# Aeroscraft's
# COSH
# Buoyancy Management System

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## Overview

This is a breakdown of Aeroscraft’s COSH buoyancy management system.

- COSH: Control of Static Heaviness

## Buoyancy Control Mythology

It’s a common misconception today that it’s impossible to manage excess buoyancy in a timely manner because the equipment needed for compressing and storing the excess lift gas would be too slow and heavy.

Aeroscraft’s COSH buoyancy management system is one example of why, in the 21st century, it’s not only possible to neutralize excess buoyancy in a timely manner but also to compress and store the excess lift gas it represents onboard and at low pressures.

## COSH Background and History

Under the direction of its founder and CEO, Igor Pasternak, Aeroscraft developed and successfully tested their COSH buoyancy management system in 2005 as part of the WALRUS program.

The COSH was deployed in their Dragon Dream ML806 prototype which had its first test flight in 2013.

## Buoyancy Management System Explained

A buoyancy management system is a system that can successfully manage the buoyancy requirements of a lighter-than-air aircraft.

It must have the capability to increase or decrease buoyancy to match loading, environmental, and crew requirements.

One of the capabilities of a modern buoyancy management system is the timely compression and onboard storage of excess lift gas whenever its buoyancy is no longer needed.

The greatest test of a buoyancy management system occurs during the offloading of the aircraft's single largest load, as this will require management of the greatest volume of lift gas in the shortest possible time.

## Types of Buoyancy

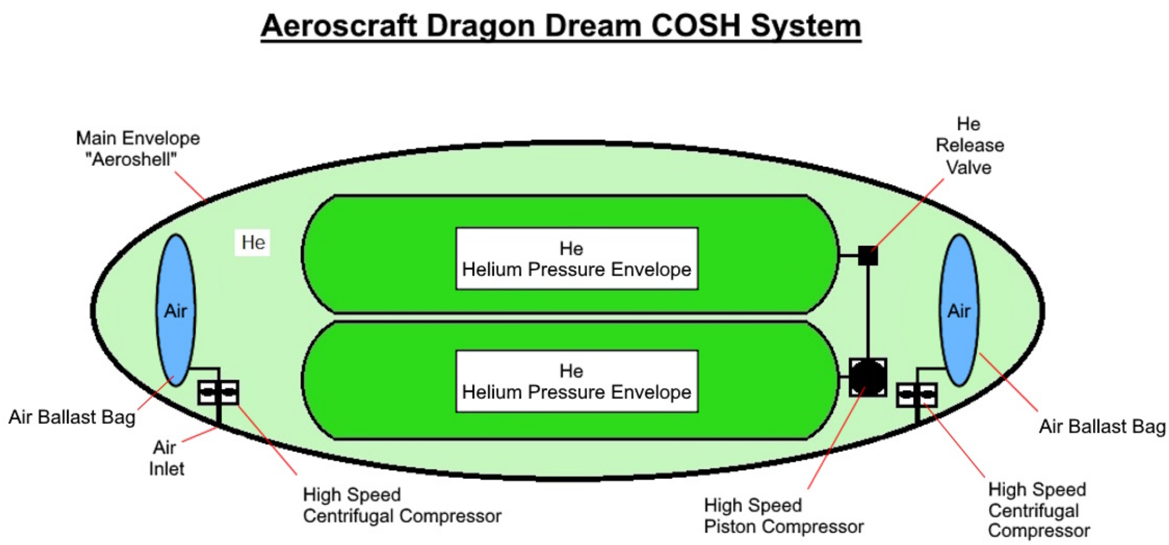
There are 3 types of buoyancy that a lighter-than-air aircraft can experience, which are also shared by the modern submarine industry:

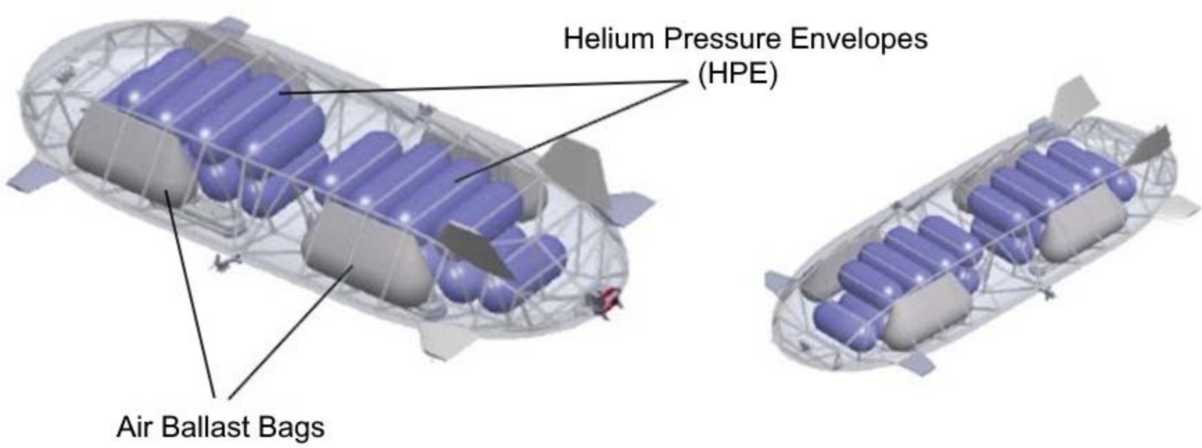
- Negative
  - The lighter-than-air aircraft is heavy because its buoyancy is less than its loading.
- Neutral
  - The lighter-than-air aircraft's buoyancy is equal to its loading.
  - This is the most fuel-efficient condition as it presents the least amount of drag.
- Positive
  - The lighter-than-air aircraft is light because its buoyancy is greater than its loading.

## COSH Components - Acronyms and Terminology

- HPE
  - Helium Pressure Envelope
  - Fabric He storage containers within the main envelope
  - Approximately 18 – 9 forward, 9 aft.
  - Capable of storing compressed gas up to 100 psi
- EC
  - Energy Converter - piston operated compressor
- VTOL
  - Vertical Take Off and Landing
- VMS
  - Vehicle Management System
- Air Ballast Bags
  - Large air bags within the airframe used to store pressurized air for ballast.

## COSH Design Components



## Dragon Dream Design Specs

| | |
|---|---|
| Aircraft Type | Rigid, fixed volume, variable buoyancy |
| Length | 81.1 m (266 ft) |
| Width, max | 29.3 m (96 ft) this is the max width of the body |
| Height, max | 15.7 m (51 ft) |
| Gas volume | 17,000 cubic meters (600,000 cubic feet) |
| Air volume | 767,077 cubic feet (estimated) |
| Air ballast bag volume | 41,769 cubic feet each (estimated) |
| Air ballast weight | 3,194 lbs. each (when pressurized to 14.7 psi) |
| Gross weight | 16,329 kg (36,000 lbs.) |
| Gross lift | 37,588 lbs. (at sea level with 95% lift gas purity) |
| Useful lift | 1,588 lbs. (at sea level with 95% lift gas purity) |
| Propulsion | 2 x engine-driven, flank-mounted thrust vectoring propellers<br>1 x engine-driven, stern mounted, three-bladed, fixed propeller with thrust vectoring. |
| Cruise speed | 40 knots (46 mph) |
| Operating altitude | 2,987 m (9,800 ft) |
| Crew | 2 x flight crew |
| | |

## COSH Operation When Loading

When cargo is added to the Dragon Dream, additional buoyancy will be required to support the new load.

To increase buoyancy, the release valves on the Helium Pressure Envelopes, aka HPEs, are opened allowing pressurized helium to flow into the Dragon Dream's main envelope or aeroshell.

## COSH Operation When Unloading

When removing cargo from the Dragon Dream, the excess buoyancy that results must be neutralized and the excess lift gas representing that buoyancy must be compressed and stored onboard for later use.

To neutralize the excess buoyancy, air is pumped into the 4 air ballast bags until the air ballast equals the weight of the cargo being unloaded.

Once the unloading is completed, the excess lift gas that was used to carry the cargo is compressed by the high-speed piston pumps and stored under pressure in the HPEs.

While the excess lift gas is being compressed and stored, the air ballast in the air ballast bags is simultaneously released.

This is necessary to keep the Dragon Dream in a neutrally buoyant state.

## Additional Reference Documents

For additional information on Aeroscraft's COSH and Dragon Dream project, see the "Aeroscraft's Dragon Dream ML806 prototype" document, which is available on our "Dragon Dream" webpage.

## Additional Images


# Aeroscraft's COSH Buoyancy Management System