Lazzarini Design Studio – *Colossea* mega-yacht & *Norge 2.0* companion airship

Peter Lobner, 17 September 2024

1. Introduction

The Italian firm Lazzarini Design Studio was founded in Rome in 2010 by designer Pierpaolo Lazzarini. The firm's first airship designs were their catamaran Air Yachts (two versions, 2021 – 2022).

Introduced in March 2024, the elegant *Colossea* mega-yacht, measuring 204 meters (699 ft) in length, is a powerful floating docking station for a detachable rigid airship known as *Norge 2.0*, measuring 106 m (347 ft) in length. The mega-yacht can cruise long distances at up to 22 knots with the airship securely docked on its upper deck. At a desired location, the airship can undock and fly away to continue the journey independently before returning to the ship and re-docking.

Colossea with docked Norge 2.0 airship. Source: Lazzarini

Lazzarini states that the *Colossea* is a tribute to the Italian N1 semi-rigid airship designed by engineer and General Umberto Nobile, and renamed *Norge* for the 1926 Amundsen-Nobile-Ellsworth expedition, which flew over the North Pole without landing on 12 May 1926. After enduring a storm, the airship finally touched down in Teller, Alaska on 14 May 1926. This is believed to be the first verified expedition to have reached the North Pole.

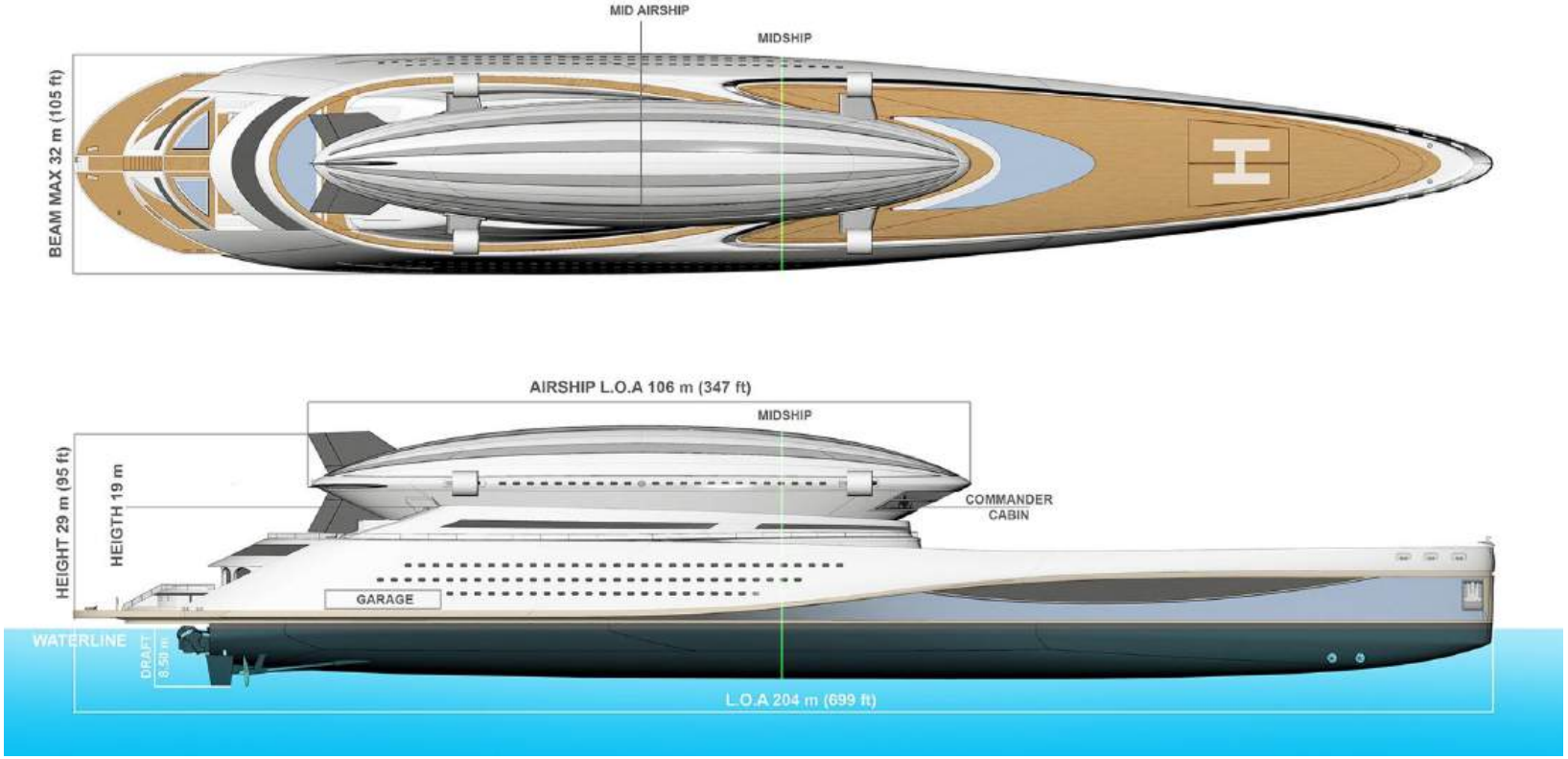
2. The *Colossea* mega-yacht

Key engineering features of the *Colossea* include the following:

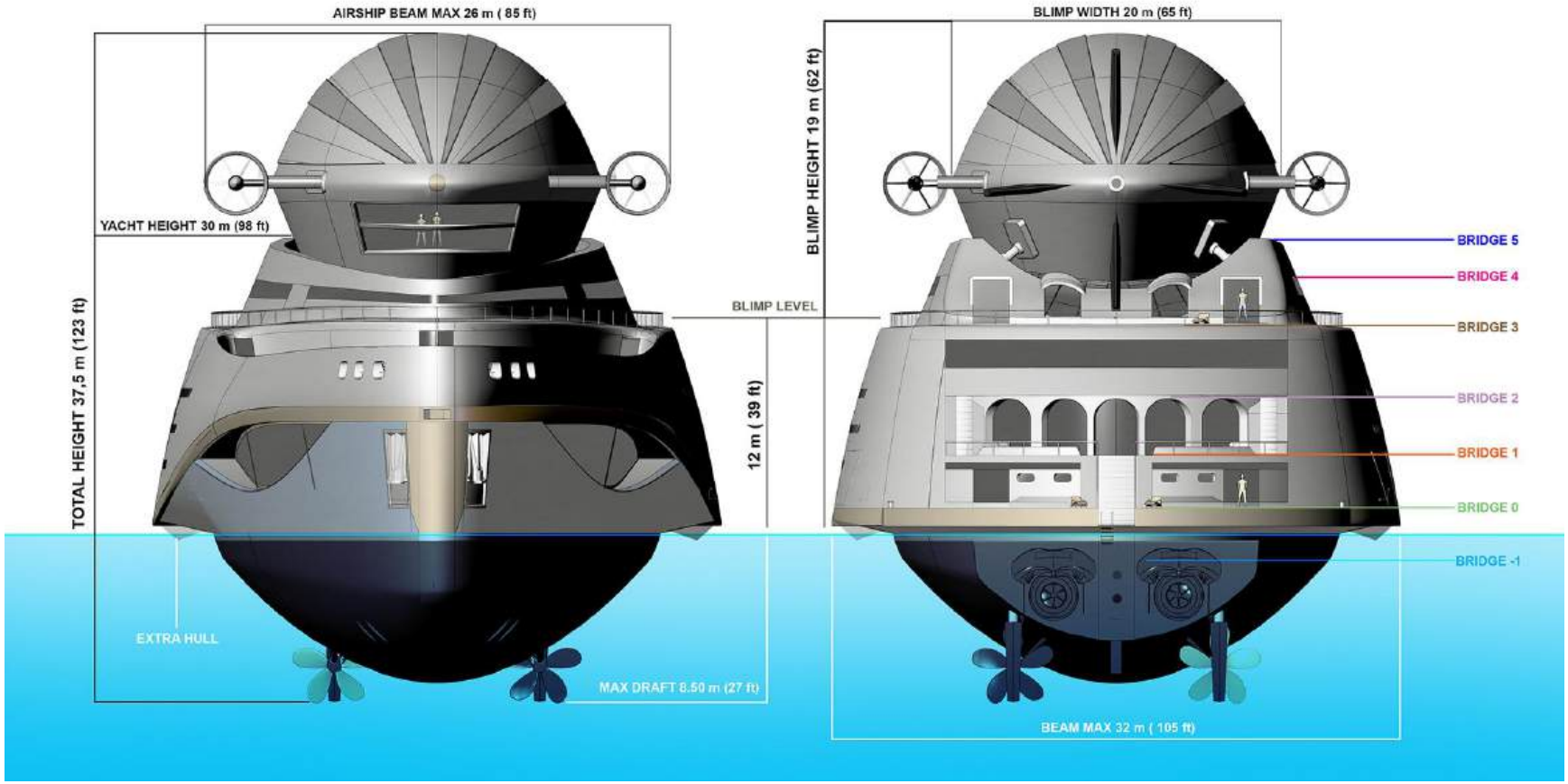
- The vessel is fabricated primarily from carbon fiber materials.
- In addition to all the other amenities frequently associated with mega-yachts, the vessel has a conformal docking station that enables carriage and operation of a large, detachable companion airship.
- The vessel carries liquid hydrogen (LH2) for use as a source of power for the yacht and the companion airship, as well as for the airship's lifting gas.

General characteristics of the Colossea yacht

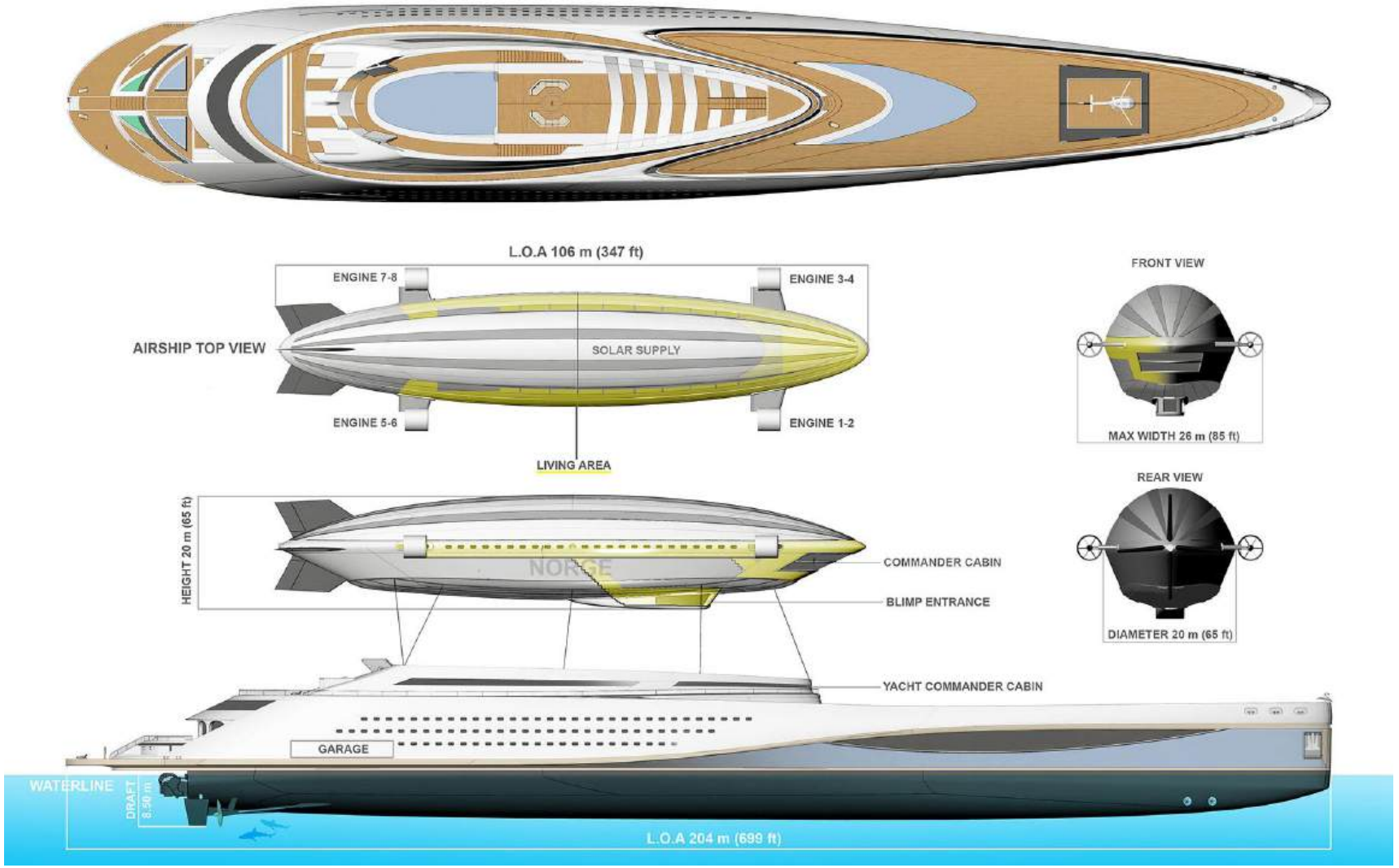
Parameter	**Lazzarini Design Studio Colossea yacht**
Type	Monohull mega-yacht that also serves as a floating docking station for a detachable companion airship.
Hull material	The ship's hull and internal structures are constructed primarily of carbon fiber materials.
Length, overall	204 m (699 ft)
Beam, max	32 m (105 ft)
Height, overall, w/o airship	30 m (98 ft)
Height, overall, w/ docked airship	37.5m (123 ft)
Draft, max	8.5 m (27 ft)
Yacht crew	20
Yacht passenger accommodations	• 44 passengers in 22 guest suites • Multiple decks, including common area & pools fore and aft • Access is via a gondola • A helicopter landing pad is on the foredeck
Power source	Cryogenically-stored liquid hydrogen (LH2) is the "fuel" for shipboard electric generators, type not stated, but likely hydrogen fuel cells.
Propulsion	4 x high temperature superconducting (HTS) electric motors driving twin screws.
Speed, max	22 knots (40.7 kph / 25.3 mph)
Range, max	Not stated



Colossea mega-yacht general arrangement with Norge 2.0 airship docked. Plan and elevation views. Note the helicopter landing pad on the foredeck. Source: Lazzarini



Colossea mega-yacht general arrangement with Norge 2.0 airship docked. Bow (left) & stern (right) views. Note the overhang for the "extra hull." Source: Lazzarini



Colossea mega-yacht general arrangement with Norge 2.0 airship undocked but still tethered on mooring lines. Overhead and side views. Source: Lazzarini

Colossea bow quarter underway view with Norge 2.0 docked.

Colossea stern quarter underway view with Norge 2.0 docked.
Source, both graphics: Lazzarini

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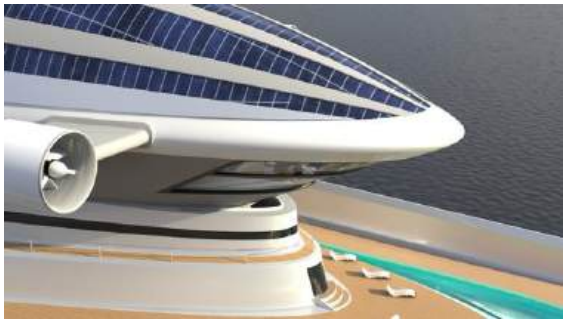
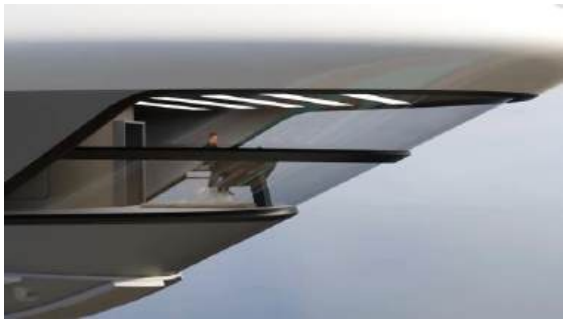
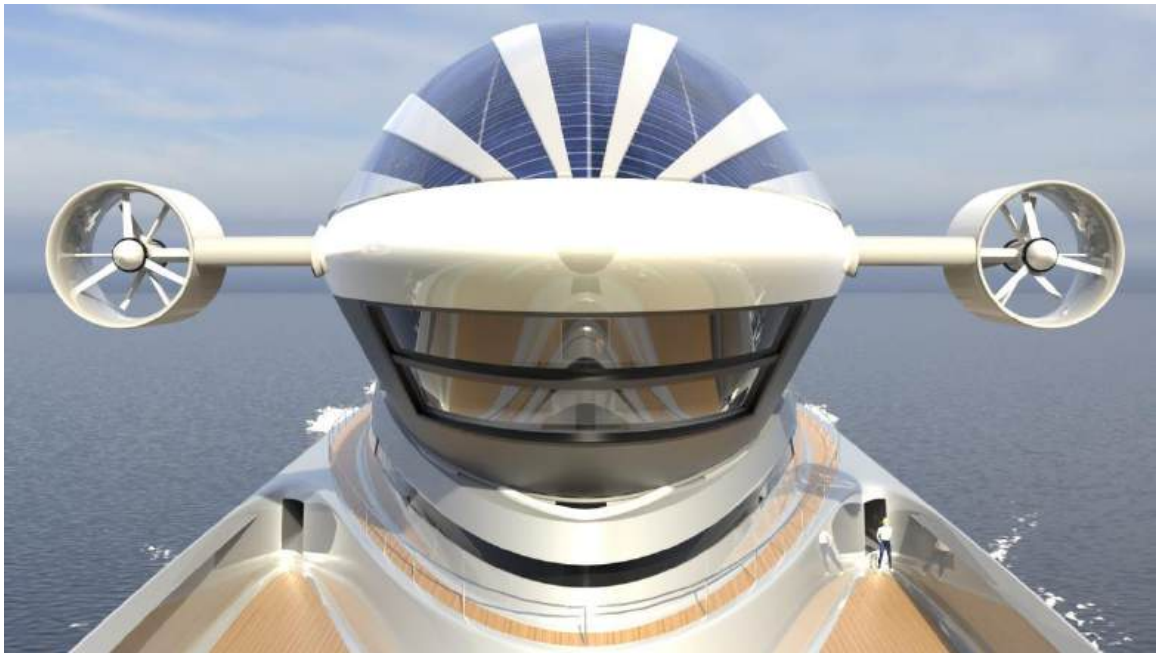
The Commander's cabin is a combined ship's bridge & airship flight deck

The Colossea's "commander's cabin" serves as both the bridge of the yacht and the flight deck of the airship, making the piloting experience practically seamless between the two craft.







The commander's cabin, tucked under the nose of the airship, serves as the bridge of the yacht when the airship is docked. Source, four graphics: Lazzarini

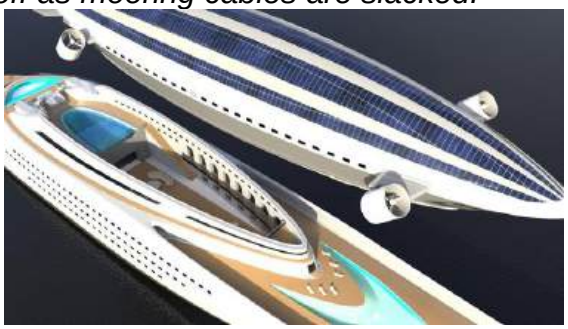
While not described by Lazzarini, the yacht presumable has a secondary piloting station to permit all shipboard functions, including navigating independently, to be performed when the airship is away on its own mission.

The upper deck is a conformal airship dock

The top deck of the *Colossea* is surrounded by a tall, roughly V-shaped structure that serves as a conformal dock to support and secure the *Norge 2.0* airship. The airship remains firmly docked to the upper deck of the yacht until it is ready to operate independently.

When the airship is ready to launch, it likely will be trimmed for slight negative buoyancy (slightly heavy). The four propulsors will be vectored up to deliver dynamic lift and the several mooring cables will be slackened to allow the airship to rise while being positively controlled until it is clear of the yacht. When the cables are released, they will be hauled aboard the airship as it gains altitude and forward speed while the four propulsors gradually rotate to their horizontal cruise position.

Norge 2.0 uses vector thrust to lift off as mooring cables are slacked.



Norge 2.0 ascends from its dock and departs. Source, three graphics: Lazzarini

Norge 2.0 departing from the Colossea yacht. Source, two graphics: Lazzarini

Upon returning to the *Colossea*, the process is reversed, starting with the *Norge 2.0* hovering precisely above the yacht and lowering its mooring cables. The yacht's crew will secure the mooring cables to a set of winches that will take a tension on the cables and haul the airship down until it once again is secured in its dock and the propulsors are shut down.

3. The *Norge 2.0* rigid airship

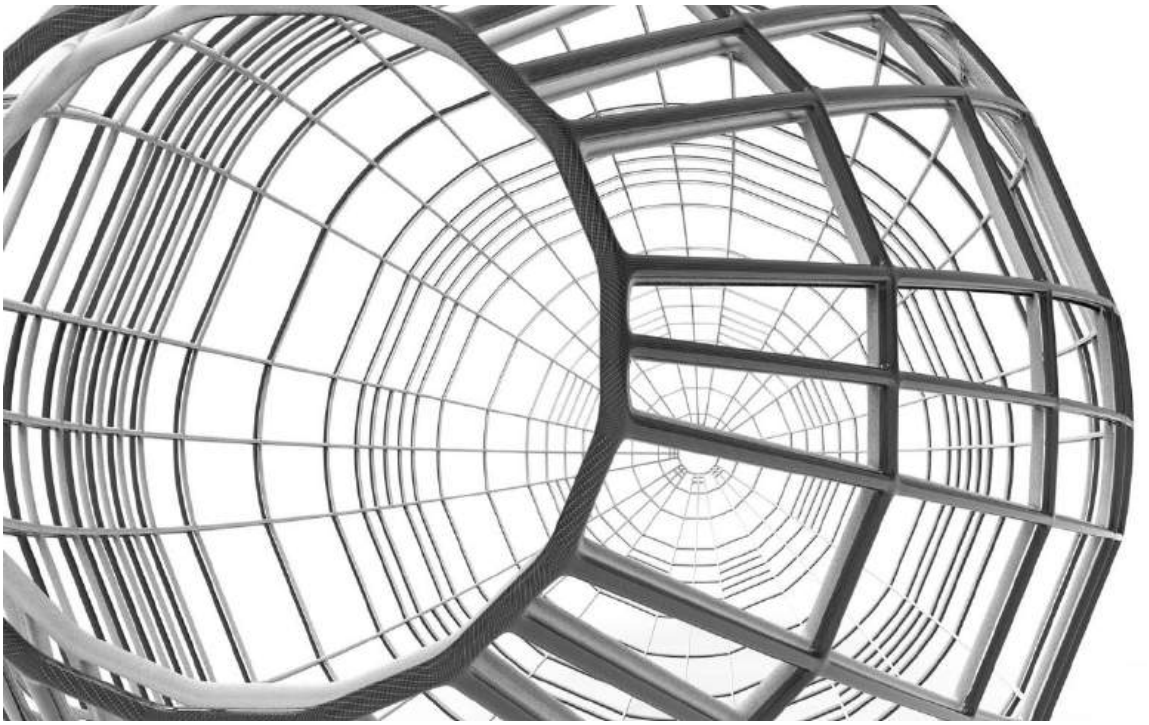
The basic external design of Lazzarini's *Norge 2.0* airship is very similar to a single hull of their 2022 catamaran Air Yacht, scaled down to the overall dimensions of the original 1924 *Norge,* which measured 106 meters (347 feet) in length, 19.5 meters (64 feet) in maximum diameter, and 26 meters (85 feet) in overall height.

The Air Yacht, V2. Source: Lazzarini (2022)

The Norge 2.0. Source: Lazzarini (2024)

Rigid airframe structure

The Norge 2.0 airship has a rigid carbon fiber structural airframe, stiffened by internal carbon fiber structures associated with 22 internal compartments. The exterior skin of the airship is carbon fiber sheathing supplemented by large photovoltaic (PV) arrays along the full length of the upper surface.



Rectangular space frame structure of the composite airframe, before installation of the composite bulkheads and central access passageway. Source: Lazzarini

Hydrogen lifting gas and power source

Lazzarini states that the *Norge 2.0* airship uses hydrogen as its lifting gas was well as a source of power.

> "The overall volume of the carrier gas compartments have 30,000 m^3, which grants the aircraft enough space to release sufficient H_2 into any compartment. The LH2 is released into the compartments to adjust the weight balancing needed and also as H_2 reserve in case of gas loss.
>
> The same LH2 is devoted to supplying the necessary energy requirement of each engine, capable of pushing the flying vessel to an estimated maximum speed of 165 km/h (about 90 knots)…"

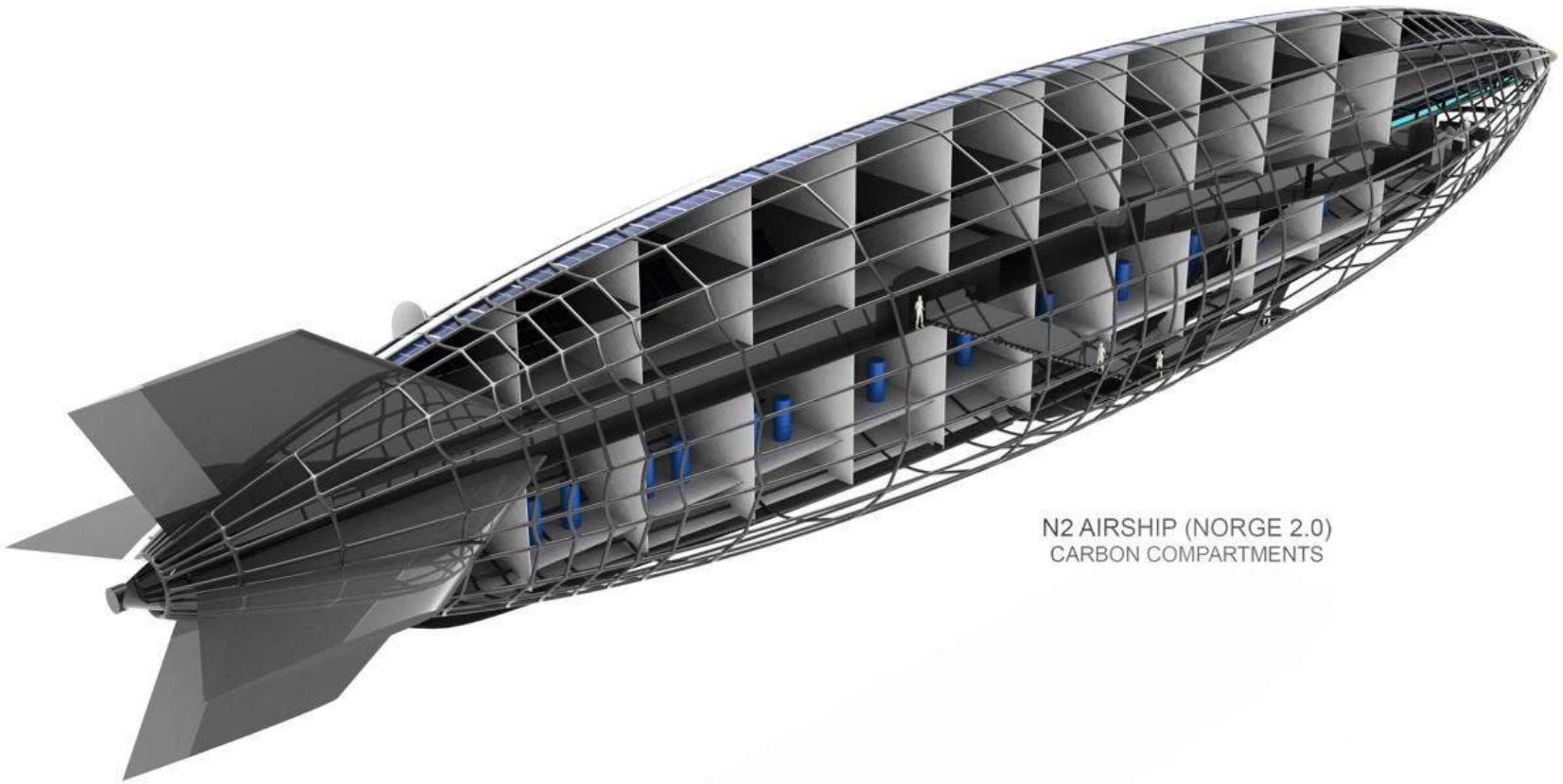
Norge 2.0 likely would be trimmed to operate with a slight negative buoyancy (slightly heavy). If needed, lifting gas volume adjustments could be from a shipboard system before flight, while the airship is docked.

The large photovoltaic array on the upper surface of the airship generates power as part of a hybrid electric power system that includes shipboard batteries for energy storage. While not specifically identified by Lazzarini, a hydrogen fuel cell system could provide additional power generation to support the higher power demands during high speed flight and maneuvering (i.e., hovering, VTOL) as well as flight operations at night.

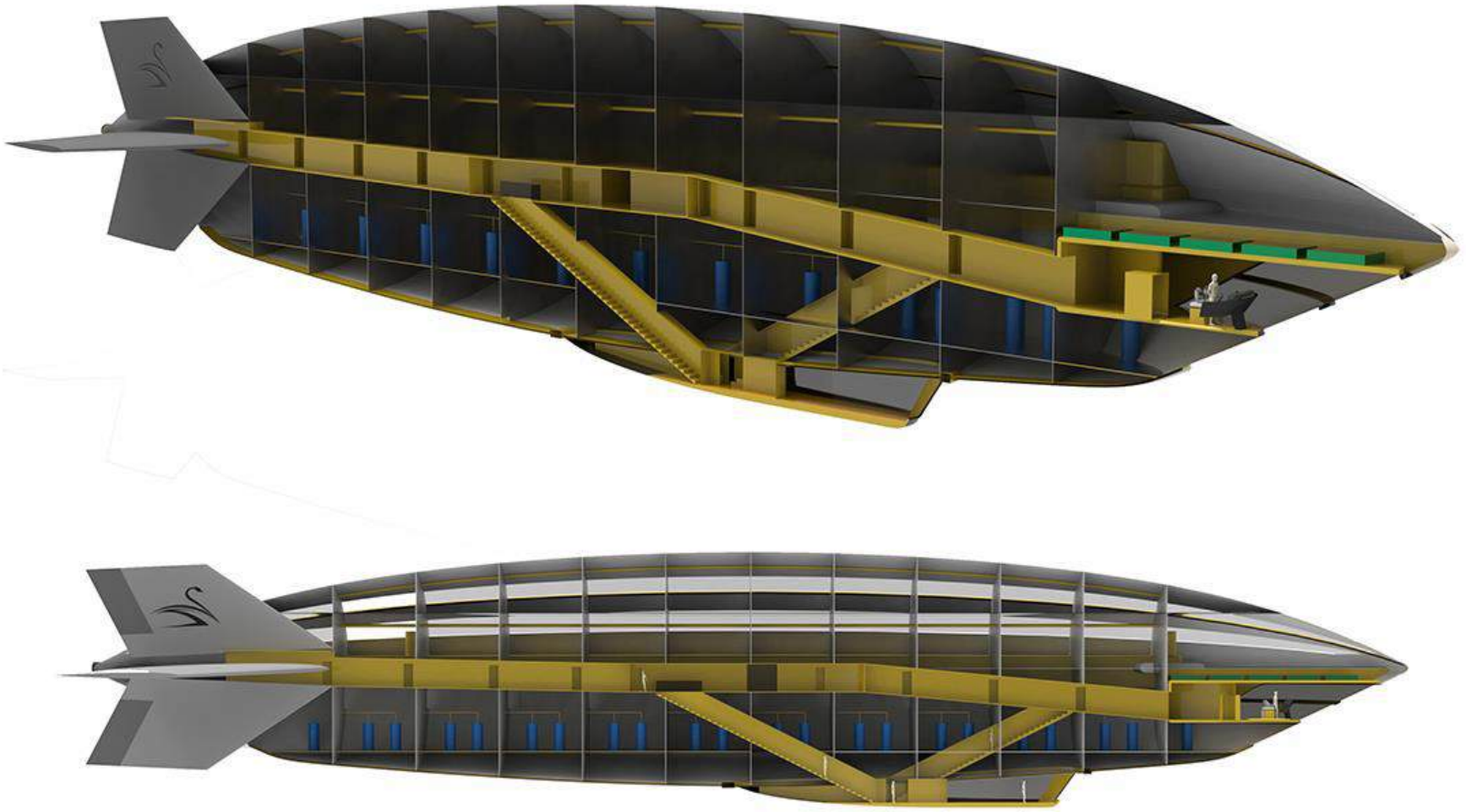
Passenger and crew accommodations

Norge 2.0 can accommodate a maximum of 24 passengers and a flight crew of 10. Passengers and crew access the *Norge 2.0* via a gondola under the hull, and then ascend via fore and aft stairways to the central passageway running the length of the hull. Twelve passenger cabins are arranged along this passageway.

Twelve passenger cabins are located along the midline of the hull, with access to the central passageway. Source: Lazzarini



Norge 2.0 cut-away view showing the rectangular space frame structure of the composite airframe, the interior compartmentalization, and the central passageway and diagonal stairways connecting to the gondola. Note also how the cruciform tail fins are attached to the central passageway structure. Source: Lazzarini



Norge 2.0 cross-sectional views down the centerline of the airship. Note the interior compartmentalization, the central passageway and diagonal stairways connecting to the gondola (gold), and the cockpit tucked under the nose of the airship. Source: Lazzarini

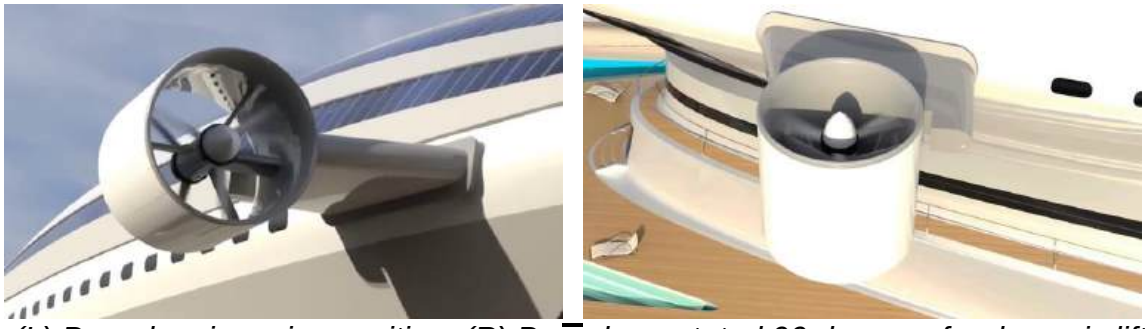
Norge 2.0 side view in cruise flight with the shrouded propulsors rotated to the horizontal position. The crew and passengers enter the airship via the small gondola under the hull. Source: Lazzarini

Thrust vectoring propulsors

Propulsion and maneuvering control is provided by two pairs of shrouded thrust-vectoring propulsors that are supported on short, streamlined pylons attached to the rigid airframe. Each shrouded propulsor unit consists of two propellers (likely contra-rotating as on the Lazzarini Air Yacht) driven by two separate electric motors. The propulsors face forward in cruise flight and when the airship is docked. They rotate vertically to generate dynamic lift during vertical takeoff or landing (VTOL) and hovering flight, and then transition back to the cruise position.

This thrust vectoring system enables the airship to maintain precise control at low or zero airspeed when the aerodynamic flight control surfaces are ineffective. The system enables a precise VTOL and hovering over designated geographic coordinates (i.e., over the anchored yacht or another destination).

Norge 2.0 likely would be trimmed to operate with a slight negative buoyancy (slightly heavy). The thrust vectoring system should provide some operational flexibility by enabling the airship to cruise in heavy or light loaded conditions, within appropriate limits.



(L) Propulsor in cruise position, (R) Propulsor rotated 90 degrees for dynamic lift during VTOL flight. Source, both graphics: Lazzarini

General characteristics of the airship *Norge 2.0*

Parameter	**Lazzarini Design Studio airship *Norge 2.0***
Type	Rigid airship
Airframe material	Carbon fiber rigid airframe structure and external carbon fiber skin
Length, hull	106 m (347 ft) (62.7% of Air Yacht single hull length)
Width, hull	20 m (65 ft) (50% of Air Yacht single hull width)
Fineness ratio	5.3 (vs. 4.2 for Air Yacht single hull)
Width, overall	26 m (85 ft) (maximum width between the outer edges of the hull-mounted shrouded propulsors)
Height, overall	20 m (65 ft)
Volume, hull	30,000 m^3 (1,059,440 ft^3)
Lifting gas	Hydrogen
Payload	10,000 kg (10 metric tons / 11 tons)
Airship weight, empty	Est. 20,000 kg (20 metric tons / 22 tons)
Airship crew	10
Passengers	24
Power source	• Hybrid solar photovoltaic system with solar arrays installed along the top of the hull and onboard batteries for energy storage. • While not stated, additional onboard electric power generation may be provided by an onboard hydrogen fuel cell system.
Propulsion	• Four shrouded, thrust vectoring propulsors, each with two propellers (likely contra-rotating). • Two electric motors drive each propulsor, for a total of eight electric propulsion motors.
Buoyancy control	Liquid hydrogen (LH2) stored aboard the yacht manages airship hydrogen lifting gas while docked.
Aerodynamic control surfaces	Cruciform tail with elevators & rudders
Air speed, max	90 knots (165 kph / 103.6 mph)
Altitude, cruise	Not stated
Range, max	Not stated
Endurance	Not stated

4. From concept to reality?

The Colossea project has an estimated price of £787,000,000 (about $1.03 billion). As with many airship design concepts, the next step depends on finding a patron with impressive financial resources.

5. For more information

- Bill Smith,, “Lazzarini’s Colossea Mega-Yacht Comes with its Own Detachable Airship Called ‘Norge,’ TECHEBLOG, 3 March 2024: https://www.techeblog.com/lazzarini-colossea-mega-yacht-airship-norge/
- Tori Latham, “This Massive Megayacht Concept Has a Built-In 347-Foot Blimp That Lets You Steer From the Skies,” Robb Report, 7 March 2024: https://robbreport.com/motors/marine/lazzarini-colossea-superyacht-airship-1235537086/
- “Sailing the Skies With Colossea by Pierpaolo Lazzarini,” The Arsenale, 8 March 2024: https://thearsenale.com/blogs/magazine/sailing-the-skies-with-colossea-by-pierpaolo-lazzarini

The original Norge airship

- “Expeditions – The Norge flight (1926),” FRAM – The Polar Exploration Museum, 2019: https://frammuseum.no/polar-history/expeditions/the-norge-flight-1926/

Video

- “Colossea,” (2:05 min), posted by Lazzarini Design, 29 February 2024: https://www.youtube.com/watch?v=BfMf4yijthw

Other *Modern Airships* articles

- Modern Airships - Part 1: https://lynceans.org/all-posts/modern-airships-part-1/
- Modern Airships - Part 2: https://lynceans.org/all-posts/modern-airships-part-2/
    - Voliris – SeaBird airship & catamaran yacht
- Modern Airships - Part 3: https://lynceans.org/all-posts/modern-airships-part-3/
    - Lazzarini Design Studio - Air Yacht
    - George Lucian’s Dare to Dream yacht and its companion, the Flying Diamond airship