Atlas (former Augur RosAeroSystems) airships

Peter Lobner, 14 August 2019

**Background**

Established in 1991 in Moscow, Augur RosAeroSystems (RAS) is a Russian manufacturer of airships and tethered aerostats. The RAS lineup of airships circa 2002 is shown in the following chart. The small, non-rigid AU-11 and AU-12 blimps were built in limited quantities. None of the other larger airships were built.

![RAS airship lineup, circa 2002. Source: RAS](image)

The current RAS airship product line includes the two-person AU-12 and ten-person AU-30 blimps. Both have fabric-film envelopes and manage their lift like other blimps with variable air balloonets and ballast. Since the early 2000s, RAS has been developing the
ATLANT ("aerostatic flying transport vehicle of a new type") hybrid cargo airship, primarily for applications in the harsh environment of the Arctic. RAS also has been developing other advanced airships designs for high-altitude geostationary roles and long-duration surveillance roles.

In about 2018, Augur RosAeroSystems was acquired by the Israeli firm Atlas LTA Advanced Technology, Ltd., in Yavne, Israel. Atlas has stated that its goal is to commercialize and further enhance the airship technology developed by Augur RosAeroSystems. While the Atlas headquarters are in Israel, the former RAS facilities for manufacturing airships, aerostats and gas envelopes, and the hangers for operating large airships are in Russia.

Prior to their acquisition by Atlas, RAS is reported to have built ground test rigs to validate the variable buoyancy control system and the propulsive lift systems that are key elements of the ATLANT design. RAS also presented a plan for developing a new factory capable constructing two to ten ATLANT airships per year. The funding requirement for the factory was estimated at $157 million. It seems likely that Atlas will need to build a new factory somewhere to support commercialization and production of the ATLANT.

The RosAeroSystems website is still active at the following link, and makes no mention of the acquisition by Atlas. [http://rosaerosystems.com/atlant/](http://rosaerosystems.com/atlant/)

I have not been able to find a website for Atlas LTA Advanced Technology, Ltd.

The following RAS airships are described in this section:

- DZ-N1 heavy lift rigid zeppelin
- MD-900 light lift, semi-rigid airship
- DPD-5000 / DZ-10 medium lift, semi-rigid airships
- ATLANT 30 & 100 rigid, variable buoyancy airships
- High Altitude Airship (HAA) Berkut

The ATLANT is the RAS / Atlas airship of the future.
In 2001, RosAeroSystems initiated work on a very large, heavy-lift cargo zeppelin designated DZ-N1, dirigible number one. It was named for Russian rocketry pioneer Konstantin Tsiolkovsky.

The basic characteristics of the DZ-N1 cargo zeppelin were:

- Rigid, all-metal hull: Semi-monocoque frame and composite panels form the envelope with 16 gas bags inside
- Length: 268 meters (880 feet)
- Width: 64 meters (210 feet)
- Height: 64 meters (210 feet)
- Maximum speed: 170 kph (111 mph)
- Propulsion power: Nine diesel engines
- Total volume: 400,000 cubic meters.
- Cargo capacity: 180 metric tons
- Range: 15,000 km (9,300 mile)
Buoyancy control would be accomplished by heating / cooling the helium lifting gas. For operation in the Arctic, heating the helium is the more important issue. Heating was to be accomplished with compact plasma generators located in each of the 16 gas bags in the giant airship, with each plasma generator capable of delivering 25 kilowatts of heating. A little blower would push cold helium through each plasma generator. In October 2002, RAS CEO Gennady Verba reported on the performance of this helium heating system at the Airships in the Arctic Symposium in Winnipeg, Canada:

“What benefits we can get from just heating the helium by 50° C? If we have an airship with a 500,000 cubic meter volume, 400,000 cubic meters are helium. If we heat it by 50° C, we gain 71 tonnes of additional lift. Of course, we heat the helium on the ground using available sources of electricity. During the flight we use a smaller generator of 340 kilowatts power, just to compensate for losses of heat. What is very important in Arctic is that we use this heating for anti-icing.”

A February 2009 article by Morning International Freight Co. Ltd. still reported that RAS was planning to produce the DZ-N1. However, no date had been set for starting construction. The DZ-N1 was never built.

RosAeroSystems MD-900 and DPD-5000 / DZ-10 airships, circa 2001 - 2009

The MD-900 was a concept for a semi-rigid, multi-purpose airship that RAS considered to be the smallest possible cargo airship for use in the Arctic. Basic characteristics of the MD-900 were:

- Semi-rigid
- Length: 60 m (196 ft)
- Height: 22 m (72 ft)
- Cargo capacity: 3 metric tons (3.3 tons, 6,614 lb)
- Range: 4,828 km (3,000 miles)
The MD-900 was proposed as a replacement for the aging Mil Mi-8 medium lift, twin-turbine helicopter, which first flew in 1961. In the MD-900 modular airship, the central part of the gondola was a removable module that could come in several different, interchangeable configurations, such as a cargo module, a portable power plant module, a tourist module, or some other module customized to the needs of the customer. As shown in the following diagram, the cargo module could accommodate two small cars.

[Diagram showing MD-900 modular airship]

MD-900 circa 2002. Source: RAS

The larger DPD-5000 was a concept for a long-range surveillance airship, with a cargo version designated DZ-10. Basic airship characteristics were:

- Semi-rigid
- Length: 126.8 m (416 ft)
- Height: 32 m (105 ft)
- Cargo capacity: 25 metric tons (27.5 tons, 55,116 lb)

Neither the MD-900 nor the DPD-5000 / DZ-10 were built.
The ATLANT airships

RosAeroSystems describes their ATLANT hybrid airships as follows:

“We develop the size spectrum of ATLANT aircraft with the lifting capacity of 15, 60 and 170 tons and flight range from 1,500 to 5,000 km. According to preliminary estimation the transportation costs will be in the range of 7 to 25 rubles per (metric) ton-km (which is about 16 to 56 cents per short ton-mile). ATLANT aircraft can be used for medium and short range distribution logistic to connect existing transport hubs with the remote regions, as well as for long-haul transportation with the possibility of door-to-door transportation including unprepared sites and water surface.”

General features of the ATLANT hybrid airships include:

- **Capable of vertical takeoff and landing (VTOL) and hovering:** Total lift is the aggregate of aerostatic lift from helium, aerodynamic lift from the hull and small wings, and propulsive lift from vectoring propulsors and the fixed air ejector lift system along the flanks of the airship. The vectoring propulsors also provide thrust for forward flight.

- **Variable buoyancy control:** Aerostatic buoyancy is controlled by a variable buoyancy control system that enables load exchanges to be conducted without exchanging external ballast at the pickup or delivery site as cargo is moved on or off the airship.
• Rigid airframe with a hard, composite, three-ply exterior aeroshell.

Source: RAS
• **The aeroshell design provides several operational benefits:**
  o The hull provides aerodynamic lift in forward flight.
  o Airship width and profile provide stability on the ground in strong side gusts up to 20 meters/second (72 kph, 45 mph).
  o Low loads in flight and on the ground.
  o The rigid hull is designed to handle snow loads up to 100 kg/square meter (20.5 pounds/square foot).
  o The aeroshell design permits “hangarless” operation, with the airship secured outdoors.

![Hull snow load capacity.](image)
*Source: RAS*

• **Designed for year-round operation, including Russian winter conditions.**
  o Able to operate with outside temperatures of -40 degrees Celsius (-40 degrees F).
  o Able to fly in icing conditions.
  o Should be capable of operating in other Arctic regions such as Canada and Alaska.
• Can operate without traditional airship ground support equipment.
  o Air-cushion landing system (ACLS) provides ground mobility on the ground, ice and water.
  o Cross-wind stability and variable ballast control reduce the need to secure the airship immediately after landing.
  o Designed for “hangarless” operation, with the airship secured outdoors.

• Electric-powered vectoring engines for cruise and VTOL flight supplemented by an ejector-lift system for VTOL.

• Hybrid electric power system meets the power demands of cruise and VTOL flight.
  o 3 x more power is needed for VTOL than for cruise.
Conducting a load exchange with an ATLANT airship

ATLANT airships primarily will make their load exchanges after the airship has made a vertical landing. An ATLANT 30 requires a landing site about 160 m (525 feet) in diameter. Using its ACLS, the airship can maneuver on the ground, ice or water to a designated loading / unloading site. After the vectored thrusters and ejector lift system have been secured, the ATLANT will be heavier-than-air. If needed, an onboard anchor can be deployed. On the ground, this is an “autonomous tie-down device” (a ground penetrating spike). Other anchors can be used after landing on ice or water. Loading and unloading takes place through large doors on the side of the airship.

The Active Ballasting System (ABS) is the variable buoyancy control system employed on ATLANT airships to manage airship buoyancy in flight and on the ground. ABS operates in two different modes.

Air pressurization / release:
- On the ground, ABS uses air to establish the needed ballast conditions as loads are removed or added to the airship. The density of air is about eight times the density of helium. To increase ballast, the ABS pumps air into pressurized air storage tanks aboard the airship, adding about 10 metric tons of ballast in 30 minutes. To decrease ballast, the pressurized air storage tanks exhaust some or all of their contents to the atmosphere.

- In flight at an altitude less than 2 km (6,500 ft), the ABS will use air to manage the buoyancy of the airship, pressurizing the storage tanks further to add ballast or venting the tanks to the atmosphere as needed to reduce ballast.

Helium pressurization / release:
- In flight at an altitude greater than 2 km (6,500 ft), ABS will reduce buoyancy by pumping some of the helium in the lifting gas cells into pressurized helium storage tanks, thereby reducing the volume of helium in the lifting gas cells. To increase buoyancy, ABS will release pressurized helium back into the lifting gas cells.
- This part of the ABS is not used on the ground.
ATLANT showing the locations of the vertical gas storage tanks (green) used by the ABS. Source: RAS

The ATLANT has the capability to carry large external cargo items in trays under the hull or as a suspended sling load, and can pick up and deliver these loads while hovering over the destination.

Rendering of an ATLANT hovering and delivering an over-sized item to a remote site. Source: RAS
Precise geo-positioning over the pick up / delivery site in variable wind conditions is required for a load transfer from a hover. While the ABS can compensate for the airship’s gain or loss of mass during the load exchange, significant time is required for the ballast adjustment to be made, especially for large loads. During such a delivery, even with precise geo-positioning over the destination, the variable wind direction may require the hovering airship to change its heading slightly to point into the wind. The ATLANT designers recognized this issue and developed a rotating external load handling system that maintains the precise alignment of a load, even if the airship has to change heading to match the wind direction. This feature is shown in the following drawing, in which a long wind turbine blade being lowered to the ground. The longest wind turbine blade currently in production is the GE Haliade-X intended for off-shore wind turbine installations. This one-piece blade is 107 meter (351 ft) long. A two degree change in airship heading could sweep the long end of the blade more than three meters (10 feet), which could be hazardous to people and structures on the ground.

Rendering of an ATLANT airship with a rotating external load handling system. Source: Atlas/RAS
At the March 2019 cargo airship conference in Toronto, Canada, Atlas / RAS CEO Gennady Verba described the air turbulence encountered on an offshore platform during the relatively simple task of retrieving a small, tethered aerostat. Such air turbulence during a heavy load exchange at an offshore platform would be quite hazardous and may require aborting the exchange.

It seems unlikely that Atlas/RAS will promote a hovering load exchange as a routine operation for an ATLANT airship. Very fine weather may be required for a successful hovering load exchange.

The ATLANT 30 airship

The ATLANT 30 airship is the smaller member of the ATLANT family. It can be configured to transport cargo and/or passengers for civilian or military applications and could be used for tourism or as a VIP air yacht.

Basic characteristics of an ATLANT 30 airship are:

- Volume: 30,000 m³ (about 1,059,000 ft³)
- Length: 75 m (246 ft)
- Width, envelope: 32 m (105 ft)
- Width, overall: 42 m (138 ft)
- Crew: 3
- Passengers: up to 80
- Payload: 16 metric tons (16,000 kg; 35,274 lb)
- Cruising speed: 90 - 140 kph (56 - 87 mph)
- Range with full load: 2,000 km (1,243 miles)

As a cargo carrier, the ATLANT 30 typically would transfer cargo from a regional logistic center (i.e., port, airfield, railway station) directly to a remote consumer location.

RosAeroSystems claims that the purchase price of an ATLANT 30 airship will be 30% less than Russia's Mil Mi-26 heavy transport helicopter, which is capable of handling a cargo of 13 metric ton (13,000 kg; 29,000 lb) and has a purchase price of $20 to $25 million.
ATLANT 30 three-view drawing. Source: RAS

ATLANT 30 concept shown in flight. Source: RAS
The ATLANT 100 airship

The largest airship currently in the ATLANT family is the ATLANT 100. Basic characteristics of an ATLANT 30 airship are:

- Volume: 100,000 m$^3$ (about 3,531,000 ft$^3$)
- Length: 110 m (361 ft)
- Width, envelope: 48 m (157 ft)
- Width, overall: 71 m (233 ft)
- Crew: 3
- Passengers: up to 200
- Payload: 60 metric tons (60,000 kg; 132,277 lb)
- Cruising speed: 140 kph (87 mph)
- Range with full load: 2,000 km (1,243 miles)

The gas envelope size of the ATLANT 100 is comparable in size to the hybrid Airlander 50 airship, which also is being designed to handle 60 metric ton loads.

ATLANT 100 concept. Note the helicopter pad on the top of the aeroshell. Source: RAS
ATLANT 100 three-view drawing. Source: RAS
High Altitude Airship (HAA) Berkut

RosAeroSystems describes the HAA Berkut as follows:

“The HAA Berkut is a solar powered airship capable to keep its position over a certain place on a 20 - 23 km altitude. The Berkut can carry up to 1,200 kg of various communication and surveillance equipment and supply it with electrical power. Geostationary performance (station keeping) enables to provide various communications, broadcasting and observation services to the territory of more than one million square kilometers. It covers any large metropolitan areas and such countries as France or United Kingdom! Unlike geostationary satellites, the HAA allows to repair, upgrade or replace the equipment every 3 - 4 months while the airship perform service landing.”

Profile and stern views of the HAA Berkut.
Source: Augur RosAeroSystems
Three versions of the HAA Berkut are contemplated, each delivering the same performance, but optimized for deployment in a specific range of latitudes (equatorial / tropical; mid-latitudes from 30-45 degrees; high latitudes from 45 – 60 degrees). The biggest variables among the three versions are related to the electrical power required for station keeping in the different average wind conditions and the area of solar cells required to deliver that power.

Basic characteristics of the mid-latitude HAA Berkut are listed below. The equatorial version is 50 meters shorter, and the high-latitude version is 50 meters longer.

- Volume: 256,000 m³ (about 9,000,000 ft³)
- Length: 200 m (656 ft)
- Width: 50 m (164 ft)
- Daily power consumption: 165 kW
- Fins with engines/props: 5 @ 50 kW max. each
- Solar cell area: 5,800 m² (62,431 ft²)
- Payload: 1,200 kg (2,646 lb)
- Altitude: 20 – 23 km (12.4 – 14.3 miles)
- Endurance: 4 months

Rendering of the HAA Berkut in flight. Source: RAS
A relocatable, inflatable hanger for HAA Berkut. Source: RAS

You can read more about the HAA Berkut airship on the RAS website here:

http://rosaerosystems.com/projects/obj687