Underwater Fiber Optic Sensing System (UFOSS/FOSS)

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Why in News?

India's Defence Research and Development Organisation (DRDO) has initiated indigenous UFOSS projects to strengthen underwater surveillance and maritime security.

- **Underwater Fiber Optic Sensing System (UFOSS)** – It is an advanced underwater surveillance technology that transforms subsea fiber-optic cables into extensive sensor networks.
- It is also known as the **Fiber Optic Sensing System (FOSS)**.
- **Technologies used** – **Distributed Acoustic Sensing (DAS)** and **Fiber Bragg Gratings (FBGs)**.
- **DAS** converts the entire optical fiber into a continuous series of sensing points.
- It detects acoustic vibrations and seismic disturbances with exceptionally high spatial resolution—often at intervals of a few millimeters to centimeters.
- **FBG** sensors, on the other hand, measure localized changes in strain, pressure, and temperature by monitoring shifts in reflected wavelengths.
- The system is deployed through **fixed seabed fiber-optic networks**, functioning much like a biological nervous system that continuously transmits information from the ocean floor.
- **Advantage** – Unlike ships, aircraft, or sonobuoys, which provide surveillance only during operational deployments, UFOSS offers **24×7 persistent monitoring** without interruption.
- This makes it particularly valuable for securing strategic maritime regions.
- **Applications** – Acoustic and hydrographic surveillance.
- It can detect and track low-frequency sounds generated by submarines, surface ships, underwater drones, and other marine activities.
- Such capabilities significantly enhance maritime domain awareness, anti-submarine warfare (ASW).
- Early warning against potential naval threats, particularly in strategically important areas such as the **Indian Ocean Region (IOR)**.
- It enables real-time **monitoring of offshore oil and gas platforms**, underwater pipelines, submarine communication cables, and offshore wind farms by detecting structural strain, leaks, or damage.
- The technology also contributes to environmental studies by monitoring oceanographic conditions, underwater earthquakes, and seismic activity, thereby supporting disaster preparedness and marine research.

Reference

The Indian Express| UFOSS