating altitude can be designed and manufactured in accordance with the order.



An example of use of the Colibris hybrid captive balloons is an aerostatic complex based on the K-15 balloon (15 m³), intended for adjustment, parameters measurement and maintenance of radar stations

A typical aerostatic complex consists of a balloon, a starting platform and a set of equipment and supplies.

The balloon includes an envelope with a tension system and valves, an empennage and rigging.

Starting platform consists of a winch, a tether (Kevlar cord) with a cable end and mooring anchors.



The Colibris aerostatic complex at Alabino-2014 exhibition

A set of equipment and supplies includes:

- a red flashing light;
- gas and vacuum system;
- ground connection;
- an awning for baloon assembling and maintenance;
- a baloon net;
- sandbags;
- a set of ropes and halyard;
- corkscrews and stakes;
- spareparts and tools;
- package.

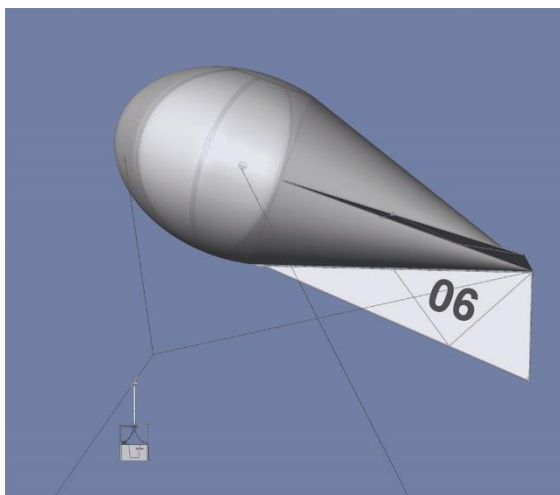
Specifications

Model	K-05M	K-07M	K-15M-T	K-15M-A	K-25M-T	K-25 M-A
Envelope specific density, g/m ²	110	110	170	110	170	110
Gas volume, m ³	4.85	6.75	14.00	14.00	23.60	23.60
Width, m	2.05	2.30	3.10	3.10	3.70	3.70
Length, m	3.70	4.20	5.70	5.70	6.80	6.80
Height of the envelope, m	1.60	1.80	2.30	2.30	2.60	2.60
Mass, kg	4.00	4.75	10.10	8.40	13.00	10.60
Tether (Kevlar) diameter, mm	2.5	2.5	3.5	3.5	3.5	3.5
Operating altitude, m	200	300	700	700	800	800
Payload, kg	0.90	2.15	3.50	5.20	10.00	12.50
Max. wind speed during baloon lifting or down-trip, m/s	12	12	12	12	12	12
Max. wind speed when the baloon is at the operating altitude, m/s	20	20	30	30	30	30
Qty. of standard gas tanks (Helium, 40 l, 150 bar), for one inflation, pcs.	1	2	3	3	5	5
Stowing dimensions, m	2,5 × 1,3 × 0,35	2,5 × 1,3 × 0,35	3,0 × 1,52 × 0,45	3,0 × 1,52 × 0,45	3,0 × 1,52 × 0,45	3,0 × 1,52 × 0,45

K-1500, a hybrid captive balloon for parachute jumpers



A Soviet book “Aerostat parachute jumps” (D.O.S.A.A.F., 1956)



The K-1500 Colibris (1500 m³)

The idea of using aerostats for parachuting is not new. The jumps technique described in detail in a Soviet book “Aerostat parachute jumps” (D.O.S.A.A.F., 1956).

The authors claim that the acceptance rate of a balloon is higher than that of an aircraft. Methods of teaching is simple, and the cost – considerably lower.

Thus, according to the Moscow City Committee of D.O.S.A.A.F. (Soviet Volunteer Society for Cooperation with the Army, Aviation, and Fleet), in winter 1955 more than five thousand jumps were made with a captive balloon during two and a half months. It took only less than half a ton of gasoline.

K-1500 refers to a class of hybrid captive balloons. Usual aerostats are in the air flow at an angle approx. 5°. As the wind increases, they make wavy and diving movements. The aerodynamic lift of the hybrid captive balloon (angle of attack is about 20°) stabilizes it. At the same time, aerostatic lift does not allow to fall at calming the wind.



The use of the Colibris hybrid captive balloons for parachute jumpers training



A parachute jump from the gondola of the Colibris hybrid captive balloon

Presence of aerodynamic lift of the hybrid captive balloon gives another advantage over the classical balloon: a significant tension of the tether. For a six-seated aerostat, a tension 600–2000 kgf (the value depends on the weight of the payload and the wind strength) allows to raise skydivers to an operating altitude in two ways:

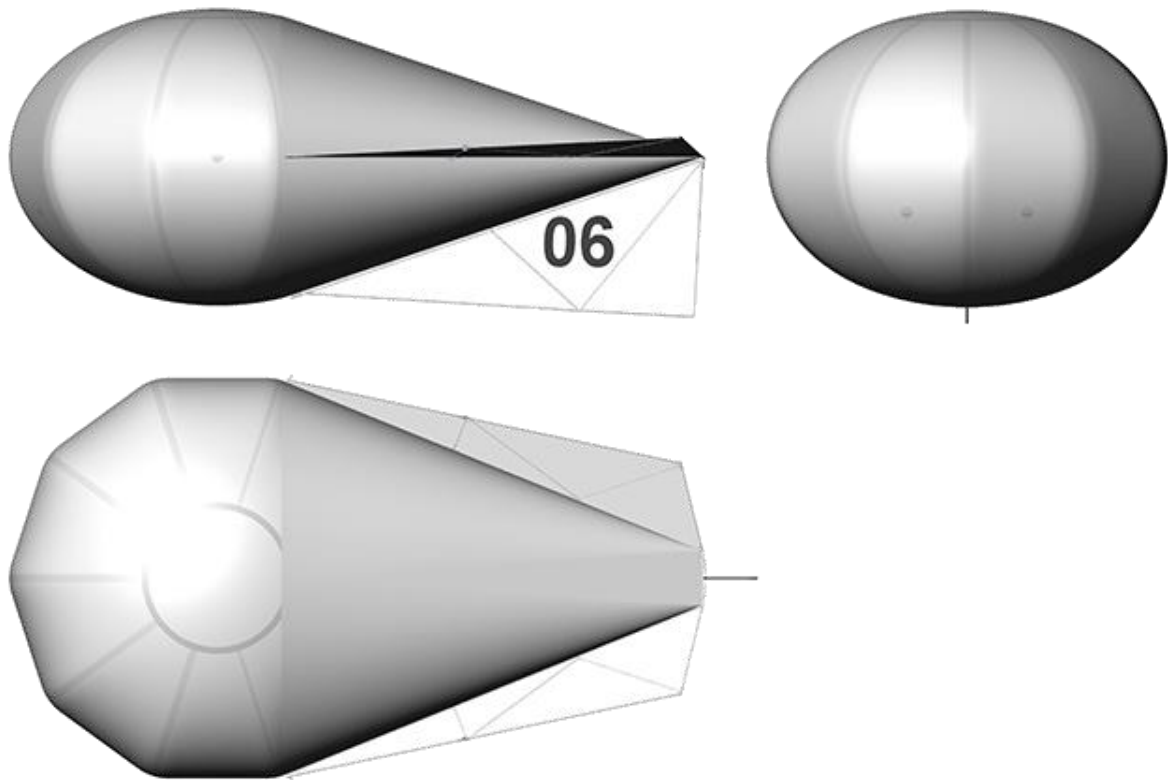
- **Usual.** The gondola lifts to an operating altitude with the balloon.
- **Shuttle.** The balloon is at the operating altitude, two gondolas only move. While one gondola with skydivers onboard goes up, the other gondola goes down (this is analogous to the mountain cable car). Moreover, this method avoids the unpleasant for all balloons ground turbulence passage and unmoored being near the ground. Gondola can be equipped with a ballistic parachute rescue system.

As a launch platform of the complex a “mobile holding device” used. It is a special truck or a trailer, equipped with a winch, mooring supports, sets of equipment, power supply, gas filling and vacuuming systems.

Application of the **K-1500** significantly reduces the cost of the jump, can save life of the aircraft, operating on the dropping of parachutists, and attract a more people willing to make the first and subsequent jumps.

With proper lifting height, tandem jumping with an instructor and jumping sports disciplines are available.

General view



K-1500 specifications

Number of parachutists	6
Lifting height	2000 m
Gas volume	1500 m ³
Compensating volume	450 m ³
Full envelope volume	1950 m ³
Number of helium balloons on a refueling	250
Loss of helium	3,36 m ³ /day.
Envelope diameter (wight)	16,3 m
Lenght	26,7 m
Height	11,8 m
Envelope area	840 m ²
Empennage area	150 m ²
Aerostat mass	300 kg
Payload	600 kg
Number of gondolas	2

Aerostat developer



A family of the **Colibris** hybrid captive balloons is designed by **OSKBES MAI** – the Design Bureau of Moscow Aviation Institute (National Research University).

Aerostat supplier



“PRO-Avia”, Planetnaya str.,
11, Moscow, 125167, Russia

E-mail: pro-avia@mail.ru

Web: www.ooo-proavia.ru

General Manager:
Vadim Demin

An official supplier of the **Colibris** hybrid captive balloons is **PRO-Avia Company**. A scope of activity of the company is production, realization, service of vehicles designed by OSKBES MAI.

Payment requisites of the organisation:

BENEFICIARY BANK VTB Bank (Deutschland) AG,
Walter-Kolb-Strasse, 13 60594 Frankfurt-am-Main
Germany, SWIFT: OWHB DE FF BENEFICIARY
telex: 485126 NMBNK RU CB NMB (OOO), MOSCOW
Acc. 0104558416 In favour “PRO - Avia”
Acc. 4070297840000000051



Ц21.1
Форма D-1

МЕЖГОСУДАРСТВЕННЫЙ АВИАЦИОННЫЙ КОМИТЕТ
INTERSTATE AVIATION COMMITTEE

АВИАЦИОННЫЙ РЕГИСТР
AVIATION REGISTER

СЕРТИФИКАТ
РАЗРАБОТЧИКА АВИАЦИОННОЙ ТЕХНИКИ
DESIGN ORGANIZATION CERTIFICATE

№ P-52

НАСТОЯЩИЙ СЕРТИФИКАТ,
ВЫДАННЫЙ

THIS CERTIFICATE ISSUED TO

Федеральному государственному бюджетному образовательному
учреждению высшего профессионального образования
"Московский авиационный институт
(национальный исследовательский университет)" (МАИ)

г. Москва, Российская Федерация

УДОСТОВЕРЯЕТ, ЧТО УКАЗАННАЯ ОРГАНИЗАЦИЯ ПРИЗНАНА В КАЧЕСТВЕ
РАЗРАБОТЧИКА ГРАЖДАНСКОЙ АВИАЦИОННОЙ ТЕХНИКИ

CERTIFIES THAT THE ABOVE ORGANIZATION IS RECOGNIZED AS A CIVIL AERONAUTICAL PRODUCTS DESIGN
ORGANIZATION

СЕРТИФИКАТ ОГРАНИЧЕН В СООТВЕТСТВИИ С ПРИЛАГАЕМОЙ ОБЛАСТЬЮ
ДЕЙСТВИЯ, КОТОРАЯ ЯВЛЯЕТСЯ НЕОТЪЕМЛЕМОЙ ЧАСТЬЮ НАСТОЯЩЕГО
СЕРТИФИКАТА

THE CERTIFICATE IS LIMITED TO THAT SPECIFIED IN THE ENCLOSED TERMS OF APPROVAL WHICH IS AN
INTEGRAL PART OF THIS CERTIFICATE

СЕРТИФИКАТ СОХРАНЯЕТ ДЕЙСТВИЕ, ПОКА ОРГАНИЗАЦИЯ ПРОДОЛЖАЕТ
СООТВЕТСТВОВАТЬ ТРЕБОВАНИЯМ АВИАЦИОННЫХ ПРАВИЛ

THE CERTIFICATE IS VALID WHILST THE ORGANIZATION REMAINS IN COMPLIANCE WITH THE REQUIREMENTS
OF AVIATION REGULATIONS

ДАТА И МЕСТО ВЫДАЧИ
DATE AND PLACE OF ISSUANCE

13 ноября 2012 г.

г. Москва

Дата первоначальной выдачи
Date of the First Issuance
27 апреля 1998г.



В.В. Беспалов

ПОДПИСЬ SIGNATURE

Председатель
Авиационного регистра МАК

ДОЛЖНОСТЬ TITLE

OSKBES MAI.
The Design Bureau
of Moscow Aviation Institute
(National Research University)

Tel.: +7 985 349-25-22; +7 499-158-44-68

Chief Designer: Vadim Demin

Email: oskbes@mai.ru

Web: www.oskbes.ru

