# Augur RosAeroSystems (RAS) - tethered aerostat systems (complexes)

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# 1. Introduction

Established in 1991 in Moscow, Augur RosAeroSystems (RAS) was Russia's premier manufacturer of airships and tethered aerostat systems. The RAS product line of tethered aerostat systems in 2010, as summarized in the following chart, is addressed in this article.

Aerolift	<ul> <li>Aeronautical attraction tethered balloon – International certification</li> <li>18 m (62.3 ft) diameter, lift up to 18 passengers to 150 m (492 ft)</li> <li>Tourist flights offering a bird's-eye-view at scenic attractions, video / photography of special events</li> </ul>
Irbis	<ul> <li>Tactical-class tethered aerostat, highly mobile, rapid deployment</li> <li>12.3 m (40.4 ft), lift up to 25 kg (33 lb) to 900 m (2,953 ft)</li> <li>Patrol and monitoring, event security, advertising, broadcasting, LTA pilot training</li> </ul>
 Lynx	<ul> <li>Tactical-class tethered aerostat – highly mobile, rapid deployment</li> <li>19 m (62.3 ft), lift up to 150 kg (331 lb) to 1,000 m (3,281 ft)</li> <li>Video surveillance, border control, anti-smuggling, electronic warfare, communications link, broadcasting</li> </ul>
Gepard	<ul> <li>Operational-class tethered aerostat – mobile, rapid deployment</li> <li>27.9 m (91.5 ft), lift up to 300 kg (661 lb) to 1,500 m (4,921 ft)</li> <li>Low-flying target detection, ground &amp; marine target detection &amp; Identification, electronic warfare / intelligence, border control</li> </ul>
Tiger	<ul> <li>Operational-class tethered aerostat – mobile, rapid deployment</li> <li>38.5 m (126 ft), lift up to 500 kg (1,102 lb) to 1,500 m (4,921 ft)</li> <li>Low-flying target detection, ground &amp; marine target detection &amp; Identification, electronic warfare / intelligence, border control</li> </ul>
Puma	<ul> <li>Strategic-class tethered aerostat – fixed site, all weather</li> <li>61 m (200 ft), lift up to 2,250 kg (4,960 lb) to 4,000 m (13,123 ft)</li> <li>Air defense, ground &amp; marine target detection &amp; identification, electronic warfare / intelligence, broadcasting</li> </ul>

In 2018, the Israeli firm Atlas LTA Advanced Technology, Ltd. acquired RosAeroSystems, its product lines and intellectual property. Atlas moved the corporate headquarters to Yavne, Israel. The Atlas website is here: <u>https://atlas-lta.com</u>.

The RosAeroSystems website is still online at the following link: <u>http://rosaerosystems.com</u>

Parameter	Aerolift (AL-30)	Irbis	Lynx (Au-27)	Gepard	Tiger	Puma
Length	18 m (59 ft)	12.3 m (40.4 m)	19 m (62.3 m)	27.9 m (91.5 m)	38.5 m (126.3 ft)	61 m (200.1 ft)
Diameter, max	18 m (59 ft)	~ 4.1 m (13.5 ft)	7 m (23.0 ft)	~ 9.8 m (32.1 ft)	12.6 m (41.3 ft)	~ 20.6 m (67.6 ft)
Envelope volume	3,050 m <sup>3</sup>	110 m <sup>3</sup>	450 m <sup>3</sup>	1,200 m <sup>3</sup>	2,670 m <sup>3</sup>	12,000 m <sup>3</sup>
	(107,710 ft <sup>3</sup> )	(3,885 ft <sup>3</sup> )	(15,892 ft <sup>3</sup> )	(42,378 ft <sup>3</sup> )	(42,378 ft <sup>3</sup> )	(423,776 ft <sup>3</sup> )
				(nominal)*	(nominal)**	
Ballonet volume,	480 m <sup>3</sup>		112.5 m <sup>3</sup>	480 m <sup>3</sup>		~ 3,400 m <sup>3</sup>
max	(16,951 ft <sup>3</sup> )		(3,973 ft <sup>3</sup> )	(16,951 ft <sup>3</sup> )		(120,070 ft <sup>3</sup> )
Envelope	4 – 6 years				5 years	
operating lifetime						
Altitude, max	up to 150 m	900 m	1,000 m	1,500 m	1,500 m	5,000 m
	(492 ft)	(2,953 ft)	(3,281 ft)	(4,921 ft)	(4,921 ft)	(16,402 ft)
Tether operating					600 cycles	
lifetime					(2.5 – 5 years)	
Raising / lowering				50 min	20 – 25 min	21 – 50 min
time				@ 30 m/min	@ 60-75 m/min	@ 100-240 m/min
Payload weight	18 passengers,	5 - 25 kg	60 - 150 kg	100 - 300 kg	200 - 500 kg	900 - 2,250 kg
	1,400 kg	(11 - 33 lb)	(132 - 331 lb)	(220 - 661 lb)	(441 - 1,102 lb)	(1,984 - 4,960 lb)
	(3,086 lb)					
Power supply	Power for ballonet	3 kW, via battery	3 kW, via battery	4 kW, via	5 kW, via	40 kW, via
	fans, via powered			powered tether	powered tether	powered tether
	tether					
Launch/recovery					12 m/s	
wind					(26.9 mph)	
Wind speed, max	10 m/s	15 m/s	25 m/s	25 m/s	27 m/s	35 m/s
at operating	(22 mph)	(33.5 mph)	(56 mph)	(56 mph)	(60.4 mph)	(78 mph)
altitude						
Wind speed, max	35 m/s	20 m/s	30 m/s	30 m/s	42 m/s	46 m/s
at mooring	(78 mph)	(44.7 mph)	(67 mph)	(67 mph)	(94 mph)	(103 mph)
Endurance	10-15 min / cycle	1 day	15 days	20 days	15 – 20 days	25 – 30 days

# General characteristics of RosAeroSystems tethered aerostatic systems (complexes)

\* Gepard is scaleable from 1,200 to 1,800 m<sup>3</sup> (42,378 to 63,566 ft<sup>3</sup>) \*\* Tiger is scaleable from 2,500 to 4,000 m<sup>3</sup> (88,287 to 141,259 ft<sup>3</sup>)

#### 2. Aerolift (AL-30) aeronautical attraction tethered balloon

The Aerolift (aka AL-30 and "Skylift") Is a large passenger-carrying tethered balloon intended primarily for scenic sightseeing services from a fixed, but relocatable site. For passenger service, this aerostat received European Aviation Safety Agency (EASA) Type Certificate TCDS BA.007 on 10 June 2005.

The envelope of this helium balloon has a volume of 3,050 m<sup>3</sup> (107,710 ft<sup>3</sup>) with an internal air ballonet pressurized by an onboard electric fan to a maximum volume of 480 m<sup>3</sup> (16,951 ft<sup>3</sup>). The envelope is equipped with six automatic / electric-controlled gas valves and a relief overpressure gas valve. A rip panel is installed on the top of the envelope to release the helium lifting gas quickly in an emergency.

The metal annular-shaped gondola has a capacity of 18 occupants, including a pilot, with two doors and an external net above the passenger rail.



When moored, the Aerolift sits on an inflated anchor ring. Source: RAS



Aerolift in tethered flight. Source: RAS

The balloon is tethered by a steel cable connected to an electricpowered winch that controls the height of the balloon and the ascent and descent speeds. On the ground, the aerostat docks with an inflated anchor ring.

If the tether breaks, the Aerolift is capable of free flight. A safe landing can be managed with an onboard gas releasing system and an emergency ballast system.



View from the Aerolift gondola. Source: RAS.

#### 3. Irbis (tactical-class tethered aerostat)

The Irbis is designed lift small payloads of up to 25 kg (33 lb) to an operating altitude of 900 m (2,953 ft) for up to 10 days. The aerostat is tethered by a simple steel cable. The aerostat can be configured to carry a variety of small payloads, such as electro-optical / infrared (EO/IR) cameras, electronic warfare / communications intelligence systems, and communications relay system, each with its own power supply. At operating altitude, the aerostat has a view over a territory with a 5 km (3.1 mile) radius.



Irbis secured on the ground. Source: RAS



Irbis ready for liftoff; helium cart at lower left. Source: RAS



Irbis in flight on its tether. Source, three photos: RAS





The Irbis aerostat is extremely simple to operate and can be deployed on any unprepared site in a short period of time. First inflation and deployment requires 4 to 6 people. Regular operation at a site, including periodic inspection, minor repair and helium addition, requires a ground crew of 1 to 2 persons.

## 4. Lynx (tactical-class tethered aerostat)

Lynx is designed for 15 day missions at a working altitude of up to 1,000 m (3,281 ft). Brief landings (1-2 hours) for maintenance between missions and helium replenishment are required.

This multi-function tethered aerostat has a range of applications, including, communications relay / broadcast, surveillance (radar, electro-optical / infrared camera), fisheries and border patrol, scientific research, advertising, aerial photography / video.



Lynx two view (left side & front) diagram. Source: RAS



Lynx in flight, side & stern views. Note the kite-style tail fins. Source: RAS





Lynx secured on the ground at a remote site. Source, both photos: RAS



Lynx flying above a remote mooring site.



Winch trailer for Lynx aerostat system. Source, both photos: RAS

## 5. Gepard (operational-class tethered aerostat)

RAS states that "Gepard" is a family of aerostats that are scaleable from 1,200 to 1,800 m<sup>3</sup> (42,378 to 63,566 ft<sup>3</sup>) envelope volume, and configurable to carry a variety of payloads, including radar, gyrostabilized electro-optical / infrared (EO/IR) systems, communications, targeting systems, electronic intelligence, etc. All get the name "Gepard," with an additional code to indicate envelope volume (i.e., Gepard-12, -18). Power for the aerostat systems and mission payload is supplied from the ground via the tether.



Gepard aerostat aloft over its mobile mooring facility. Source: S. M. K. Bakmaev, et al., (2015)

From an operating altitude of 1,500 m (4,921 ft), Gepard can provide persistent surveillance over a territory with an 80 km (40.7 miles) radius. The mobile mooring facility enables the Gepard aerostat system to be rapid deployed and repositioning





Gepard aerostat aloft over its mobile mooring facility. Note that a sensor under the envelope has been obscured in these photos. Source, both photos: RAS

#### 6. Tiger (operational-class tethered aerostat)

RAS states that "Tiger" is a family of aerostats that are scaleable from 2,500 to 4,000 m<sup>3</sup> (88,287 to 141,259 ft<sup>3</sup>) envelope volume, and configurable to carry a variety of payloads, which are powered from the ground via the tether. All get the name "Tiger," with an additional code to indicate envelope volume (i.e., Tiger-27, -32). The Tiger aerostats operate from a 23,200 kg (25.6 ton) mobile mooring facility that is integrated on a trailer with a main tether winch and three auxiliary mooring winches. Tiger aerostats have an anti-icing system.



Tiger aerostat on its mobile mooring facility. Source: RAS





Tiger aerostat aloft over its mobile mooring facility. Source: RAS



A Tiger aerostat (1) is secured to its mobile mooring facility (4) by its powered tether and high capacity winch (2) and the 3-point mooring rigging controlled with three auxiliary winches (3). Source: RAS



(L) Tiger aerostat with its 3-point mooring lines released. (R) Note that the shadow of the single ballonet on the bottom of the envelope. Source: RAS



Tiger aerostat moored during night operations. Source: RAS

## 7. Puma (strategic-class tethered aerostat)

The Puma aerostat is designed primarily to carry a large surveillance and early-warning radar antenna, but also could carry other surveillance and communications equipment. The radar antenna is carried on a truss, suspended under the envelope, within a protective, slightly-pressurized dome with an aerodynamic shape. Up to 40 kW of electric power is delivered to the aerostat via the tether. Maximum transmitted power is 32.5 kW. Data are transmitted to a ground station via a radio link.



Graphic representation of the Puma aerostat's radar capabilities to detect, identify and track airborne, seaborne and ground targets. Source: RAS.

Working altitude is between 2,000 to 5,000 m (6,562 to 16,402 ft). The aerostat has an automatic pressure control system.



Source (above right & bottom): Photos by Marina Lystseva via Pakistan Defense (23 March 2011)



Puma side view showing the maximum extent of the ballonet inside the gas envelope, the ventral radar dome, the tether & the 3-point mooring lines. Source: adapted from Atlas

The large inflated tail fins are maintained at an overpressure and are connected via bracing wires for stability. In the tail photos above, note the three "hoses" connected at the back edge of each fin. These help equalize pressure in the three fins.



Puma aloft, above its fixed ground station. Source: RAS



Puma mooring facility, annotated. Source: Adapted from RAS



Puma aloft, above its fixed ground station. Source, both photos: RAS



In 2011, RAS delivered a third Puma to China. Additional deliveries likely occurred in the following decade. In April 2022, Janes reported, "According to Janes data, China's unmanned systems market is set to grow fivefold over the decade with the total value reaching USD19 billion by 2031. The data shows that most of the unmanned systems will be developed locally, with foreign supplies of unmanned systems to China only including the 'Puma aerostat' that is developed by the Russian company, RosAeroSystems."

## 8. For more information

- Yu.S. Boyko, "Aeronautics: Tethered, Free, Managed," (in Russian), ISBN 5.8122-0233-8, Publishing house MGUP, Moscow, Russia, 2001
- "Russian firm builds another aerostat system for China," Sputnik International, 8 January 2011: <u>https://sputniknews.com/20110108/162078107.html</u>
- "China buys aerostat from Russia," Pakistan Defense, 23 March 2011: <u>https://defence.pk/pdf/threads/china-buys-aerostat-from-russia.99699/</u>
- S. M. K. Bakmaev, G. V. Tsepilov, I. S. Vorontsov, and V. V. Ivanov, "Some Problems of Designing Tethered Low-Volume Aerostat Systems," Biosciences Biotechnology Research Asia, Vol. 12, No. 2, 2015: <u>https://www.biotech-asia.org/vol12no2/some-problems-of-designing-tethered-low-volume-aerostat-systems/</u>

# Type certificate

 "AL-30 tethered gas balloon," European Aviation Safety Agency (EASA) Type Certificate TCDS BA.007, Issue 01, 10 June 2005: <u>https://www.caa.co.uk/Documents/Download/3936/5530fc38-</u>

<u>100d-4d0c-9883-5e78f0a41d10/1022</u>

## <u>Videos</u>

- "TV Augur," (Irbis aerostat), (2:29 min), posted by RosAeroSystems, 22 April 2015: <u>https://www.youtube.com/watch?v=swFgVj\_xmjY</u>
- "TV Augur," (Puma aerostat), (1:31 min), posted by RosAeroSystems, 22 April 2015: <u>https://www.youtube.com/watch?v=P0jdHGMIwzk</u>
- "TV Augur," (Gepard aerostat), (0:54 min), posted by RosAeroSystems, 30 October 2014: https://www.youtube.com/watch?v=IMHNObdWzpE

- "TV Augur," (Lynx aerostat), (2:38 min), posted by RosAeroSystems, 23 April 2015: https://www.youtube.com/watch?v=FRE\_3QjVLLE
- "TV Augur," (Aerolift balloon), (1:02 min), posted by RosAeroSystems, 22 April 2015: <u>https://www.youtube.com/watch?v=WU\_mHK\_4Ycw</u>

## Other Modern Airships articles

- Modern Airships Part 1: <u>https://lynceans.org/all-posts/modern-airships-part-1/</u>
- Modern Airships Part 2: <u>https://lynceans.org/all-posts/modern-airships-part-2/</u>
  - RosAeroSystems airships
  - Atlas LTA Advanced Technology airships
- Modern Airships Part 3: <u>https://lynceans.org/all-posts/modern-airships-part-3/</u>