

TROPOSPHERIC AIRSHIP

Concept study of an observation airship for arctic operations





A RADICALLY DIFFERENT KIND OF AIRSHIP

EADS Innovation Works is conducting a concept study for an innovative hybrid airship that is envisioned for use in multi-role missions in Arctic regions, providing a long-endurance platform capable of all-weather operations. Its missions will be environmental and wildlife monitoring, natural resources management, observation and security applications, along with the surveillance of shifting ice patterns and related tracking of ships in the increasing number of open-water routes that are created by the warming climate. The airship is tailored for tropospheric flight up to altitudes of 7,000 metres, with an all-terrain capability allowing its deployment from established base locations as well as unprepared sites without ground support infrastructure.

THE ARCTIC ENVIRONMENT

The melting of the Arctic ice cap is creating new challenges and opportunities for the vast land masses and ocean waters of the region, increasing the need for constant monitoring of the natural environment and the impact from activities of industrial developments and increased traffic. Deployment of the EADS Tropospheric Airship on extended surveillance, detection and reporting missions would provide a new-generation resource that is nearly silent in operation and generates little or no emissions – while offering significantly longer endurance than patrol aircraft or unmanned aerial vehicles – at lower costs. The airship's size will enable it to carry a range of mission payloads.

HYBRID LIFT CONCEPT

The Tropospheric Airship is based on an imaginative catamaran-type design combining aerostatic lift with helium gas in a rigid airframe and additional lift from its wings. The variation of the gas volume required for flight up to 5,000 meters is considerably less than the variation needed for 7,000 meters, resulting in a smaller overall hull volume and the possibility to incorporate an innovative buoyancy control system.



INNOVATIVE BUOYANCY CONTROL

A breakthrough technology for the hybrid Tropospheric Airship will be the use of multi-segmented buoyancy cells in the lower part of the two hulls. Extending a cell increases its volume and reduces the internal gas pressure, resulting in increased buoyancy and a lifting force. Retracting a cell reduces the volume, compresses the gas and decreases the cell's buoyancy. Extending and retracting the cells in unison can control climb and descent of the airship. When moving them differentially by segment, the changes in buoyancy allow control of the vehicle's attitude in pitch and roll.

Yaw control is provided by sideward facing fans that are positioned forward and aft on each side of the twin hulls. Propulsion is provided by aft-mounted diesel or electric engines located on each hull, which drive pusher propellers.

OPTIMISED SHAPE

The Tropospheric Airship has an overall length of 90 meters, with a width of 60 meters and a height of 8 meters. Its novel twin-hull design creates a more streamlined profile than single-body dirigibles – reducing aerodynamic drag. The low height, in particular, facilitates hangarage for maintenance, systems integration or storage, thereby eliminating the need for hangars with the extremely high internal clearance required for conventional single-hull airships.

LARGE OPERATING ENVELOPE

Designed primarily for unmanned missions, the airship is to have an uninterrupted endurance of up to 40 days. Flight speeds will be from 60 km./hr. to 150 km./hr., with this range applicable throughout the airship's flight envelope. The aerostatic buoyancy alone allows attaining an altitude of 5,000 meters. With additional lift being created in forward flight by the fore and aft wings, an altitude of 7,000 meters can be reached. The tandem wings will also contribute to the airship's manoeuvring capabilities in the landing phase, where "negative lift" can provide the necessary down-force to secure the vehicle on the ground in high wind conditions – eliminating the need for mooring systems that are required at landing sites for conventional airships. Ground handling is facilitated by landing gear that could take multiple forms: skids with saw-tooth contours and grapple devices to provide grip are being considered, while retractable wheels would be used at airfields.

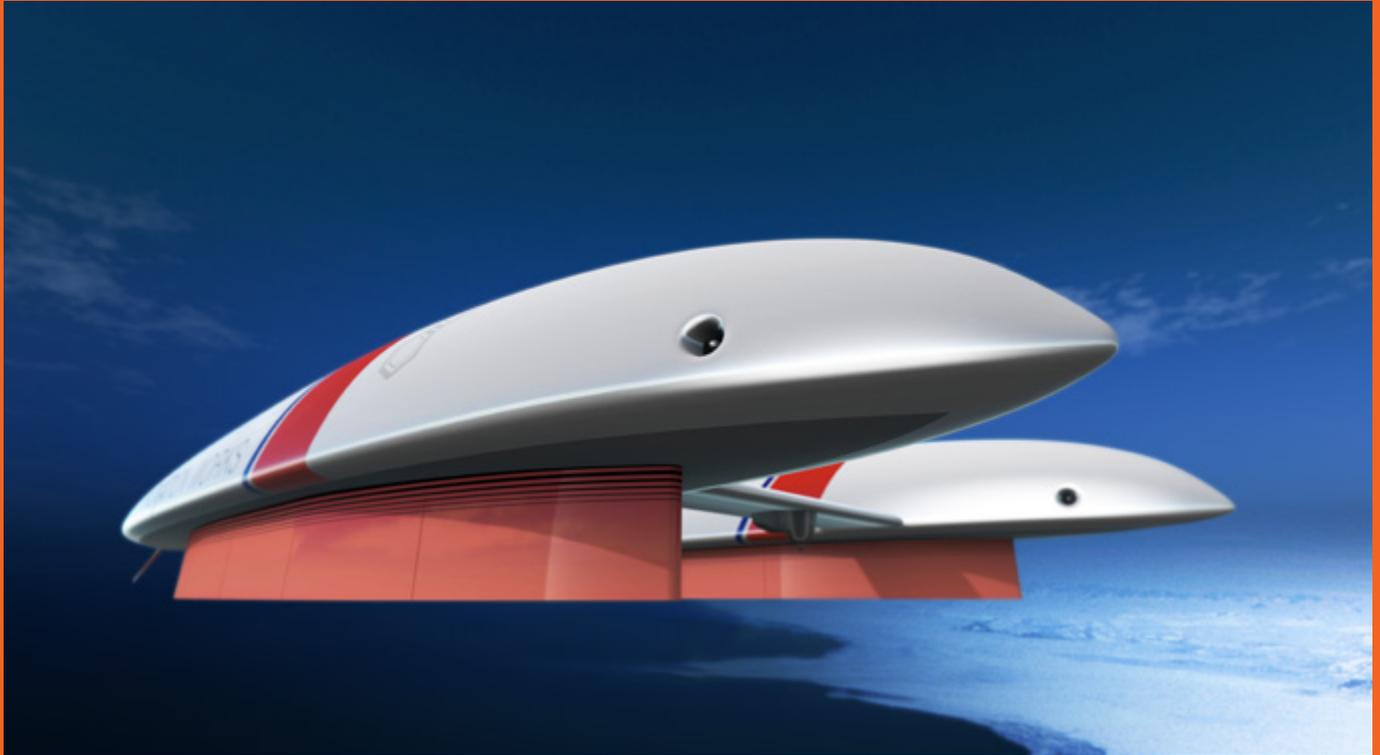
EXPANDED MISSION CAPABILITIES

The Tropospheric Airship's unique flight characteristics open up many mission possibilities. Its size allows a full complement of sensors, cameras and information processing systems to be installed, while the integration of antennas enables collected data to be forwarded via satellite links. In support of search and rescue operations, the airship also can serve as an airborne relay platform for the transmission of distress signals.

Among other potential scenarios are the surveillance for homeland security, the detection and documentation of illegal dumping of bilge oil by ships, the exploration of remote and less-charted regions in support of forestry, mining and oil/gas sectors and fisheries protection. In its secondary role as a cargo transport, the airship can carry 1 ton at an altitude of 7,000 meters and 7 tons at 1,000 meters as external sling loads. At the critical point of releasing the cargo on the ground, with the airship hovering above, the buoyancy cells are used to counteract the sudden increase in lift at the moment of release.

PROGRAMME STATUS

By studying the Tropospheric Airship concept, EADS Innovation Works is further applying its expertise in defining new means of air transportation and contributing to users' mission responsiveness. Following the airship's initial definition, the company is seeking partners for follow-on work that could lead to flight tests of a first (manned) demonstrator in three years.



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