LTA Aerostructures (LTAA) rigid airships

Peter Lobner, 28 July 2019

**Background**

LTA Aerostructures Inc. (LTAA) is a Canadian company that was formed as an investment partnership among US-based US Lighter Than Air Corp. (US-LTA Corp, New York), NEXA Capital Partners and other partners. LTAA was founded in 2014 in Mirabel, Quebec, Canada, with the goal of developing heavy lift cargo airships capable of providing precision vertical lift and delivery of large tonnage into remote areas with limited or no ground infrastructure.

In November 2015, LTAA reported that it planned to build a new $60 million manufacturing facility in Mirabel, near Montreal, Canada, where LTAA’s heavy lift cargo airships were to be designed, fabricated, assembled and certified. LTAA’s President and CEO, Michael Dyment, stated, “Our 10 tonne lift and 70 tonne lift lenticular airships will for the first time meet the cargo and logistics needs of people in remote areas, as well as in the mining and oil and gas industries that must operate there.” At that time, it was expected that the new class of heavy lift cargo airship would enter revenue service in 2019. However, the planned LTAA factory was never built and the former LTAA corporate website, www.lta-aerostructures.ca, no longer is active.

In July 2019, I spoke to a representative from AeroMontréal (https://www.aeromontreal.ca/lta-aerostructures-en.html), a strategic “think tank” created in 2006 to mobilize Quebec's aerospace sector, who confirmed that LTAA no longer is part of their future plans for the region. Instead, Quebec will be implementing a new plan to develop an airship industry in Montreal in collaboration with the French airship manufacturer Flying Whales. In June 2019, Quebec’s Economy Minister announced at the Paris Air Show that Quebec intends to buy a minority stake in Flying Whales and construct a production facility in the Montreal area within five years.

The remainder of this section describes the evolution of the LTAA cargo airships that might have been.
**Business case for Canadian Arctic airships**

The initial target markets for these airships included transporting cargo for oil and gas companies exploring in remote regions of northern Canada, and delivering completed housing units, other structures and supplies to improve the living conditions in First Nation communities in these remote regions. On return trips, airships would be able to remove decades of trash for recycling and take Arctic products, such as fish and other locally produced items, to southern markets. The business case for LTA airships is described in the 2015 general presentation at the following link:


**Lenticular airship patents**

The intellectual property law firm Finnegan (https://www.finnegan.com) reports that they “guided the entire developments of LTA’s patent portfolio that includes over 120 patents and pending applications directed to lighter-than-air airship technology. The applications cover airship technologies ranging from hull and empennage configurations, propulsion and power source arrangements, flight control systems, attitude regulation and control, attitude displays, variable buoyancy techniques, solar powered flight, aerodynamic features, and various ornamental designs and configurations.”

The LTAA airship designs include patented features based on lenticular airship patents held by its parent company, US-LTA Corp, New York. You’ll find a list of these patents at the following website. Several of the key patents are identified and described briefly in the following text.

https://patents.justia.com/assignee/lta-corporation

French inventor Pierre Balaskovic has long been a champion of lenticular airships. The following patents, listing Balaskovic as inventor and US-LTA Corp, New York as the applicant, establish the basic configuration and characteristics of a lenticular, oblate spheroid-shaped airship of the type shown in the following diagram.

**FIG. 1**

General arrangement drawing support structure (20), hull (22), propulsion assemblies (31), empennage assembly (25), gondola (35), longitudinal frame member (124), landing gear (377 & 777).
Source: US 7866601 B2

**FIG. 1B**

Structural drawing, showing empennage assembly (25), keel hoop (120), lateral frame members (122), longitudinal frame member (124).
Source: US 7866601 B2
The following patents, listing John Goelet as inventor and US-LTA Corp, New York as the applicant, apply to the lenticular, elongated oblate spheroid-shaped airship shown in the following diagrams. This airship has aerodynamic components that are integrated with the hull and are designed primarily to improve the stability of the airship in windy conditions.


Hull (12) and one example of helium cells (1200). Source: US 8596571 B2
This lenticular airship design is further elaborated and evolved in other patents, including:


**FIG. 1**

General arrangement showing solar panels on the top of the hull (12) and propulsion assemblies (31). Source: US 8894002 B2
A variable buoyancy control system for a solar-powered lenticular airship with a similar overall layout is presented in US patent US 9,899,514 B2, published 2 December 2014 and available here:


This patent describes the configuration of the lenticular airship and the arrangement of lifting gas cells into outer (lower pressure) volumes and inner (higher pressure) volumes and the use of a computer system, pumps and valves to manage the airship’s overall buoyance by moving helium between the outer and inner volumes.

To increase lift:

“….the computer is configured to increase lift ….by operating….the valves coupled with at least one inner bladder to vent the lighter-than-air gas from the…inner bladder to the outer bladder so as to increase a volume of the lighter-than-air gas retained in the outer bladder.”

To decrease lift:

“…the computer is configured to decrease lift…by operating…at least one of the valves coupled with …(an) internal bladder and the pump to increase the internal pressure of the….internal bladder using the lighter-than-air gas from the outside bladder so as to reduce a volume of lighter-than-air gas retained in the outer bladder.”

This method of implementing variable buoyancy control in an airship appears to be functionally similar to the Control of Static Heaviness (COSH) system patented by Worldwide Aeros Corp. (Aeros), demonstrated in flight in 2013 on their prototype airship, the Dragon Dream, and implemented in all subsequent Aeroscraft airship designs.
The lenticular airship design representative of the LTA-10 and LTA-70 airships is described in Canadian patent application CA2929507A1, entitled "Cargo Airship," published on 23 July 2015 (also designated WO 2015/108607 A3). This is a rigid hybrid airship, with the structure defining the lenticular shape of the airship while providing support for the numerous systems associated with the airship.

![FIG. 1](image)

**FIG. 1**

General configuration of the airship showing the lenticular hull (12), placement of four vectorable thrusters (48) and four large stabilizing fins (44). Source: CA2929507A1

![FIG. 2](image)

**FIG. 2**

General configuration of the rigid structure of the airship, including the gondola (20), support structure (26), frame members (28), structural rings (30), longerons (32) and the main structural beam (34) that distributes loads evenly throughout the support structure. Source: CA2929507A1
Side view of the airship showing the lenticular hull (12), the gondola (20), the cargo bay (64), which includes provisions for an internal upper cargo bay (68) and an external lower cargo bay (66), and cargo (70).
Source: CA2929507A1

Front view (Fig. 3) and back view (Fig. 4) of the airship showing the lenticular hull (12), the gondola (20), the stabilizing fins (44), the vectorable thrusters (46) and the landing gear (56).
Source: CA2929507A1
Cargo handling system shown lifting an ISO standard cargo container (70), a hoist (88), and a cargo attachment member for the cargo (90).

Source: CA2929507A1

FIG. 17

Cargo handling system (22) showing one hoisting mechanism (82) consisting of a two-rail crane (84), crane rails (86), and hoist (88).

Source: CA2929507A1

FIG. 16
LTA 10 & LTA 70 airship general features

General features of LTAA's two airship designs, as described at the September 2015 Nunavut Trade Show & Conference, include the following:

- Rigid airship, advanced carbon/lattice-based composites, including stabilizers
- Patented “lenticular” form, streamlined for performance in high Arctic wind conditions
- Variable ballast control system
- Durable ice resistant coatings and snow removal technologies
- Heavy lift capability
- Flexible cargo handling: accommodates ISO intermodal containers, non-standard containers, palletized freight, large outsized freight items and winch-suspended sling loads
- Precision hovering load exchange, including hovering in windy conditions.
- Designed for Arctic operation: year-round in an operating temperature range from +110 to -50 degrees F.
- Engines with thrust vectoring capability
- Cruise speed 65 kph (40 mph); maximum speed 130 kph (81 mph)
- Retractable landing pods
- Minimum or no ground infrastructure required
- Improved operational availability

Load exchange process

With the variable buoyancy control system described in US patent US 9,899,514 B2, it appears that the LTA 10 and LTA 70 airships have the means to adjust their buoyancy when picking up or dropping off cargo and/or passengers.

It is assumed that the variable buoyancy control system has the ability to establish near-neutral buoyancy in flight and in hover, and that the airship will land from a hover with the assistance of vectoring thrusters and/or air balloonets. Once on the ground, the airship would be made heavier-than-air
so it is stable while cargo is being loaded and/or unloaded. The nose landing gear is designed to be secured to the ground to serve as the pivot point around which the airship moves to point into the wind.

Taking into account the new overall weight of the airship after the load exchange, the variable buoyancy control system will reestablish near-neutral buoyancy on the ground immediately prior to takeoff and then takeoff will be executed with the vectoring thrusters and/or air ballonets.

LTAA has noted that airships returning from destinations in the Canadian Arctic can be loaded with trash and other cargo that should be removed from the sensitive Arctic environment.

A “precision hovering load exchange” will be more challenging because the airship must maintain its airborne position throughout the load exchange transaction. The speed of this transaction will be governed by the size of the load and the rate at which the variable buoyancy control system’s can change the overall buoyancy of the airship so that suspended loads can be safely delivered at the destination and other loads picked up for delivery to another site.

**The LTA 10 airship**

The LTA-10 is aimed at transportation and logistics roles in northern Canada, including governments and First Nation logistics and commercial mining, oil and gas exploration logistics. The LTA 10 airship is 80 meters (262 feet) long, with a maximum width of 40 meters (131 feet). It is designed to carry 10 metric tons (11 short tons; 22,000 pounds) of cargo. Planned propulsion will be by four vectorable PT-6 turboprop engines. Operating range is 1,287 km (800 miles).

**The LTA 70 airship**

The LTA-70 is designed to provide heavy-lift cargo services in northern Canada for mining production and extraction and facilities construction, including wind farms and other power plants. The LTA 70 airship will be 152 meters (499 feet) long, with a maximum width of 76 meters (249 feet). It is designed to carry 70 metric tonnes (77 short tons; 154,324 pounds) of cargo. Propulsion will be by six vectorable electric motors powered by diesel / solar / fuel cells. Operating range is 4,074 km (2,531 miles).
General arrangement of an LTA airship. Source: LTA Aerostructures
Four views of an LTA airship and its cargo module.
Source: LTA Aerostructures

ISO cargo module handling.
Source: LTA Aerostructures
Rendering of an LTA airship operating in the Arctic.  
*Source: LTA Aerostructures*