Today's Prelims Topics

National Technical Textiles Mission

Context

The National Technical Textiles Mission has completed five years since its launch.

About National Technical Textiles Mission (NTTM)

- NTTM was launched by the **Union Textile Ministry** in 2020.
- It aims to **boost research, innovation, domestic production and exports** in technical textiles.
- India is the **6th largest exporter of textiles globally**, holding a **3.9% share** in world textile exports.
- The textile sector **contributes nearly 2% to India's GDP** and is expected to **grow to $350 billion by 2030**.

Key Initiatives Under NTTM

- **Grant for Internship Support for Technical Textiles (GIST 2.0):** Provides **hands-on training** to students in technical textiles.
- **Grant for Research & Entrepreneurship Across Aspiring Innovators in Technical Textiles (GREAT) Scheme:** Launched in **August 2023** to fund startups and entrepreneurs in technical textiles.
- **Skill Development Programs:** Aims to train **50,000 individuals** in technical textiles.
- **Technotex 2024 (Part of Bharat Tex 2024):** A **major global event** showcasing India's **technical textiles industry**.

What are Technical textiles ?

- Technical textiles are specialised textile materials and products designed primarily for their **functional properties** rather than aesthetic appeal.
- They are engineered for specific applications across various industries, emphasising performance characteristics such as **strength, durability and resistance to environmental factors.**
- **Based on usage, there are 12 technical textile segments:**

Meditech	Mobiltech	Oekotech	Packtech	Protech	Sportech
• Diapers, Sanitary Napkins, Disposables, Contact Lens, Artificial Implants	• Airbags, Helmets, Nylon Tyre Cords, Airline Disposables	• Recycling, Waste Disposal, Environmental Protection	• Wrapping Fabrics, Polyolefin Women Sacks, Leno Bags, Jute Sacks	• Bullet Proof Jackets, Fire Retardant Apparels, High Visibility Clothing	• Sports Net, Artificial Turf, Parachute Fabrics, Tents, Swimwear

Agrotech	Buildtech	Clothtech	Geotech	Hometech	Indutech
• Shadenets, Fishing Nets, Mulch Mats, Ant – hail Nets	• Cotton Canvas Tarpaulins, Floor and Wall Coverings, Canopies	• Zip Fasteners, Garments, Umbrella Cloth, Shoe Laces	• Geogrids, Geonets, Geocomposites	• Mattress and Pillow Fillings, Stuffed Toys, Blinds, Carpets	• Conveyer Belts, Vehicle Seat Belts, Bolting Cloth

Source:

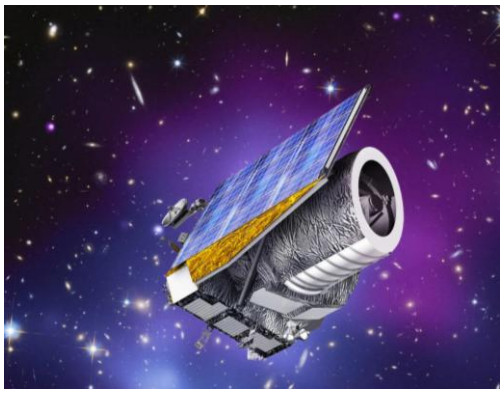
- **PIB - NTTM**

Euclid Telescope

Context

Recently the Euclid space telescope has achieved a significant milestone by capturing high-resolution images of **26 million galaxies**.

About Euclid Telescope



- It was launched by the European Space Agency (ESA) in July, 2023.
- It is equipped with a **1.2-meter telescope**, it captures high-resolution images and spectra of distant galaxies.
- **Instruments Onboard:**
    - **VIS (Visible instrument):** A 600-megapixel camera to record visible light.
    - **NISP (Near-Infrared Spectrometer and Photometer):** A near-infrared camera/spectrometer to determine the redshift of detected galaxies.
- It operates from the **Sun-Earth L2 orbit**, about 1.5 million km from Earth.
- **Mission Duration** - 6 Years.

Mission Objectives:

- **Explore the "dark universe":** It is designed to study the composition and evolution of the dark universe, focusing on dark matter and dark energy.
- **Create a 3D map:** The mission will map the large-scale structure of the universe, revealing how it has expanded and evolved over billions of years.
- **Observe billions of galaxies:** Euclid will observe billions of galaxies, some as far as 10 billion light-years away, to study their distribution and evolution.
- **Understand dark energy and dark matter:** By studying the shapes and clustering of galaxies, Euclid will help scientists understand the role of gravity and the nature of dark energy and dark matter.

Source:

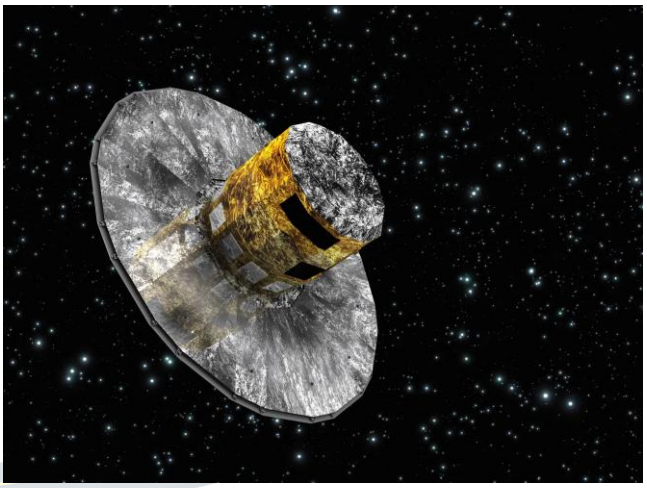
- **Indian Express- Euclid Telescope**

ESA's Gaia Mission

Context

The **European Space Agency (ESA)** has officially shut down its space observatory mission, **Gaia**, on **March 27, 2025**.

About Gaia Mission



- Its original name was **Global Astrometric Interferometer for Astrophysics (GAIA)**, it was later renamed **Gaia**.
- **Primary objective**: Astrometry—**precisely mapping celestial bodies** by determining their locations and movements in space.
- **Orbital Position**: Placed at **Lagrange Point 2 (L2)**, **1.5 million km behind Earth** (relative to the Sun), allowing unobstructed views of space.
- **Scientific Instruments**:
    - **Astrometer** – Measures the precise location of stars.
    - **Photometer** – Measures the brightness and color of celestial objects.
    - **Spectrometer** – Analyzes the chemical composition of stars and objects.

Major Discoveries and Contributions

- **Mapping the Milky Way:**
    - Created the **most detailed 3D map** of the galaxy.
    - Helped scientists understand the **structure of the Milky Way**—showing its **central bar, spiral arms and warped, wobbly disc**.
- **Discovery of New Black Holes**:
    - Identified a **new type of black hole**, including one **close to Earth**.
    - Unlike earlier detections based on emitted light, Gaia found **"truly black" black holes** by observing their **gravitational effects**.
- **Asteroid Tracking and Threat Assessment**:
    - **Identified over 150,000 asteroids** and predicted their **future orbits**, including some that **may pose a threat to Earth**.

Source:

- Indian Express - Gaia Mission

Restoration of Mangroves

Context

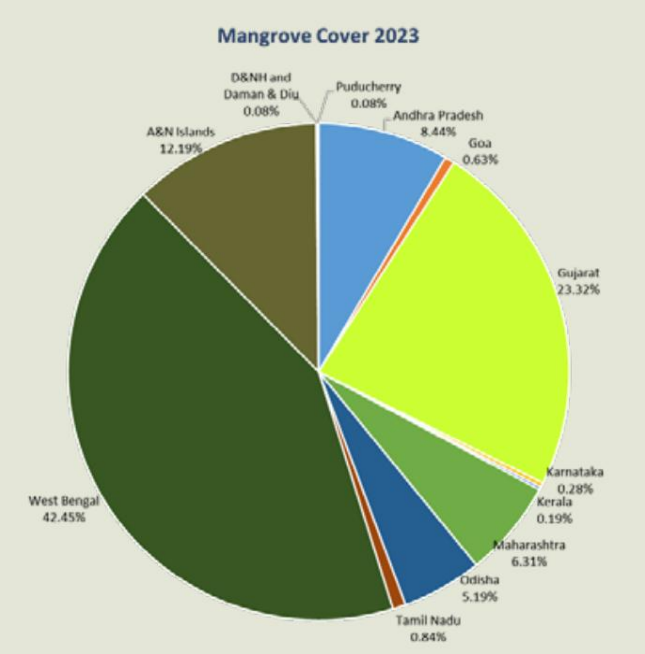
The government is implementing various measures to conserve and restore mangrove ecosystems across coastal regions.

Mangrove Cover in India (ISFR 2023 Data)

- Mangrove forests in India are found along the coastline of **9 States and 4 Union Territories.**
- **Total Mangrove Cover (2023)**: **4,991.68 sq. km** (0.15% of India's total geographical area).
- **Increase in Mangrove Cover**:
  - +363.68 sq. km (7.86%) from 2013 to 2023.
  - +509.68 sq. km (11.4%) from 2001 to 2023.

Regulatory Measures for Mangrove Protection:

- **Coastal Regulation Zone (CRZ) Notification, 2019 under The Environment (Protection) Act, 1986:**
  - **Mangroves classified as Ecologically Sensitive Areas (ESAs)** – strict restrictions on activities in these zones.
  - **50-meter buffer zone** (CRZ-IA) for mangrove areas **larger than 1,000 sq. meters**.
  - **Limited activities permitted** in buffer zones:
    - Laying pipelines, transmission lines.
    - Construction of roads on stilts for public utilities.
  - **Compensatory Plantation Rule**: If mangroves are lost due to development, **three times the lost mangroves must be replanted**.



Promotional Measures for Mangrove Restoration

- **Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI) Programme:**
  - **Objective**: To restore and conserve **540 sq. km of mangroves** across India's coastline.
  - Financial support from **National CAMPA (Compensatory Afforestation Fund Management and Planning Authority)**.
- **National Coastal Mission** – Conservation & Management of Mangroves & Coral Reefs:
  - **Objective**: Support 38 mangrove sites and 4 coral reef sites across 9 coastal states and 4 UTs.
  - **Funding Mechanism**: **60:40 cost-sharing** between **Central Government and State Governments**.
- **Green Climate Fund (GCF)** – Enhancing Coastal Resilience of Indian Coastal Community **(ECRICC)** Project
  - Aims to restore **10,575 ha of mangroves in Andhra Pradesh, Maharashtra, and Odisha.**
  - **Progress (2019-2024)**: **3,114.29 hectares of mangroves restored**.

Source:

- PIB - Mangroves

News in Shorts

Nag Anti-Tank Missile System (NAMIS)

- The Ministry of Defence has signed a contract under the Buy (Indian-Indigenously Designed Developed and Manufactured) category for procurement of NAMIS.

About NAMIS

- NAMIS is an indigenously developed, **third-generation, fire-and-forget missile** designed to destroy heavily armored enemy tanks and other combat vehicles.
    - **Fire-and-Forget Capability:** Once launched, the missile autonomously tracks and engages the target without the need for further guidance.
- **Developed by:** Defence Research & Development Laboratory of Defence Research and Development Organisation (DRDO).
- **Nag ATGM** aims to provide the Indian Armed Forces with a potent anti-tank weapon capable of operating in all weather conditions, day and night.

Source:

- The Hindu - NAMIS

Silvaguard

- Silvaguard is an autonomous, AI-based drone system designed for early forest fire detection and suppression.
- It is developed by **Dryad Networks** and works in combination with the **Silvanet system, a solar-powered wireless network.**
- The Silvanet system enables communication in remote forest areas where mobile network coverage is unavailable.

- **Working Mechanism:**
  - Silvaguard uses AI-powered sensors to detect wildfire smoke and differentiate it from other sources like vehicle emissions, reducing false alarms.
  - Once a fire is detected, AI-driven drones autonomously assess and help suppress the fire, ensuring a rapid response.
  - The system significantly reduces fire response times, helping to prevent large-scale forest destruction.

Source:

- **The Hindu - Silvaguard**

ISRO's Next-Generation Launch Vehicle (NGLV) Soorya

- ISRO has initiated the design process for its **Next-Generation Launch Vehicle (NGLV) Soorya**.
- ISRO plans to develop two versions of **NGLV Soorya**:
  - **Low Earth Orbit (LEO) version.**
  - **Geosynchronous Transfer Orbit (GTO) version.**
- **Specifications of NGLV:**
  - NGLV is a **three-stage partially reusable** Heavy-lift launch vehicle.
  - It will have a **reusable first stage,** which would be utilised 15 to 20 times, to make the launches more affordable. **(Remember - Not Fully Reusable).**
  - NGLV will have **semi-cryogenic propulsion** (refined kerosene as fuel with liquid oxygen (LOX) as oxidiser) for the booster stages.
  - **Payload capacity:**
    - Low Earth Orbit (LEO) - 23.4 tonnes & Geosynchronous Transfer Orbit (GTO) - 9.6 tonnes.
    - Recoverable payload capacity of 14.8 tonnes to LEO and 5.5 tonnes for GTO.

Source:

- **TOI - NGLV Surya**

Editorial Summary

Concerns Over SAHYOG Portal

Context

X Corp sued the Indian government, challenging content regulation under Section 79 of the IT Act and the Sahyog portal for bypassing legal safeguards.

About SAHYOG Portal

- **Developed by:** Ministry of Home Affairs (MHA) under the Indian Cyber Crime Coordination Centre (I4C).
- **Objective**: To enhance collaboration between government agencies and social media intermediaries to create a safer cyberspace.
- **Working**: The portal streamlines the reporting and removal of unlawful content and facilitates data requests from law enforcement agencies under the Information Technology (IT) Act, 2000.

Concerns Over SAHYOG Portal

- **Bypassing Legal Safeguards:** SAHYOG uses **Section 79(3)(b)** of the IT Act, which lacks procedural safeguards under **Section 69A** for content blocking.

- **Section 69A of the IT Act** allows content blocking only on specific grounds like national security and public order, with procedural safeguards such as:
  - Approval by a designated officer
  - Written justification
  - Independent review of blocking requests

- **Risk of Censorship and Overreach:** The portal allows multiple government agencies (Ministries, State Governments, Local Police) to issue takedown requests, increasing the risk of **unchecked censorship** and political misuse.
- **Violation of Supreme Court Guidelines:** The portal's functioning could violate the Supreme Court's judgment in **Shreya Singhal vs Union of India** (2015), which upheld the need for due process and safeguards in content blocking.
- **Threat to Free Speech:** Fear of losing **safe harbour protection** under Section 79 may push platforms to over-remove content, creating a chilling effect on free speech and online expression.
- **Absence of Redressal Mechanism:** There is no clear mechanism for affected parties to **appeal** or challenge takedown orders issued through the portal.
- **Lack of Transparency:** The Ministry of Home Affairs (MHA) has not provided detailed information about the portal's working, raising concerns about **accountability** and **misuse**.

Way Forward

- **Introduce Procedural Safeguards:** Align SAHYOG's framework with **Section 69A** of the IT Act by ensuring:
  - Approval by a designated officer
  - Written justification for takedown requests
  - Independent review of blocking decisions
- **Strengthen Oversight and Accountability:** Establish an independent regulatory body to monitor the portal's operations.
  - Ensure regular audits and public reporting to prevent misuse.

- **Ensure Transparency:** Publish clear guidelines on the types of content that can be removed.
    - Provide public access to data on takedown requests and their outcomes.
- **Establish a Redressal Mechanism:** Create a system for users and platforms to **appeal** or challenge takedown decisions.
- **Protect Safe Harbour for Intermediaries:** Clarify that intermediaries will retain **safe harbour protection** under Section 79 unless content violates established legal norms.
    - Prevent over-compliance by social media platforms due to fear of penalties.
- **Maintain Balance Between Security and Free Speech:** Ensure that content blocking is restricted to cases involving **national security**, **public order**, or **legally defined unlawful content**.
    - Prevent political or ideological misuse of the portal.

Source: **The Hindu: Back Door Censor**

Should the free movement regime between India and Myanmar remain?

Context

- In February 2024, Union Home Minister Amit Shah announced the **scrapping of the Free Movement Regime (FMR**) along the Myanmar border.
    - However, **no official notification** has been issued by the Ministry of External Affairs, **nor has any bilateral agreement been reached** with Myanmar yet.

About Free Movement Regime (FMR) with Myanmar

- FMR is a bilateral agreement between India and Myanmar established in **1968**, allowing residents within a certain distance of the border to cross freely due to familial and ethnic ties.
    - The **Mizo, Kuki and Chins,** collectively known as **Zo people** (on either side of the border) share a common ancestry and strong ethnic ties.
- Indian & Myanmar share a boundary of **1643 Km. (largely unfenced)** which passes through **4 Indian States - Arunachal Pradesh, Nagaland, Manipur and Mizoram**
- **Concerns Related to FMR:**
    - **Security Risks**: Unrestricted movement exploited by insurgents and terrorists to cross the border undetected.
    - **Illegal Activities**: smuggling goods, drug trafficking and arms across the border.
    - **Challenges in Monitoring:** Free movement makes it difficult for border security forces to monitor and differentiate between regular community members and those engaging in illegal activities.

Arguments in Favour of Scrapping the Free Movement Regime (FMR)

- **Security Concerns:** Unregulated cross-border movement is linked to **ethnic conflicts** and insurgencies, especially in **Manipur**.
    - Increased smuggling of **drugs (from the Golden Triangle)**, **gold**, and **contraband goods** through the porous border.
- **Illegal Migration and Demographic Changes:** Fear that unchecked migration from Myanmar could lead to demographic shifts and social tensions.
    - Potential for infiltrators to exploit the FMR for subversive activities.
- **National Sovereignty and Border Control:** Scrapping the FMR would strengthen India's control over its borders, reinforcing territorial integrity.
    - Enhanced border security would help prevent illegal activities and maintain law and order.
- **Political and Strategic Stability:** Better control over cross-border movements could prevent destabilization in conflict-prone areas like **Manipur** and **Nagaland**.
    - Reduced influence of armed groups and insurgents operating from across the border.
- **Legal and Administrative Clarity:** Removing the FMR would bring consistency in border regulations and align them with broader national security policies.
- **Improved Trade Regulation:** Better monitoring and control over trade would ensure fair taxation and reduce illegal trading practices.

Arguments Against Scrapping the Free Movement Regime (FMR)

- **Historical and Cultural Ties:** Communities on both sides of the border have **shared ancestry**, familial bonds, and social ties.
    - FMR enables preservation of traditional links and cultural exchange.
- **Humanitarian Concerns:** Refugees from Myanmar's civil conflict have sought shelter in **Mizoram** and **Manipur** on humanitarian grounds.
    - Scrapping the FMR could violate human rights and strain local communities' ability to provide aid.
- **Economic Impact:** Local economies along the border rely on cross-border trade for livelihood.
    - Increased border restrictions could disrupt trade, affecting income sources for border communities.
- **Political Fallout:** Scrapping the FMR without consulting local communities could fuel demands for a **unified homeland** (like Frontier Nagaland).
    - Risk of increased resistance and political instability in the Northeast.
- **Practical Challenges of Fencing:** Difficult terrain along the 1,653 km border makes fencing costly and impractical.
    - Fencing could lead to displacement and protests from border communities.
- **Alternative Solutions Available:** Strengthening customs and law enforcement along the border could be more effective than scrapping the FMR.
    - Legalizing certain trade items and improving infrastructure could address smuggling without disturbing social harmony.

Source: **The Hindu: Should the free movement regime between India and Myanmar remain?**

Women Safety in Public Spaces

Context

Despite stringent laws, women remain far from feeling safe in most public spaces.

What are the Recent Incidents?

- A 23-year-old woman sustained severe injuries after jumping off a train to escape an assaulter.
- A pregnant woman who was allegedly pushed out of a train following an attempted rape suffered a miscarriage.

Issues Related to Women in Public Spaces

- **Sexual Harassment and Assault:** Women frequently face **catcalling**, **groping**, and **verbal abuse** in public spaces.
    - Incidents of **molestation** and **rape** in public transport and other crowded areas remain alarmingly high.
- **Lack of Safety Infrastructure:** Poorly lit streets, absence of **CCTV surveillance**, and inadequate police patrolling increase vulnerability.
    - Lack of **separate compartments** or safe zones in public transport exposes women to greater risk.
- **Societal and Cultural Mindset:** Victim-blaming and moral policing discourage women from reporting incidents.
    - Cultural norms restrict women's mobility, reinforcing the idea that they need to be protected rather than empowered.
- **Legal and Administrative Gaps:** Delayed justice and low conviction rates weaken confidence in the legal system.
    - Understaffing in law enforcement and lack of gender sensitivity training among police officers.
- **Fear and Restricted Mobility:** Women are forced to avoid certain areas and times of day due to safety concerns.
    - Fear of harassment limits women's participation in economic, educational, and social activities.
    - **E.g.,** According to **NFHS-4 (2015–16)**, only **41% of Indian women** reported being allowed to go alone to the market, health facility, and places outside their community, while **6%** were not permitted to visit any of these destinations.
- **Inadequate Public Transport Facilities:** Lack of reserved seating, insufficient female conductors, and poor enforcement of harassment laws in public transport.
    - Overcrowded and poorly maintained public transport increases the risk of assault and discomfort.

Stringent Laws Related to Women Safety in India

- **Protection of Women from Domestic Violence Act, 2005:** Protects women from physical, emotional, sexual, and economic abuse.
    - Provides remedies like protection orders, residence orders, and monetary relief.
- **Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013** (POSH Act): Mandates Internal Complaints Committees (ICC) in workplaces.
    - Establishes procedures for preventing and addressing sexual harassment.
- **Criminal Law (Amendment) Act, 2013:** Introduced after the 2012 Delhi gang-rape case.
    - Defines new offenses (acid attacks, stalking, voyeurism) and prescribes stricter penalties, including the death penalty for certain rape cases.
- **Bharatiya Nyaya Sanhita, 2023**: Strengthens legal provisions related to crimes against women and children.
    - **E.g., Section 74** of the Bharatiya Nyaya Sanhita (BNS), 2023: It prescribes imprisonment of **one to five years** and a fine for assault or criminal force with the intent to **outrage the modesty of a woman**.
- **Protection of Children from Sexual Offences (POCSO) Act, 2012:** Protects minors from sexual abuse.
    - Provides stringent punishments and child-friendly reporting and trial procedures.

Recommendations to Ensure Women's Safety in Public Spaces

- **Awareness and Sensitization:** Conduct **gender sensitization and awareness programs** for police personnel and society to change attitudes towards women's safety.
    - Improve **social messaging** through banners at traffic lights and on public transport to raise awareness about harassment and safety measures.
    - **Example:** In **Raipur**, initiatives like ***'Suno Raipur' and 'Walk A Cause'*** connect women with police and encourage reporting through designated channels.
- **Law Enforcement and Policing:** Deploy more **women police officers** at key locations like bus stops, schools, and public transport.
    - Increase **night-time patrolling** and ensure the presence of security personnel in public transport.
    - **Example: Durga Vahini** in **Faridabad** – a dedicated police patrol unit to ensure women's safety in public spaces.
- **Surveillance and Monitoring:** Install and maintain **CCTV surveillance systems** in vulnerable public spaces.
    - Ensure **regular monitoring** of CCTV footage to respond to incidents promptly.
    - **Example:** Over **2,000 CCTV cameras** installed in **Meerut** to monitor and prevent harassment and chain-snatching.
- **Street and Public Space Infrastructure:** Improve **street lighting** in isolated areas — use solar-powered lighting where possible.
    - Build more **women's toilets** with functional doors, proper lighting, ventilation, and water supply.
    - Install **clear signage** indicating police stations, shelter homes, and hospitals.
    - **Example: 60,000 streetlights** installed in **Ranchi** to improve visibility and enhance safety.
- **Public Transport Safety:** Deploy **security personnel** in buses, trains, and at stations.
    - Display **emergency helpline numbers** prominently in public transport and waiting areas.
    - Establish visible signage indicating **surveillance** and legal consequences for harassment.
    - **Example:** Presence of **female bus drivers and conductors** in **Vijayawada** has enhanced the perception of safety.
- **Victim Support and Assistance:** Ensure effective implementation of **victim assistance centers** such as Women Helplines for timely intervention.
    - Strengthen the capacity of response teams to handle cases sensitively and efficiently.

- **Example: Pink Gasht** WhatsApp helpline in **Raipur** for immediate assistance.

Source: **The Hindu: Women Unbound**

India's Deeps Sea Challenge

Context

India's Matsya-6000 submersible aims to enhance deep-sea exploration for resources and security, amid growing geopolitical competition and technological advances in undersea infrastructure and surveillance by nations like China.

More in News

- **Matsya-6000 Submersible:** India completed wet testing of the Matsya-6000 submersible, capable of diving up to **6 km** to explore underwater minerals.
    - Its launch later this year will place India among the few nations capable of manned deep-sea exploration.
- **China's Deep-Sea Cable Cutter:** China unveiled a compact deep-sea cable-cutting device capable of severing even the most fortified underwater communication and power lines, reinforcing its dominance with the **largest fleet of submersibles** in the world.
- **France and Japan:** These countries have successfully commercialized deep-sea mining and undersea infrastructure development through long-term investment and policy support.

Fact

- According to the **United Nations Convention on the Law of the Seas (UNCLOS)**, the **Exclusive Economic Zone (EEZ)** of a country extends from the **baseline of its coast to 200 nautical miles (about 370 km) into the sea.**
- A nation has **exclusive rights to living and non-living resources** in the waters and on the seabed within its EEZ.

Need for Deep-Sea Technology

- **Harnessing Economic Resources:** The ocean holds vast untapped resources:
    - **Gas hydrates** – Potential future energy source.
    - **Polymetallic nodules** – Rich in rare earth metals (manganese, nickel, cobalt).
    - **Oil and gas reserves** – Essential for energy security.
    - **Nutraceuticals** – Bioactive compounds for pharmaceuticals and health products.
    - Developing deep-sea technology will enable India to explore and commercially exploit these resources.
- **Enhancing National Security:** Increasing geopolitical competition in the deep sea (e.g., China's deep-sea cable-cutting device).
    - Developing deep-sea surveillance and defence technology is crucial to protect **underwater infrastructure** and **maritime borders**.
    - Maintaining **Underwater Domain Awareness (UDA)** is critical for national security and strategic dominance.
- **Strengthening Communication and Digital Infrastructure:** Over **95% of intercontinental internet traffic** flows through undersea cables.
    - Developing indigenous capability to lay, maintain, and secure undersea cables will ensure **digital sovereignty** and **data security**.
    - Protecting undersea cables from sabotage and disruption is vital for global connectivity and financial systems.
- **Supporting the Blue Economy:** India's Exclusive Economic Zone (EEZ) spans **2.37 million sq km**.
    - The blue economy can contribute significantly to GDP through:
        - Deep-sea fishing
        - Aquaculture
        - Marine biotechnology

        - Eco-tourism
    - Deep-sea technology is essential to maximize the potential of marine resources.
- **Scientific Research and Climate Studies:** Deep-sea exploration will enhance understanding of **marine biodiversity** and **ecosystems**.
    - Oceanographic data can improve **climate change models** and **weather forecasting**.
    - Studying hydrothermal vents and marine life can provide insights into **evolution** and **potential medical breakthroughs**.
- **Technological and Strategic Edge:** Developing deep-sea technology will put India alongside global leaders like the **US, China, Japan, France, and Russia**.
    - Technological dominance in deep-sea exploration can create leverage in **geopolitical negotiations** and **international maritime policy**.

Challenges Associated with Deep Sea Exploration

- **Extreme Pressure and Conditions:** Pressure increases by approximately **1 atm for every 10 metres** of depth.
    - Pressure at the ocean bed in the Indian EEZ is around **380 atm** – demanding specialized materials and engineering for submersibles.
    - The **OceanGate Titan submersible disaster (June 2023)** highlights the risks of operating in high-pressure environments.
- **Technological Limitations:** Lack of cutting-edge deep-sea technology like **Very Low Frequency (VLF)** and **Extremely Low Frequency (ELF)** sound technology for communication and navigation.
    - Limited domestic capability for undersea mining, infrastructure building, and submarine rescue.
- **Inadequate Infrastructure and Human Capital:** Absence of specialized institutions for deep sea research and limited expertise in underwater engineering.
    - Lack of skilled human capital for complex underwater missions and infrastructure projects.
- **Geopolitical and Security Risks:** China's dominance in deep sea technology and the recent unveiling of a **deep-sea cable-cutting device** poses a strategic threat to undersea communication lines.
    - Vulnerability of **undersea cables** to sabotage, which carry over **95% of intercontinental internet traffic**.
- **Limited Financial and Policy Support:** India's **Deep Ocean Mission (2018)** is underfunded compared to nations like China, the US, and Japan.
    - Lack of a streamlined policy and administrative framework for deep-sea exploration.
- **Environmental Challenges:** Potential environmental damage due to deep-sea mining and exploration.
    - Lack of proper frameworks to balance deep-sea resource exploitation with ecological preservation.

What India Must Do

- **Enhance Financial and Policy Support:** Upgrade the **Department of Ocean Development** to a full-fledged ministry with a **cabinet-rank minister**.
    - Ensure **generous funding** and launch **time-bound, mission-mode projects** with high stakeholder accountability.
    - Develop a **10-year strategic plan** for deep-sea exploration and infrastructure development.
- **Invest in Advanced Technology:** Develop indigenous technologies for **submersibles**, **VLF/ELF communication**, and **undersea infrastructure**.
    - Establish specialized research centres for deep sea technology similar to China's deep-sea science and engineering centres.

- **Strengthen Human Capital and Research:** Create **institutes of excellence** in deep-sea research and exploration.
    - Train and develop highly skilled personnel for deep-sea diving, mining, and rescue operations.
- **Build Strategic and Defensive Capabilities:** Develop response mechanisms to counter threats like China's **deep-sea cable-cutting device**.
    - Deploy **underwater sensors** and **monitoring equipment** to safeguard India's maritime interests.
- **Enhance Infrastructure for Exploration and Security:** Expand deep-sea fishing and exploration capabilities.
    - Develop capability for undersea cable laying, maintenance, and protection.
    - Invest in infrastructure for **oil and gas extraction** and **underwater mining**.
- **Ensure Environmental Sustainability:** Establish guidelines and frameworks for sustainable deep-sea mining and exploration.
    - Promote eco-friendly technologies to minimize environmental impact.

Source: **Indian Express: India's Deep Sea Challenge**