# Man-Portable Autonomous Underwater Vehicles (MP-AUVs)

#### 1.Introduction

- India has strengthened its undersea surveillance and mine-countermeasure capabilities through the development of Man-Portable Autonomous Underwater Vehicles (MP-AUVs).
- Developed by DRDO's Naval Science and Technological Laboratory (NSTL), Visakhapatnam, these AUVs support underwater security, mine detection, and coastal defence operations.

# 2. What are MP-AUVs?

- Man-portable, compact, and lightweight underwater robots capable of operating without human control once deployed.
- Designed for rapid underwater reconnaissance, especially in shallow, complex coastal regions.

# 3. Key Features (UPSC-Relevant)

## 3.1 Autonomy & Operation

- Can **navigate underwater autonomously** using pre-programmed routes.
- Suitable for deployment from **small naval crafts or patrol vessels**.
- Ideal for **quick deployment** in emergency mine-threat situations.

## 3.2 Sensors & Payloads

- Equipped with side-scan sonar:
  - Produces detailed seabed images
  - Detects objects, anomalies, and mine-like threats
- Integrated underwater cameras:

- Enables visual confirmation of suspicious objects
- Useful for mapping and reconnaissance missions

### 3.3 Advanced Artificial Intelligence

- Uses deep-learning-based algorithms for:
  - Automatic target recognition (ATR)
  - Classification of underwater objects (mines, debris, man-made structures, etc.)
- Reduces operator workload and enhances speed and accuracy in decisionmaking.

#### 3.4 Portability

- Compact and lightweight, easy to carry by small naval teams.
- Specially designed for **man-portable mine-detection missions** during naval operations.

# 4. Role of DRDO's NSTL (Naval Science & Technological Laboratory)

- NSTL is India's premier laboratory for naval systems and underwater defence technologies.
- Located in **Visakhapatnam**, it has developed:
  - Torpedoes
  - Autonomous underwater platforms
  - Mine countermeasure systems
- MP-AUV development is part of its effort to enhance indigenous underwater military capability.

# 5. Mission Objectives (Clear & UPSC-Oriented)

## **Primary Objective**

 Real-time detection and classification of underwater mines and minelike objects.

#### Other Mission Goals

- Coastal security
- Reconnaissance and seabed mapping
- Harbour and naval base protection
- Intelligence gathering in sensitive maritime regions
- Support to special naval operations

# 6. Strategic Importance for India's Maritime Security

# 6.1 Enhancing Mine-Countermeasure Capability

- Mines are among the cheapest yet deadliest maritime weapons.
- MP-AUVs allow safe, fast, and unmanned detection reducing risk to naval divers and ships.

## **6.2 Strengthening Coastal Defence**

- India's coastline: 7,500+ km
- High movement of:
  - Merchant vessels
  - Naval assets
  - Strategic maritime trade
- AUVs help maintain security in these dense maritime zones.

#### 6.3 Protection of Critical Infrastructure

- Useful around:
  - Ports
  - Offshore installations

- Naval bases
- Shipyards
- Strategic islands (e.g., Andaman & Nicobar)

### **6.4 Force Multiplication**

- Autonomous operations allow the Navy to redeploy manpower to other critical tasks.
- Low logistics footprint due to **portability**.

#### 6.5 Indigenous Defence Capability

- Strengthens Atmanirbhar Bharat in defence.
- Reduces dependence on foreign underwater surveillance systems.

# 7. Exam-Oriented Quick Facts (For Prelims/Mains)

- Developed by DRDO's NSTL, Visakhapatnam.
- Equipped with:
  - Side-scan sonar
  - Underwater optical camera
- Uses deep-learning algorithms for autonomous classification.
- Mission: Mine-like object detection in real time.
- Compact, lightweight, suitable for man-portable naval deployment.
- Enhances coastal monitoring, harbour defence, and underwater reconnaissance.

# 8. Possible UPSC Mains Questions

- "Discuss the significance of indigenous Autonomous Underwater Vehicles (AUVs) in strengthening India's maritime security architecture."
- 2. "How can Al-enabled systems such as MP-AUVs transform underwater

#### mine countermeasure capability for the Indian Navy?"

# 9. Conclusion

- The MP-AUV project reflects India's rapid advancements in **naval robotics**, **underwater surveillance**, **and strategic defence technologies**.
- By integrating Al and deep learning with autonomous operations, India is not only strengthening its **coastal security** but also moving towards **self-reliance in underwater military systems**.

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