



Titan Tragedy Lessons for Proposed Indian Submersible Dive

For Prelims: Matsya-6000, Titan submersible, [Deep Ocean Mission](#), RMS Titanic, [Atlantic Ocean](#), [NOAA](#), [UNESCO](#).

For Mains: Deep Ocean Mission and Its Significance for India.

Why in News?

Scientists are preparing for a Deep See Dive with the Vehicle **Matsya-6000 in late 2024 similar** to the Titan **submersible**, which recently went missing.

- **The Matsya-6000 project under [India's Deep Ocean Mission](#)**, scheduled for late 2024, aims to explore the Indian Ocean at a depth of about 6,000 meters.
- In light of the recent incident of **Titan Submersible**, the safety systems employed for the crew will undergo reviews to ensure their effectiveness.

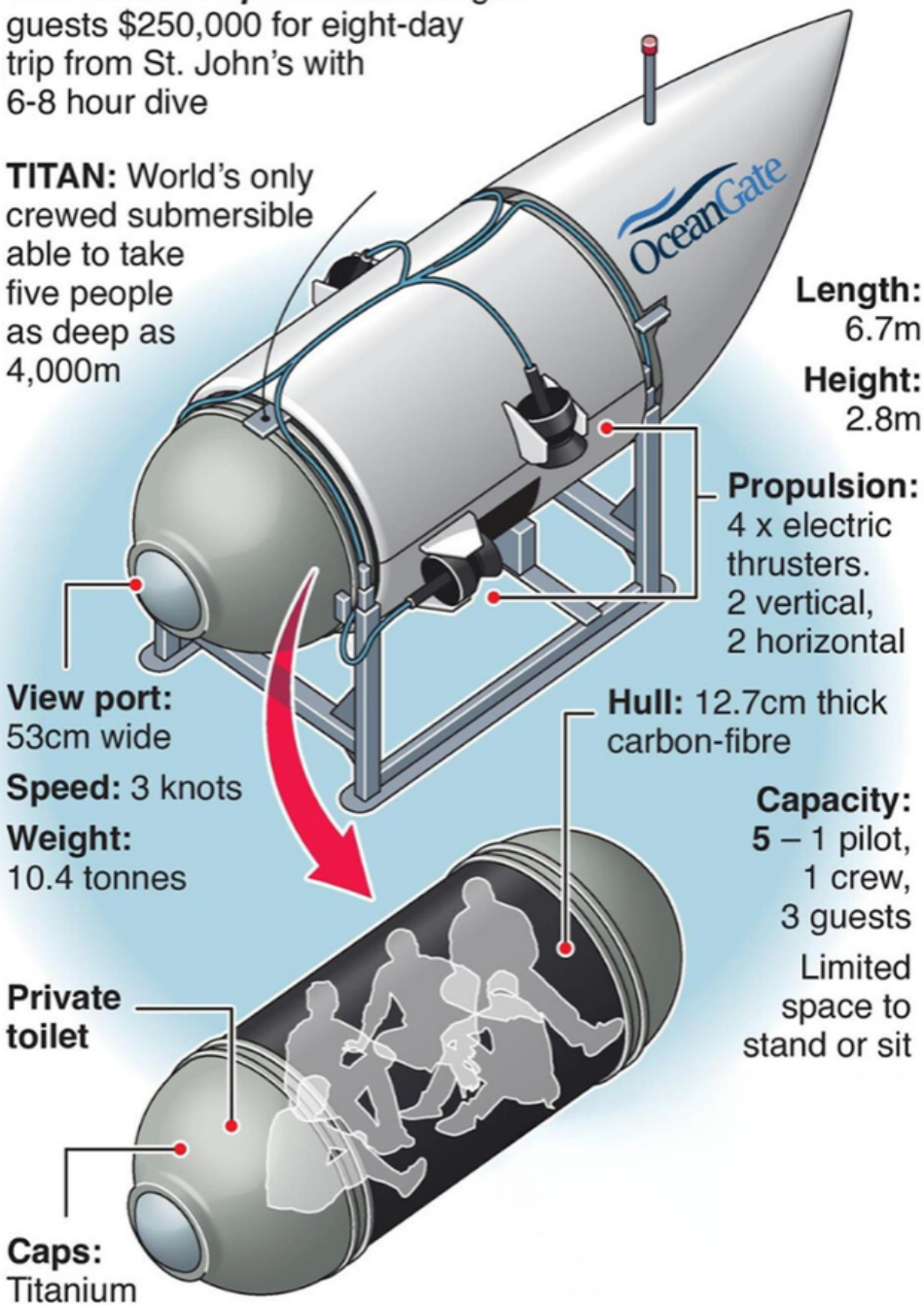
What are the Key Points of Titan Submersible?

- **About:**
 - Titan submersible is operated by the privately owned U.S. company **OceanGate that organizes underwater expeditions** for both research and tourism.
 - It was built with "off-the-shelf" components, is lighter and **more cost-efficient than other deep diving** submersibles.
 - Titan is made of **carbon fibre and titanium** and weighs 10,432 kilograms.
 - It is capable of **going 4,000 metres undersea** and moves as fast as three knots per hour (5.56 kph).

OceanGate's Titan Submersible

OceanGate Expeditions charges guests \$250,000 for eight-day trip from St. John's with 6-8 hour dive

TITAN: World's only crewed submersible able to take five people as deep as 4,000m



▪ Objective:

- Titan Submersible was travelling to see the **wreckage of RMS (Royal Mail Ship) Titanic**, which is nearly four thousand metres under water in the **frigid North Atlantic Ocean**.
 - One hour and forty-five minutes into the journey, contact with Titan was lost.

▪ Concerns:

- The submersible's forward viewport was certified for 1,300 meters, but OceanGate aimed to reach 4,000 meters.
- The technology and components of the submersible **may not have met rigorous safety standards**. Insufficient hull testing raises the risk of failure and endangers occupants.
- The **pressure vessel's combination of titanium and carbon fiber is unusual** and

raises concerns due to their different properties in deep diving situations.

What Happened to the Titan?

- The submersible “Titan” **experienced a “catastrophic implosion,”** according to the U.S. Coast Guard. The five occupants on board are presumed to have died during the implosion.
- An implosion is the **opposite of an explosion**. In an explosion, the force acts outwards, but in an **implosion the force acts inwards**. When a submersible is deep in the ocean it experiences **the force on its surface due to water pressure**.
- When this force becomes larger than the force hull can withstand, the **vessel implodes violently**.
 - With every **descent of 10 meters into the water**, the pressure increases by approximately one atmosphere.
 - One atmosphere is equivalent to the average atmospheric pressure at sea level, which is approximately **101.325 kilopascals (kPa) or 14.7 pounds per square inch (psi)**.

What are Carbon Fibres and Titanium?

- **Carbon Fibre:** Carbon fibre is a polymer that is **known to be quite strong despite being lightweight**. It can be as much as **five times stronger than steel** and twice as stiff.
 - A carbon-fibre composite, compared to titanium, is much stiffer and does not have the same kind of elasticity.
- **Titanium:** Titanium is as **strong as steel but around 45% lighter**. It is twice as **strong as aluminum** but only 60% heavier, according to the United States Geological Survey.
 - A titanium or thick steel pressure vessel is usually a spherical shape that can withstand the crushing pressures at 3,800m – the depth at which the Titanic wreck lies.
 - Titanium is elastic and **can adapt to an extended range of stresses without** any measurable permanent strain remaining after the return to atmospheric pressure. It shrinks to adjust to pressure forces and re-expands as these forces are alleviated.

Submarine Vs Submersible

- While the two categories can overlap, a **submarine refers to an underwater vehicle** that is largely independent and has power reserves to **help it depart from a port or come back** to the port after an expedition.
- Meanwhile, a submersible is **generally smaller in size** and has less power, so it needs to **work with a ship in order to be launched** and recovered.
 - The missing submersible Titan was working with a vessel named Polar Prince.

What are the Key Points Related to Matsya-6000?

- **About:**
 - Matsya-6000 is an indigenous deep-sea dive submersible being developed by the [National Institute of Ocean Technology \(NIOT\)](#) in India. It is designed to explore the depths of the Indian Ocean at a **depth of about 6,000 meters**.
 - The mission aims to send three Indian navigators to a point approximately 1,500 km away from Kanyakumari, India.
- **Objective:**
 - The mission's primary objective is to support India's energy requirements and explore ocean resources.
 - India aims to conduct exploratory mining for [Polymetallic Nodules](#) containing valuable resources such as copper, nickel, cobalt, and manganese.
 - This endeavor aligns with the Indian government's Deep Ocean Mission, which aims to develop vehicles and technology for ocean scanning and mining.

▪ **Features of Submersible:**

- The submersible features a **spherical titanium hull**, which is crucial for withstanding the immense pressure at great depths.
 - The titanium hull is manufactured by the [Indian Space Research Organisation \(ISRO\)](#), as no commercial fabricators in India were capable of producing such a hull.
- Two hemispheres of titanium alloy are **fused to create a single hull**, which serves as the primary barrier between the crew and the surrounding water columns.

▪ **Learning from Titan Incident:**

- The recent incident has highlighted the **need for thorough safety evaluations** and repeated testing.
- The inability to locate the submersible despite multiple communication systems **onboard raises questions**. Future submersibles may incorporate "**black box**" equivalents, similar to those found in aircraft, to aid in investigating the cause of such incidents.
- The choice of titanium for the submersible's enclosure, the utilization of syntactic foam, and the implementation of **acoustic communication and tracking systems should be thoroughly evaluated**.

UPSC Civil Services Examination, Previous Year Question

Q. Ilmenite and rutile, abundantly available in certain coastal tracts of India, are rich sources of which one of the following? (2023)

- (a) Aluminium
- (b) Copper
- (c) Iron
- (d) Titanium

Ans: (d)

Exp:

- India is endowed with large resources of heavy minerals which occur mainly along coastal stretches of the country.
- Heavy mineral sands comprise a group of seven minerals, viz, ilmenite, leucoxene (brown ilmenite), rutile, zircon, sillimanite, garnet and monazite. **Ilmenite (FeO.TiO_2) and rutile (TiO_2)** are the two chief mineral sources of titanium. Hence, option (d) is correct.

Source: TH

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