SAMUDRAYAAN MISSION

NEWS: India’s first manned deep ocean mission ‘Samudrayaan‘ into a 6,000-metre depth using the manned submersible vehicle ‘Matsya’ is expected to be launched by the end of 2026.

WHAT’S IN THE NEWS?

I. Overview of the Deep Ocean Mission (DOM)

1. Ambitious Ocean Exploration Program
    - DOM is India’s flagship mission for deep-sea exploration and research, primarily implemented by the Ministry of Earth Sciences (MoES).
    - It operates in mission mode, aligning with India's vision for a sustainable and resilient Blue Economy.
2. Approval and Budget
    - The Union Cabinet approved the mission in June 2021, allocating a budget of approximately ₹4,077 crore for a five-year phased implementation.
3. Alignment with Blue Economy Goals
    - DOM supports India's Blue Economy sectors such as marine fisheries, energy, tourism, and ocean-based industries, ensuring long-term marine resource sustainability.

II. Six Major Components of Deep Ocean Mission

1. Development of Technologies for Deep-Sea Mining and Manned Submersible

- Samudrayaan Project
    - Involves deploying a manned submersible named ‘Matsya 6000’, capable of carrying 3 scientists to 6,000 meters depth.
    - It is equipped with scientific sensors for real-time observation, sampling, and experimentation.
- Integrated Mining System
    - Designed for mining Polymetallic Nodules (PMNs) at 6,000 m depth in the Central Indian Ocean Basin (CIOB).

- Aims at future commercial extraction under norms of the International Seabed Authority (ISA).

2. Development of Ocean Climate Change Advisory Services

- Objective: To model ocean-related climate variables for seasonal to decadal projections.
- Applications: Supports climate-resilient planning, particularly in coastal infrastructure and tourism sectors.

3. Technological Innovations for Deep-Sea Biodiversity Exploration & Conservation

- Focuses on bio-prospecting of deep-sea flora, fauna, and microbial life, identifying compounds of medicinal and industrial value.
- Promotes sustainable biodiversity use, contributing to the Marine Fisheries and Allied Services domain of the Blue Economy.

4. Deep Ocean Survey and Exploration

- Conducts systematic seabed mapping and exploration.
- Aims to locate and study multi-metal hydrothermal sulphide deposits along the Indian Ocean Mid-Ocean Ridge (MOR) system.

5. Energy and Freshwater from the Ocean

- Focus on Offshore Ocean Thermal Energy Conversion (OTEC) technology to generate renewable energy.
- Development of OTEC-powered desalination plants to produce freshwater, reducing stress on land-based sources.

6. Advanced Marine Station for Ocean Biology

- Establishes a state-of-the-art facility for ocean biology and biotechnology research.
- Includes an on-site business incubator to support blue trade, biomanufacturing, and marine biotech startups.

- Facilitates human capacity development in ocean sciences and engineering.

III. Matsya 6000 Submersible: India's Deep-Sea Technology Flagship

1. Design and Purpose
    - Matsya 6000 is a manned submersible designed to explore ocean depths of up to 6,000 meters.
    - It supports real-time data collection, sample retrieval, and in-situ scientific experiments.
2. Crew and Capabilities
    - It can carry three crew members, with life support systems and scientific payloads for deep-ocean research.
3. Developer and Construction
    - Developed by the National Institute of Ocean Technology (NIOT), Chennai.
    - The crew sphere is made of titanium alloy, capable of withstanding pressures up to 6,000 bar.
4. Technical Features
    - Equipped with propellers for 360-degree movement, viewports for visual observation, and acoustic communication systems.
    - Combines features of Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs).
5. Global Significance
    - Once operational, India will join elite countries like USA, Russia, China, France, and Japan with crewed deep-sea mission capabilities.

IV. Strategic Significance of the Deep Ocean Mission

1. Strategic and Technological Self-Reliance

- Positions India as a global leader in indigenous deep-sea technology.
- Enhances maritime security and provides critical capabilities for strategic ocean surveillance.

2. Economic Growth through Blue Economy

- Supports deep-sea mineral exploration, blue trade, and job creation in MSMEs, shipbuilding, and related sectors.
- Promotes ocean-based economic diversification in line with global Blue Economy frameworks.

3. Environmental Sustainability

- Aids sustainable use of marine ecosystems and contributes to the UN Decade of Ocean Science for Sustainable Development (2021–2030).

4. Climate Resilience and Forecasting

- Enhances capacity for climate forecasting and advisory services, especially important for coastal population resilience and tourism planning.

5. Marine Resource and Energy Security

- Unlocks new energy sources (OTEC) and freshwater through desalination, reducing dependence on conventional energy and water.

6. Human Resource and Innovation Capacity

- Strengthens marine science and engineering education, ocean biology research, and industrial innovation via incubators and research hubs.

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