Undersea Communication Cables: Strategic Backbone of the Global Digital Economy

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Recent Developments:

- Rising incidents of suspected cable sabotage in regions such as the **Baltic Sea**, **Red Sea** and **Taiwan Strait** have highlighted the strategic importance of undersea communication infrastructure for national security, digital connectivity and global trade.
- In **2024**, the **International Telecommunication Union (ITU)** and the **International Cable Protection Committee (ICPC)** established the **International Advisory Body for Submarine Cable Resilience** to strengthen the security and resilience of global submarine cable networks.
- With more than **99% of intercontinental digital traffic** moving through submarine cables, governments are increasingly treating them as critical infrastructure requiring strategic protection. International Telecommunication Union International Cable Protection Committee

Understanding Undersea Communication Cables:

Meaning and Evolution:

- Undersea communication cables are insulated communication links laid on the seabed to transmit information across oceans and seas.
- The earliest systems consisted of **telegraph cables**, while modern networks use **fibre-optic technology** capable of transmitting massive volumes of digital data at high speed.
- These cables transformed long-distance communication by reducing message transmission times from weeks or months to a matter of minutes and later to near-instantaneous transmission.
- The world's first successful undersea telegraph cable was laid across the **English Channel** in **1851**, marking the beginning of global submarine communications.
- Modern submarine fibre-optic cables form the physical foundation of the global internet, international banking systems, cloud computing services and digital commerce.

The All-Red Line and Imperial Communications:

Emergence of the All-Red Line:

- During the late nineteenth century, Britain constructed an extensive submarine telegraph network connecting different parts of its empire.
- The network became known as the **All-Red Line** because British territories were traditionally depicted in red on imperial maps.
- The communication system enabled rapid transmission of military, administrative and commercial information across the empire.
- The network was deliberately routed through British-controlled territories to reduce dependence on rival powers and enhance strategic security.
- Important routes passed through the **Strait of Gibraltar**, **Mediterranean Sea**, **Malta**, **Suez Canal**, **Red Sea**, **Indian Ocean**, **Bombay** and extended towards **Hong Kong**.

- The All-Red Line demonstrated how communication infrastructure could serve as an instrument of geopolitical influence and strategic control.

Strategic Importance of Undersea Cables in the Modern Era:

Role in the Global Economy and Security:

- More than **99% of global intercontinental internet traffic** is carried through submarine cable systems rather than satellites.
- International financial transactions worth trillions of dollars depend upon uninterrupted cable connectivity.
- Global cloud computing services, e-commerce platforms, digital payments and government communications rely heavily on submarine cable networks.
- Military command systems, intelligence sharing and strategic communications increasingly depend upon secure undersea data infrastructure.
- Submarine cables have become as strategically important in the digital age as sea lanes were during earlier eras of global trade.

Major Vulnerabilities Associated with Undersea Cables:

Physical, Technological and Security Risks:

- Multiple submarine cables are often concentrated along similar seabed routes, creating potential single points of failure.
- Damage to a few strategically located cables can disrupt communications across entire regions.
- Repair operations require specialised vessels, advanced technical expertise and international coordination, making restoration difficult during crises.
- Natural hazards such as earthquakes, volcanic activity, underwater landslides and tsunamis can damage cable networks.
- Fishing activities, ship anchors and accidental maritime incidents remain major causes of cable disruptions.
- Hybrid warfare tactics and state-sponsored sabotage have emerged as growing threats to critical underwater infrastructure.
- Existing international legal provisions provide limited clarity regarding accountability for intentional cable disruptions during grey-zone conflicts.

India's Undersea Cable Ecosystem:

Current Status and Connectivity:

- India is an important participant in the global submarine cable network with **17 international submarine cables** and **14 cable landing stations**.
- Major landing stations are located in coastal cities such as **Mumbai**, **Chennai**, **Cochin**, **Tuticorin** and **Trivandrum**.
- By the end of **2022**, India's total lit capacity and activated capacity stood at approximately **138.606 Tbps** and **111.111 Tbps** respectively.
- India is connected to global digital networks through systems such as **South East Asia–Middle East–Western Europe 4 (SMW4)**, **India–Middle East–Western Europe (IMEWE)** and several other international cable corridors.
- These networks support India's digital economy, information technology services sector and international data exchanges.

Challenges Faced by India:

Technological, Regulatory and Operational Deficiencies:

- India lacks a comprehensive legal framework specifically designed to protect submarine cable infrastructure within territorial waters and the **Exclusive Economic Zone (EEZ)**.
- Unlike countries such as Australia, India has not established dedicated **Cable Protection Zones** for safeguarding critical cable routes.
- India currently lacks indigenous submarine cable repair vessels and remains dependent on foreign ships for maintenance and emergency restoration.
- Dependence on external repair capabilities can significantly increase recovery time following cable damage.
- Real-time underwater surveillance and monitoring infrastructure remains limited, reducing the ability to detect threats and disruptions promptly.
- Increasing digitalisation of governance, banking and commerce makes these vulnerabilities a significant national security concern.

International Efforts to Enhance Submarine Cable Resilience:

International Advisory Body for Submarine Cable Resilience:

- The body was established in **2024** by the **International Telecommunication Union** in partnership with the **International Cable Protection Committee**.
- Its objective is to strengthen global submarine cable resilience through policy coordination, risk assessment and best-practice recommendations.
- The initiative focuses on addressing growing data traffic, ageing infrastructure, environmental threats and geopolitical risks.
- It promotes cooperation among governments, industry stakeholders and international organisations to improve cable security.

International Cable Protection Committee (ICPC):

Role and Functions:

- The **International Cable Protection Committee** was established in **1958** as a global platform for governments and commercial stakeholders involved in submarine cable operations.
- It facilitates the exchange of technical, legal, operational and environmental information relating to cable systems.
- The organisation promotes best practices for cable installation, maintenance and protection.
- It works to reduce risks arising from maritime activities and supports the development of international standards for cable security.

Legal Framework Governing Undersea Cables:

Relevant International Provisions:

- The United Nations Convention on the Law of the Sea recognizes the freedom to lay submarine cables on the high seas and within certain maritime zones.
- Coastal states possess rights and responsibilities regarding cable protection within territorial waters and exclusive economic zones.
- International law requires states to avoid unnecessary interference with submarine cable operations.
- However, significant legal ambiguities remain regarding intentional disruption of cables during hybrid warfare and geopolitical confrontations.

Significance for India:

Strategic and Economic Importance:

- India's ambition to become a global digital hub depends upon secure and resilient submarine cable infrastructure.
- Programmes such as **Digital India**, cloud computing expansion, fintech growth and artificial intelligence development require high-capacity international connectivity.
- Protection of submarine cables is essential for national security, economic stability and technological competitiveness.
- Enhanced resilience can strengthen India's position as a major data centre and digital services destination.
- Secure cable infrastructure is increasingly becoming a component of maritime security strategy in the **Indian Ocean Region**.

Way Forward:

Measures Required for Strengthening Resilience:

- India should establish dedicated cable protection zones around critical submarine cable routes and landing stations.
- Indigenous cable repair and maintenance capabilities should be developed to reduce dependence on foreign service providers.
- Deployment of underwater surveillance systems, autonomous monitoring platforms and maritime domain awareness technologies should be expanded.
- Public-private partnerships should be encouraged for strengthening cable infrastructure security.
- Greater cooperation with regional partners and international organisations should be pursued to address transnational threats.
- Legal and regulatory frameworks should be updated to provide clear mechanisms for cable protection and incident response.
- Diversification of cable routes should be encouraged to reduce concentration risks and improve network redundancy.

Value Addition for UPSC:

Important Facts, Concepts and Institutions:

- **More than 99% of intercontinental internet traffic** is transmitted through submarine cables.
- The first successful undersea telegraph cable was laid across the **English Channel in 1851**.
- The **All-Red Line** represented Britain's global imperial telegraph network connecting major colonies through secure communication routes.
- **Exclusive Economic Zone (EEZ):** Extends up to **200 nautical miles** from the coastal baseline and grants sovereign rights over marine resources.
- **Cable Protection Zone:** A designated maritime area where activities capable of damaging submarine cables are regulated or restricted.
- **International Telecommunication Union (ITU):** Specialized agency of the United Nations responsible for information and communication technologies.

International Cable Protection Committee (ICPC): Principal international organization promoting submarine cable security and resilience.