Atlas LTA Advanced Technology, Ltd. airships

Peter Lobner, 3 April 2021

1. Introduction

Atlas LTA Advanced Technology, Ltd, based in Rosh Ha’Ayin, Israel, was established in 2016 by Gennadiy Verba, then CEO of the Russian airship firm Augur RosAeroSystems. In 2018, Atlas acquired Augur RosAeroSystems, its product lines and intellectual property. Atlas moved the corporate headquarters to Israel and maintains subsidiaries in Russia and US.

Atlas has stated that its business goals include enhancing the ATLANT variable buoyancy airship technology and commercializing these rigid, heavy lift airships. In addition, Atlas is developing additional product lines of smaller, non-rigid, electric-powered airships and specialized airships and aerostats for other missions. The Atlas website is here: https://atlas-lta.com.

The following Atlas LTA Advanced Technology, Ltd. airships are described in this article:

- ATLANT Autonomous Transport Long-range Aircraft of New Type - rigid, variable buoyancy airships
- Atlas non-rigid electric airships
- Propulsion Assisted High Altitude Platform (PAHAP)

The legacy of Augur RosAeroSystems’ pre-2018 airships is addressed in a separate article.

2. ATLANT heavy lift airships

The ATLANT family of variable buoyancy hybrid airships consists of three models with payload capacities ranging from 18 to 165 metric tons. All three are being designed as multi-role, vertical takeoff and landing (VTOL), long range, heavy transport airships. Basic specifications for the ATLANT 30, 100 and 300 airships are summarized in the following table.
ATLANT airships can be configured for a wide range of missions:

- **Cargo transportation:**
  - Vehicles, machinery, bulk and high volume cargo carried in the internal cargo bay.
  - Oversized cargo carried in an underside belly tray (i.e., wind turbine blades).
  - Large, indivisible load carried as a suspended load.
- **Emergency response** (essential product delivery, personnel evacuation, flying hospital, emergency power station, etc.)
- **Firefighting,** with the ability to replenish itself from a nearby water body.
- **High-rise construction support** (flying crane)
- **Passenger ferry**
- **Luxury sky yacht**
- **Special missions**
ATLANT is being designed as a pilot-optional airship. However, for passenger, emergency response and special missions, the ATLANT will be piloted.

ATLANT’s ability to takeoff and land vertically on almost any unprepared surface with no need for special infrastructure enables the airship to serve even very remote locations. The airship is designed to withstand extreme weather conditions in flight as well as on the ground, even in Arctic conditions without a hangar.

Rendering of an ATLANT on the ground in the Arctic, unloading via the side cargo door. Source: Atlas

Rendering of an ATLANT flying in at low altitude. Source: Atlas
**ATLANT key design features include:**

A. **Optimized aerodynamic shape:** Both computational fluid dynamics (CFD) analysis and wind tunnel tests have confirmed good stability and efficient aerodynamic characteristics in flight and safe ground handling on the ground at any wind direction without the need for permanent feathering. The lifting body hull shape generates aerodynamic lift in flight, which compensates for any static heaviness that required propulsive lift during takeoff. In normal cruise trim, propulsive lift is not required.

B. **Rigid structure:** Rigid internal framework and hard outer panels are made of light, strong composite material that can withstand all loads in flight and on the ground, including strong side winds and heavy snow when parked outside in Arctic conditions. This feature makes possible hangar-less, autonomous operation of the airship in a wide range of weather conditions.

C. **Variable buoyancy control:** Aerostatic buoyancy is controlled by a variable buoyancy 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. The
ATLANT’s variable buoyancy control system is called the Active Ballasting System (ABS). It has two different modes of operation: air ballast control and helium lift gas control.

Air ballast control:
- On the ground, the ABS can partially compensate for the weight of unloaded cargo by taking on air ballast. This is done by pumping ambient air into high pressure air storage tanks aboard the airship.
- For takeoff, the high pressure air storage tanks are vented back to the atmosphere to achieve the desired overall buoyancy.

Helium lift gas control:
- In flight, the ABS controls the aerostatic buoyancy from helium as altitude changes. When required, buoyancy is reduced by pumping helium from the atmospheric pressure lift gas cells into smaller pressurized storage tanks. To increase buoyancy, helium is vented from the pressurized storage tanks back into the much larger helium lift gas cells. No helium is lost during this cycle.
- This part of the ABS is not used on the ground.

*High-pressure gas storage tank installation.*  
*Source: Atlas*
D. Hybrid airship designed for vertical takeoff and landing (VTOL) and hovering: The total lift generated by the ATLANT is the aggregate of aerostatic lift from helium, aerodynamic lift from the hull and small aerosurfaces, and propulsive lift from the thrust vectoring main cruise engines (MDM) and the fixed “multicopter type” lift fans (ALM) installed along the flanks of the airship. The thrust vectoring main cruise engines are aligned to deliver forward thrust in cruise flight.

During VTOL operations, including hovering, total lift is the sum of aerostatic lift and propulsive lift. There is no aerodynamic lift during VTOL operations.

The ATLANT can takeoff and land vertically from a small landing space to deliver or pickup loads on the ground. With precise geo-positioning during hover, the ATLANT also can operate as a flying crane and pickup or deliver suspended cargo while hovering above the destination

One of four MDM + ALM installations on an ATLANT-30.
Source: Atlas
The ABS controls aerostatic buoyancy during hovering and VTOL operations. This is an important factor when operating as a flying crane.

E. **Hybrid electric propulsion system (HEPS):** The Dual Fuel self-Ballasting System (DFBS) consists of diesel/turboshaft generator sets (GS) and hydrogen powered fuel cells (FC) that provide power during all modes of flight. The battery packs (BP) are intended to boost available power during VTOL and hovering operations. The DFBS optimizes fuel consumption between clean hydrogen and hydrocarbon fuel, considerably reducing both the carbon footprint and overall operating cost.

F. **Adaptive mooring:** The “adaptive mooring system” consists of an air-cushion landing system (ACLS) and a supplementary “multi-tool anchoring system.” For stability when parked on the ground, the ACLS fans operate in reverse and take a suction on the ground to hold the airship steady in significant winds. The ACLS and the supplementary anchoring system together enable the ATLANT to remain securely on the ground in side winds up to 45 knots without feathering (pointing into the wind) and head winds up to 90 knots.
G. All-weather, year-round operation without traditional airship ground support equipment
- ACLS provides airship mobility after landing, enabling the airship to taxi by itself to a parking site.
- Airship aerodynamic design and ACLS provide cross-wind stability, reducing the need to secure the airship immediately after landing.
- No mooring mast is required. If needed, an onboard anchor can be deployed.
- Designed for “hangarless” operation, with the airship secured outdoors.
- Able to operate in Arctic conditions.
- Able to fly in icing conditions.

H. Pilot-optional operation: The high level of flight control automation is a key factor for unmanned cargo operation, which removes flight endurance limitations, reduces operational cost, enables better utilization of the available airships and implementation of a fully optimized, AI (artificial intelligence) operated, autonomous cargo distribution network.
**Conducting a load exchange on the ground**

ATLANT airships primarily make their load exchanges after the airship has made a vertical landing. After landing, the ATLANT will be ballasted to be heavier-than-air. Using its ACLS and the main cruise engines, the airship can maneuver on the ground, ice or water to a designated loading / unloading site.

The Active Ballasting System (ABS) manages the airship’s aerostatic buoyancy during the load exchange, with air ballast being loaded as needed to compensate for the weight of cargo being removed. Loading and unloading the internal cargo bay takes place through large doors on the side of the airship. Some long, slender cargo items (i.e., wind turbine bladed) can be carried in external trays under the airship.

*ATLANT 100 with external belly cargo trays carrying a set of wind turbine blades. Source: Atlas*

When cargo operations have been completed, the airship may remain parked or readied for takeoff. The ABS adjusts the aerostatic buoyancy as required.
Conducting an airborne load exchange (Flying Crane)

With precise geo-positioning during hover, the ATLANT can operate as a flying crane and pickup or deliver suspended cargo while hovering above the destination. When operating as a flying crane, the ATLANT carries a reduced payload and uses a rotating lifting platform to precisely align the suspended payload while the airship control systems are independently maintaining the airship’s geo-position and compensating for any turbulence or wind gusts.

During delivery, the suspended load is lowered to the ground and the load exchange is accomplished by reducing overall lift to transfer the weight of the suspended load to the ground. Then the slack lift cables from the airship can be safely disconnected from the load and hauled up to the airship. Then the airship can depart for its next assignment.

To pick up a load that will be carried externally, the ATLANT establishes a hover and extends the slack lift cables, which can be safely connected to the load on the ground. Then the ATLANT picks up the load by increasing overall lift, first to take a tension on the cables and then to lift the load off the ground. When the load has been lifted and secured for flight, the ATLANT is ready to fly on to the delivery point.
3. Atlas electric piloted airships

The Atlas non-rigid, electric, piloted airships are designed primarily for aerial sightseeing services. There are two basic models, the Atlas-06 and the larger Atlas-11.

![Atlas-11 two-view drawing & alternate gondola layouts. Source: Atlas](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Atlas-06E</th>
<th>Atlas-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>60.4 m</td>
<td>72.5</td>
</tr>
<tr>
<td></td>
<td>198 ft</td>
<td>237.9 ft</td>
</tr>
<tr>
<td>Diameter, max.</td>
<td>14.6 m</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>48 ft</td>
<td>57 ft</td>
</tr>
<tr>
<td>Height</td>
<td>18.3 m</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>60 ft</td>
<td>70.2 ft</td>
</tr>
<tr>
<td>Total volume</td>
<td>6,400 m³</td>
<td>10,800 m³</td>
</tr>
<tr>
<td></td>
<td>226,000 ft³</td>
<td>381,400 ft³</td>
</tr>
<tr>
<td>Passenger capacity</td>
<td>8</td>
<td>17 to 24</td>
</tr>
<tr>
<td>Crew</td>
<td>2</td>
<td>2 or 3</td>
</tr>
<tr>
<td>Speed, max.</td>
<td>110 kph</td>
<td>110 kph</td>
</tr>
<tr>
<td></td>
<td>68.3 mph</td>
<td>68.3 mph</td>
</tr>
<tr>
<td>Speed, cruise</td>
<td>80 kph</td>
<td>80 kph</td>
</tr>
<tr>
<td></td>
<td>49.7 mph</td>
<td>49.7 mph</td>
</tr>
<tr>
<td>Endurance, cruise</td>
<td>1.5 to 10 hours</td>
<td>2.5 to 10 hours</td>
</tr>
</tbody>
</table>

Source: Atlas
These airships are offered with two propulsion system options. A battery-only electric propulsion system is optimized for short flights of 1.5 to 2.5 hours, with replaceable batteries for fast turn-around. For longer flights, a hybrid electric propulsion systems enables flights of up to 10 hours. Both propulsion systems drive three electric motor driven propulsors: 2 x flank vectoring propulsors attached to the envelope and 1 x stern vectoring propulsor attached to the envelope at the tail. The flank propulsors are located aft of the passenger gondola to ensure low noise and vibration during flight.
The gondola on each model is equipped with an onboard bar, galley and a rear observation deck with a glass floor and floor-to-ceiling windows, as shown in the previous graphic.

Renderings of Atlas electric powered airships on scenic tourist flights.
Source, both graphics: Atlas
4. Atlas electric unmanned airships

The Atlas non-rigid, electric, unmanned airships are designed to conduct long duration, mobile surveillance missions at medium altitudes, up to 4,000 m (13,123 ft). These unmanned airships complement the surveillance capabilities available on Atlas’ low-to-medium altitude tethered aerostats and high altitude platforms.

The design of these unmanned airships is very similar to the electric piloted airships in the following areas:

- General layout
- Propulsion configuration: 2 x flank vectoring electric propulsors attached to the envelope and 1 x stern vectoring electric propulsor attached to the envelope at the tail.

Unmanned electric-powered airship three-view drawing.

*Source: Atlas*
While the electric piloted airships offer battery-only or hybrid electric propulsion systems, the unmanned airship designs incorporate the Atlas hybrid electric propulsion system, with the hydrogen powered Dual Fuel self-Ballasting System (DFBS).

All passenger accommodations have been removed, providing room in the unmanned airships for mission payloads up to 700 kg (1,543 lb) and fuel to support long duration missions of up to 100 hours and range up to 5,000 km (3,106 miles). The hybrid electric system can deliver up to 20 kW of power to the mission payload.

The unmanned airships can be configured for a range of missions, such as:

- Coast and border control
- Environmental monitoring
- Aerial photography and 3D mapping
- Special missions

Rendering of an Atlas electric powered unmanned airship.
Source: Atlas
5. Propulsion Assisted High Altitude Platform (PAHAP)

The PAHAP is a scaleable design for a solar-powered, propelled, high altitude platform (HAP). It can be built in various sizes, with gas envelope volumes ranging from 10,000 to 50,000 m³ (353,000 to 1,766,000 ft³) and a payload capacity of up to 500 kg (1,102 lb) on the largest of these airships.

PAHAPs are designed to operate in the relatively low wind region commonly found at stratospheric altitudes between 16 and 22 km (49,200 to 72,200 ft). The hybrid solar electric power system enables the PAHAP to maintain station keeping above a precise geo-location 24/7 in wind speeds up to 20 meters/sec (45 mph), which should be adequate for 99% of the time on station. In stronger wind conditions, the PAHAP can change altitude in the range from 16 to 22 km, seeking more favorable wind conditions at its assigned geo-location. If needed, the PAHAP can temporarily reposition to a geo-location with better wind conditions.

In addition to powering the propulsion system, the hybrid solar electric power system can deliver 3 kW of power to the payload. The airship can conduct missions of up to one year, making it well suited for persistent surveillance and communications relay missions.

Rendering of a PAHAP flying in the stratosphere. Source: Atlas
PAHAP general configuration two-view drawing. Source: Atlas

6. For more information

• “Is it a UFO? No, it’s an ATLANT cargo airship!,” Cargo Forwarder Global, 3 January 2021: https://www.cargoforwarder.eu/2021/01/03/is-it-a-ufo-no-it-s-an-atlant-cargo-airship/