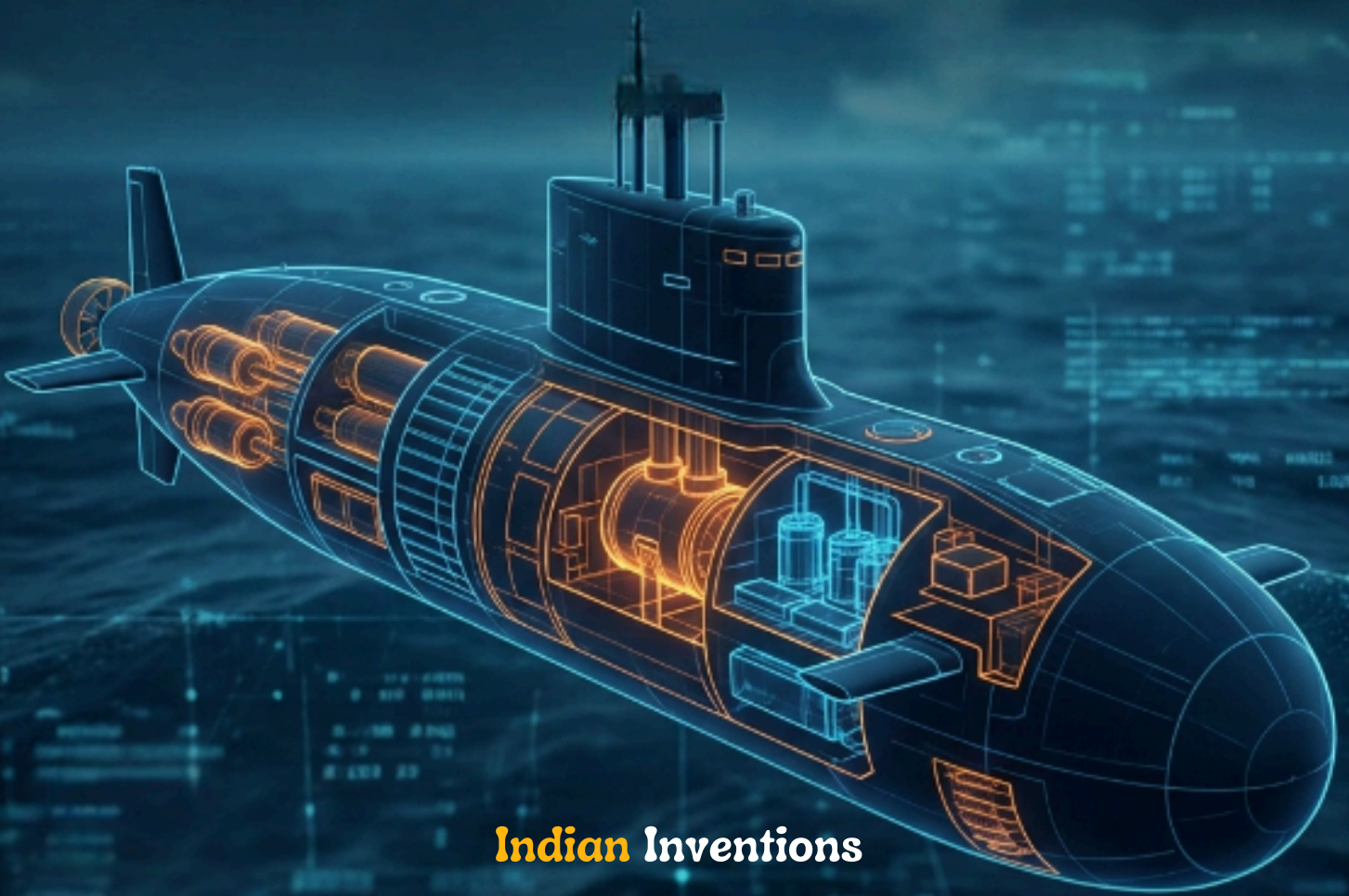




Indian Inventions

Arihant Class Submarine Technology

Arihant is India's Underwater Powerhouse & the Science Beneath the Sea. They are the Silent Guardians of the Ocean.

Deep beneath the ocean surface, invisible to the human eye and almost undetectable by enemies, moves one of India's most powerful defence systems, the **Arihant Class Submarine**.

Unlike ships that sail on water, submarines operate **underwater for long durations**, carrying advanced technology and strategic capabilities.

India's first nuclear - powered submarine, INS Arihant, represents a major milestone in the country's scientific and technological journey. This is not just a military achievement, but in innovation, **engineering, and scientific excellence**.

What is a Submarine?

A submarine is a vessel that can:

- Operate underwater
- Control its depth
- Stay submerged for long periods

What is the Arihant Class Submarine?

The Arihant class is a group of:

- Nuclear – powered submarines
- Capable of launching ballistic missiles
- Designed for long – duration underwater missions

Fun Fact

Nuclear submarines don't need frequent refuelling



Why Does India Need It?

- Strengthens national security
- Provides second – strike capability
- Ensures strategic deterrence

It forms part of India's **nuclear triad** (land, air, sea defence systems).

Where is it Used?

- Deep oceans
- Strategic defence zones
- Coastal and international waters
- Surveillance
- Deterrence missions

Who Developed It?

Defence Research and Development Organisation, Indian Navy and Bhabha Atomic Research Centre

Do You Know?

Sound travels faster in water than in air

Challenges

- Surface ships are visible and vulnerable
- Enemy detection systems are advanced
- Long – distance strategic defence is required
- Need for stealth (invisibility underwater)
- Requirement of long – duration missions
- Dependence on foreign technology

Develop an **indigenous nuclear submarine** that can:

- Stay underwater for months
- Avoid detection
- Carry strategic weapons

This leads to advancements in:

- Nuclear science
- Marine engineering

Defence technology



Scientific Concepts Behind Arihant

1. Buoyancy (Floating & Sinking)

Submarines use **ballast tanks**:

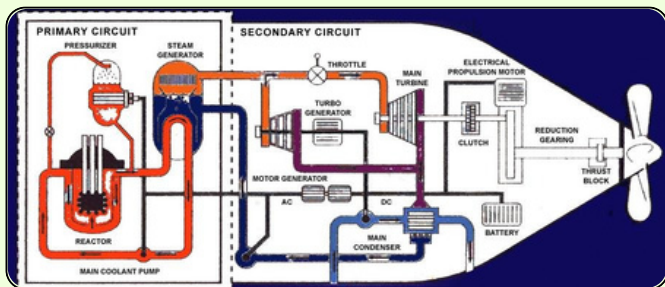
- Filled with water → submarine sinks
- Filled with air → submarine rises

This is based on Archimedes' Principle.

2. Nuclear Propulsion

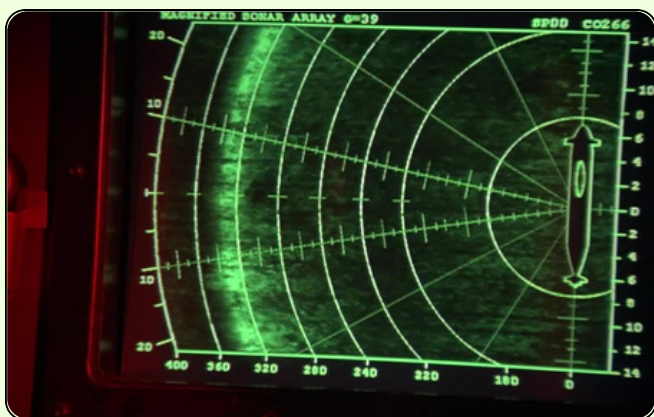
Instead of diesel engines, Arihant uses

- A nuclear reactor
- Generates heat → produces steam
- Drives turbines → moves submarine



3. Sonar Technology

SONAR = Sound Navigation and Ranging



- Uses sound waves
- Detects objects underwater

DIY Activity: Sound in Water

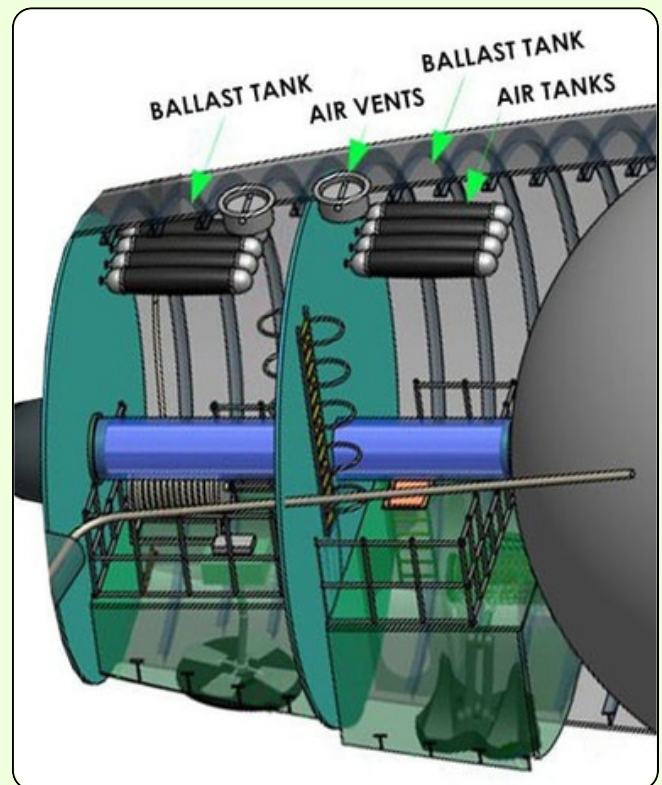
Tap two objects underwater and observe the sound transmission

4. Stealth Technology

- Special design reduces noise
- Makes the submarine hard to detect

How does it work?

1. **Submerge** using ballast tanks
2. **Navigate** using sonar and navigation systems
3. **Propel** using nuclear – powered turbines
4. **Communicate** using advanced systems
5. **Execute missions** stealthily



Answer in your own words?

- What is buoyancy?
- Why is stealth important?

Conclusion

Science Beneath the Waves. The Arihant – class submarine is a powerful example of how science works even in the deepest parts of the ocean.