Webinar on 04 Mar 2025 at 1600 hrs IST
Marine Spatial Planning (MSP) through Indigenous Innovation – A Live Demonstration of the Shipping Radiated Noise (SRN) Tool

The rapid rise in global maritime traffic has led to a concerning increase in underwater noise pollution, with direct consequences for marine ecosystems, fisheries, and coastal communities. Studies indicate that low-frequency ocean noise has surged by 3 dB per decade post the industrial era, primarily due to commercial shipping**. In the Indian Ocean Region, home to some of the world's busiest trade routes**, this issue demands urgent attention. Large cargo ships generate noise levels between 180-190 decibels, affecting marine species that rely on acoustic vision. Shipping noise has been linked to behavioural changes, including disrupted migration patterns, breeding disturbances, and declining fish catch rates—estimated reductions reaching 50%. Addressing this challenge is crucial for sustaining India's marine economy, with **digital transformation** playing a pivotal role through advanced **real time monitoring, predictive analytics, and AI-driven mitigation strategies.**

Radiated noise, primarily generated by propeller cavitation, contributes significantly to rising ambient ocean noise. Cavitation occurs when pressure changes create and collapse water vapor bubbles, releasing sound energy. Studies since the 1930s indicate that underwater radiated noise (URN) levels have risen by approximately three decibels per decade, largely due to shipping. This **disrupts the natural acoustic environment, posing challenges for marine life reliant on sound for navigation, communication, and reproduction.** Species such as whales and dolphins are particularly vulnerable.

Regulatory bodies, including the International Maritime Organization (IMO), have taken steps to address URN. The IMO’s guidelines encourage noise reduction measures, while instruments such as **Particularly Sensitive Sea Areas (PSSAs)** impose protective controls. However, despite **MARPOL** covering various environmental concerns, it does not yet regulate shipping noise. The **Energy Efficiency Existing Ship Index (EEXI),** effective since January 2023, indirectly contributes to noise reduction by limiting engine power output. Additionally, continuous onboard noise affects human health, prompting IMO and International Labour Organization (ILO) regulations to mitigate hazardous exposure.

Shipping, a key player in global trade, has seen its **noise emissions double in just over a decade.** The COVID-19 pandemic briefly reduced emissions to 2017 levels, underscoring the link between shipping activity and noise pollution. Efforts to mitigate URN pollution are gaining momentum, with the IMO and the European Union implementing non-compulsory guidelines and regional directives. Given its transboundary nature, international cooperation is essential for effective control.

In response, **NirDhwani Technologies** has developed an **indigenous Shipping Radiated Noise (SRN) tool** for real-time monitoring, analysis, and mitigation. This webinar will showcase its capabilities in **data acquisition, acoustic pattern analysis,**

and AI-driven insights for effective noise management. Participants will explore how AI and machine learning process **large-scale underwater acoustic data**, enabling predictive modelling for **Marine Spatial Planning (MSP).** AI-powered tools are revolutionizing maritime sustainability by enhancing environmental monitoring, optimizing ship design, and facilitating data-driven noise reduction strategies.

Computational models provide valuable insights into potential noise reductions through design modifications or operational adjustments. These models analyse noise sources, transmission paths, and total predicted levels, helping shipowners and designers implement effective noise control measures. Strategies such as vibration isolation, structural damping, acoustical insulation, and optimized propeller design contribute significantly to noise mitigation, with modelling and simulation reducing costs by providing accurate predictions before large-scale deployment.

This webinar marks a crucial step in strengthening India's sustainable maritime governance and technological self-reliance. By leveraging indigenous AI-powered solutions, India is poised to lead in balancing economic growth with ecological preservation. NirDhwani Technologies, at the forefront of AI-driven maritime solutions, continues to support **India's vision of self-reliance in ocean governance**. This event will foster collaboration between policymakers, industry leaders, and researchers, offering valuable insights into the role of technology in advancing maritime sustainability and **the Blue Economy.**

Program Schedule

Opening Remarks (05 min)

Mrs. Cathrine J, Head Research & Publication, MRC, Pune.

Introductory Remarks (10 min)

Dr. (Cdr) Arnab Das, Founder & Director, Managing Director NDT.

Presentation & Demo (40 min)

Mr. Shridhar Prabhuraman – Head Innovation NDT.

Mr. Jay Pinjarkar, Project Lead.

Intervention by Dignitaries (25 min)

Dr. Purvaja Ramachandran, Director NCSCM Chennai.

Mr. Ajit Sukumaran, Chief Surveyor, Government of India.

Dr. Tune Usha, Sc G, National Centre for Coastal Management.

Cmde. Anil J Singh, Vice President, Atlas Electronics.

Dr. Shishir Shrotriya, Head Center for Maritime Economy & Connectivity.

Concluding Remarks (10 min)

Amb. Anup Kumar Mudgal – Former Diplomat and Blue Economy Expert

Vote of Thanks

Mr. Praful Talera – Blue Economy Advisor, Maritime Research Center, Pune

Convenor

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Enclosure - 1

Underwater Domain Awareness (UDA) Framework

The concept of Underwater Domain Awareness (UDA), in a more specific sense, will translate to our eagerness to know what is happening in the underwater realm of our maritime areas and the freshwater systems. This keenness for underwater awareness from the security perspective means defending our Sea Lines of Communication (SLOC), coastal waters, and varied maritime assets against the proliferation of submarines and mine capabilities intended to limit access to the seas and littoral waters. The freshwater systems, particularly the transboundary Rivers, are not defended by the Navy & the Coast Guard, but these waters are equally vulnerable and more complex to manage. However, military requirements may not be the only motivation for generating underwater domain awareness. The earth's underwater geophysical activities have a lot of relevance to the well-being of humankind, and monitoring them could provide vital clues to minimize the impact of devastating natural calamities. The commercial activities in the underwater realm need precise inputs on the availability of resources to effectively and efficiently explore and exploit them for economic gains. Underwater resources include fisheries, aquaculture, seaweeds, pharma ingredients, minerals, and others with significant market value. The regulators, on the other hand, need to know the pattern of exploitation to manage a sustainable plan. The connectivity through the water bodies has been recognized as the most effective and efficient mode of transportation, however, ensuring navigability in these water bodies requires a massive amount of UDA.

With so many commercial and military activities, there is a significant impact on the environment. Any conservation initiative needs to precisely estimate the habitat degradation and species vulnerability caused by these activities and assess the ecosystem status and climate change risk. The scientific and research community needs to engage and continuously update our knowledge and access of the multiple aspects of the underwater domain. The global community is looking at the Indo-Pacific strategic space for their geopolitical and geostrategic engagements. The Indo-Pacific region, by definition, is the tropical waters of the Indian and Pacific Oceans. The tropical waters present unique challenges and opportunities regarding rich biodiversity and resource availability. However, the sub-optimal sonar performance is the biggest issue, limiting the UDA in these regions. The sonars that were designed for the temperate & polar waters of the Greenland, Iceland, United Kingdom (GIUK) gap during the Cold War era suffered 60% degradation when deployed in tropical waters. The developing nations in tropical waters need to customize these technologies to suit their conditions. The Western nations that are pushing this hardware do not have the manpower to deploy it. In contrast, the tropical nations, have the manpower but lack the appreciation of the technology and the know-how. The proposed UDA Framework, presented in the figure below, can optimize resource deployment and provide nuanced policy and technology intervention, along with acoustic capacity & capability building to manage the tropical challenges and opportunities. There is significant fragmentation among all four stakeholders, namely Strategic Security, Blue Economy, Sustainability

& Climate Change Risk Management, and Science & Technology (Digital Transformation), and the UDA framework provides a comprehensive way forward for the stakeholders to engage and interact.

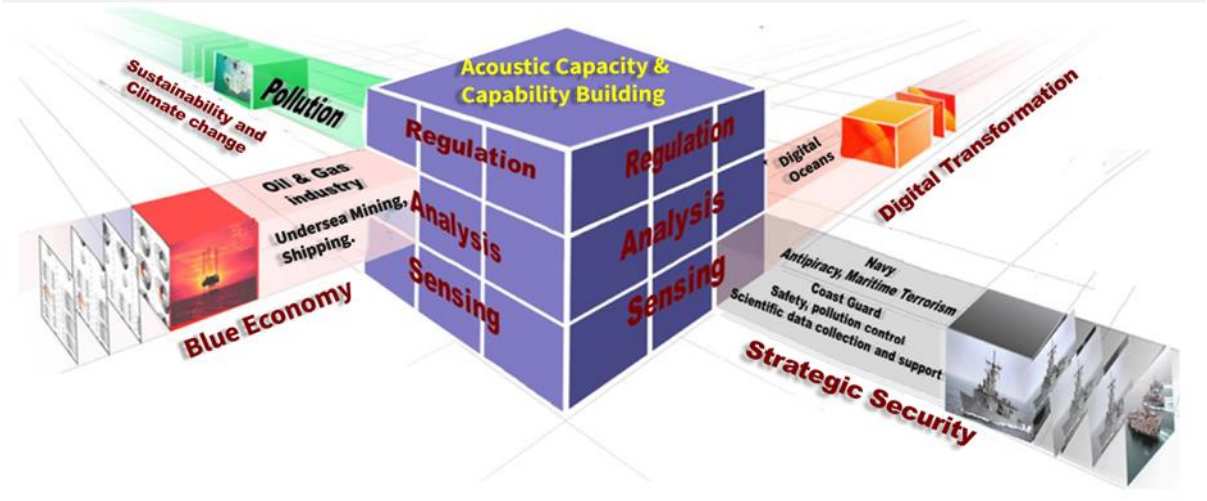

Figure. Comprehensive Perspective of the UDA Framework

On a comprehensive scale, the UDA Framework needs to be understood in terms of its horizontal and vertical construct. The horizontal construct would be the resource availability in terms of technology, infrastructure, capability, and capacity specific to the stakeholders or otherwise. The stakeholders represented by the four faces of the cube will have their specific requirements, however, the core will remain the acoustic capacity and capability. The vertical construct is the hierarchy of establishing a comprehensive UDA. The first level, or the ground level, would be the sensing of the underwater domain for threats, resources, and activities. The second level would be making sense of the data generated to plan security, conservation, and resource utilization strategies. The next level would be to formulate and monitor regulatory framework at the local, national, and global levels. The individual cubes represent specific aspects that need to be addressed. The ‘User-Academia-Industry’ partnership can be seamlessly formulated based on the user requirement, academic inputs, and the industry interface represented by the specific cube. It will enable a more focused approach and a well-defined interactive framework. Given the appropriate impetus, the UDA Framework can address multiple challenges being faced by the global community today. Meaningful engagement of the young and aspirational population is probably the most critical aspect that deserves attention. Multi-disciplinary and multi-functional entities can interact and contribute to synergize their efforts towards a larger goal seamlessly.

The UDA Framework is a structured, comprehensive, and inclusive framework to drive the underwater domain effectively and efficiently. The structured approach will minimize the fragmentation among the stakeholders, regional players, national authorities, and local bodies. The multiple entities will have divergent interests and priorities, thus, converging them into one single and focused governance mechanism will be a challenge. The governance mechanism must be comprehensive and recognize all dimensions of the stakeholder requirement. The dimensions include

varied layers that are instrumental in building a strong governance mechanism. The first layer would be five pillars: research, skilling, academia, innovation, and policy. The second layer is its translation into policy & technology intervention, along with acoustic capacity & capability building. The inclusive aspects include varied socio-economic, socio-political, and socio-cultural native groups in the larger governance framework. The varied socio-economic strata of the society, particularly the coastal & riverine communities, get excluded in the conventional development models. The students need to prepare for real-world challenges and get very late before they get exposed to the nuances of real-world issues. The political spectrum is always driven by the social structure, based on left or right leanings. The governance mechanism has to address the concerns and aspirations of both sides. The cultural divide translates to the traditional practices and beliefs that drive their livelihoods and social structure. The governance mechanism has to address these divides and integrate everyone into one national, regional, or global framework.

The global community is also professing the triad of people, economy, and nature for enhanced governance mechanisms. The people component includes the livelihood, well-being of the native communities, social dynamics, and more. The economic component is the growth and prosperity associated with the activities. The nature component addresses sustainability and climate change risk management. This is also measured in terms of the Environmental, Social, and Governance (ESG) formulation. The UDA Framework is consciously addressing all these varied measures of global good parameters.