

Webinar Concept Note – 08 Apr 2026 at 1600 hrs IST UDA Framework Based Sediment Management in the Tropical Waters of the Indo-Pacific Strategic Space

Background & Rationale

The movement of sediment plays a critical role in shaping tropical shallow waters, both for the marine and freshwater systems, which is influenced by intense monsoon-driven hydrodynamics, high riverine sediment discharge, and complex seabed morphology. These processes govern shallow bathymetry, sediment transport pathways, benthic ecosystem health, and the sustainability of maritime infrastructure. Conventional sediment management approaches are often based on localised, reactive hydrographic surveys, which are time and cost-intensive and fail to capture the spatial and temporal variability of sediment processes. In rapidly developing coastal economies in the Indian Ocean Region (IOR) such as India, Sri Lanka, and Bangladesh, ineffective sediment management contributes to challenges including port siltation, reduced navigational depth, increased urban flood risk, and the degradation of sensitive benthic ecosystems.

These effects are further intensified by rapid coastal development and climate-change driven hydrological variability. Addressing these challenges requires an integrated, data-driven framework that combines advanced monitoring technologies and predictive modelling. Within a broader Underwater Domain Awareness (UDA) framework approach, acoustic sensing and remote monitoring can enable sediment classification, seabed mapping, and assessment of sediment-bearing pressure, which are essential for offshore infrastructure stability, submarine cable routing, and seabed suitability analysis. Such digital transformation can support technically informed policy decisions for sustainable sediment management and resilient coastal infrastructure planning.

The Framework: Integrated UDA Sediment Assessment

The proposed framework shifts the focus from conventional sediment strategies to holistic UDA-driven sediment management by integrating three core pillars of digital monitoring:

1. **Acoustic Sediment Classification:** Utilising underwater acoustics to determine seafloor composition and sediment characteristics (e.g., grain size, porosity), providing the ground truth data for sub-surface conditions.
2. **Satellite-Based Sediment Concentration:** Leveraging remote sensing to monitor Total Suspended Solids (TSS) and turbidity plumes across vast tropical coastal expanses.
3. **AI-Based Sediment Transport Prediction:** Deploying machine learning models to simulate and predict sediment movement under varying hydrological conditions and flow patterns.

Technical Applications

The UDA-driven sediment monitoring framework has multiple engineering and environmental applications. These would include :

1. Sediment Classification and Seabed Mapping

- Acoustic classification of seabed sediments based on grain size, density, and roughness
- Identification of sediment types for dredging, disposal, and beneficial reuse
- High-resolution mapping of sediment distribution for coastal and offshore engineering projects

2. Sediment Bearing Capacity and Seabed Stability

- Assessment of sediment-bearing pressure for offshore structures and seabed-mounted systems
- Evaluation of foundation stability for offshore platforms, wind turbines, and subsea installations
- Identification of weak or mobile sediment layers that may affect infrastructure performance

3. Maritime Infrastructure

- Assessment of sediment-induced loading on offshore structures
- Seabed suitability analysis for submarine cables and pipelines
- Long-term bathymetric stability analysis

4. Port and Navigation

- Optimisation of dredging schedules based on sediment transport predictions
- Maintenance of navigational channels and port basins

5. Watershed Management and Urban Flooding

- Identification of sediment accumulation zones in river mouths and estuaries
- Improved sediment budgeting for catchment-scale management

6. Coastal Zone Management

- Detection of sediment-driven habitat changes in mangroves and coral systems
- Monitoring turbidity impacts on coastal ecosystems

Objectives

The webinar aims to:

- Highlight the strategic and economic importance of sediment management for India's Blue Economy.
- Present a UDA-based framework that integrates acoustic, satellite, and AI data streams.
- Demonstrate the necessity of understanding unique tropical conditions for accurate modelling.
- Introduce an MSP-based tool that incorporates socio-economic factors for balanced coastal development.
- Explore digital transformation pathways for dredging, defence, and disaster management.

Expected Outcomes

- Digital Twin of Sediment Flow: A predictive modelling environment for the Indian coast and freshwaters.
- MSP-Integrated Tool: A decision-support system that balances industrial needs with socio-economic and environmental health.
- Policy Insights: Actionable data for national frameworks (e.g., Sagarmala or National Framework for Sediment Management) regarding sustainable sediment management and reuse.
- Enhanced Resilience: Improved forecasting for habitat changes and infrastructure risks under climate change scenarios.

Program

- 1600 hrs IST - Opening Remarks by Dr(Cdr) Arnab Das, Founder & Director Maritime Research Center (MRC), Pune.
- 1610 hrs IST - Main Presentation on Sediment Management
Mr. Romit Kaware, Research Fellow MRC, Pune.
- 1645 hrs IST - Comments by Panel Members
Cmde Sheikh Mahmudul Hassan, Additional Secretary, Maritime Affairs Unit, MoFA Bangladesh.
Rear Admiral YN Jayarathna (Retd), Former Chief Hydrographer, Sri Lanka (TBC).
Dr. Amit Rajan, Research Fellow, Institute of South Asian Studies, NUS Singapore.
Dr. R Chandrashekhar, Strategic Analyst.
Vice Admiral Adhir Arora (Retd), Former Chief Hydrographer, India.
- 1730 hrs IST - Interventions by Invited Participants
- 1745 hrs IST - Concluding Remarks by Amb Anup Mudgal, MRC Strategic Adviser.
- 1800 hrs IST - Closing Remarks by Mrs. Cathrine J, Head Research & Publication, MRC, Pune.

Convenor

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