MARITIME RESEARCH CENTER
FOUNDATION FOR UNDERWATER DOMAIN AWARENESS

NIR TECHNOLOGIES DHWANI

Concept Note for Training of Other Stakeholders and Personnel of Other Services Class-I, II & III for the current financial year 2025-26- reg Research and Innovation, based on the Underwater Domain Awareness (UDA) Framework

The Indian Ocean Region (IOR) is marked by tropical waters and all of us, dealing with the ecology and the ecosystem that shapes community behavior and sustainable growth, need to appreciate the tropical characteristics. The waterfronts present very unique challenges, given the accessibility and transparency issues. Acoustics is the only means to penetrate below the surface of the water and Sonar is the tool for processing acoustic signals. The marine and freshwater systems in the tropical waters are site-specific and no generalized appreciation of the underwater domain can be used to understand the tropical waters. Land-based approaches have limited utility in managing underwater issues. Remote sensing is being used for even water bodies, however, such techniques in the absence of acoustic means to validate the efficacy of the remote sensing techniques are significantly limited.

The tropical waters present unique characteristics in terms of random underwater medium fluctuations, leading to sub-optimal performance of the sonars deployed for any underwater monitoring. The sensors imported from the West suffer degradation of performance of the order of 60%, in our tropical waters, thus the deployment has to factor in this massive ineffectiveness. The tropical characteristics also include unique sediment transport pattern that impacts navigability, flooding & erosion, benthic ecosystems, sediment-bearing pressure, and many more. The rich biodiversity and huge mineral resources in the tropical waters can provide massive commercial opportunities but can also become a cause of competition to dominate these resources.

Professionals dealing with sustainability, climate change risk management, disaster management and more need to appreciate these nuances related to the tropical characteristics. The strategic approach will require Underwater Domain Awareness (UDA) at a high level to ensure the effective and efficient deployment of our strategic assets. Digital Transformation is known to be the most optimal tool for ensuring effective and efficient management of any domain. Marine Spatial Planning (MSP) is a well-known digital transformation tool in the underwater domain. A UDA framework (Enclosure-1) driven MSP will be the most comprehensive, structured, and inclusive way forward ensuring optimum deployment due to the pooling of resources & synergizing of efforts, across the stakeholders. The UDA framework provides policy and technology interventions, along with acoustic capacity & capability building. The research & innovation-based learning program will facilitate nuanced capacity building among our Other Stakeholders Service Officers at multiple levels. Capacity and capability building has to be undertaken at multiple levels through calibrated learning tools to map the local challenges and opportunities and find real world solutions. Project based learning with hands-on exposure to multi-disciplinary skills & knowledge will be critical. The governance mechanism will require massive data driven mapping of the entire water bodies and nuanced interpretation of the ground inputs to be translated into policy interventions. UDA will be the key driver for the technology

backup for the policy interventions. Acoustic capacity & capability building will be the main pillar.

Proposal

A three-day workshop is planned to sensitize the Other Stakeholder Service Officers on the Underwater Domain Awareness (UDA) framework. The workshop will not only expose the participants to the basics of the UDA framework but will also provide them with a road map for well-informed opportunities to participate in the UDA journey. Project-based learning backed by local site-specific research and innovation will be the core focus.

Program

The program will be delivered as follows:

Day One - Introduction to the UDA framework and multiple dimensions.

Day Two - Policy and Technology Intervention and the Gaps.

Day Three - Acoustic Capacity & Capability Building.

Each day will have six hours of actual sessions with 90-minute session duration. The sessions will include domain expert talks, guest lectures, research presentations, interactions with policymakers, community interactions, and corporate interactions.

Resource persons for the entire event will comprise former diplomats, former bureaucrats, scientists, domain experts, academics, and corporate professionals. MRC has a rich in-house strategic and research advisory board to manage such high-profile training programs.

Coordinator

Dr. (Cdr) Arnab Das,
Founder & Director,
Maritime Research Center (MRC), Foundation for Underwater Domain Awareness, Pune.
Founder & Managing Director, M/S NirDhwani Technology Pvt Ltd (NDT).
Mobile No. - +91-9665033463. Email Id. - director@maritimeresearchcenter.com.

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.

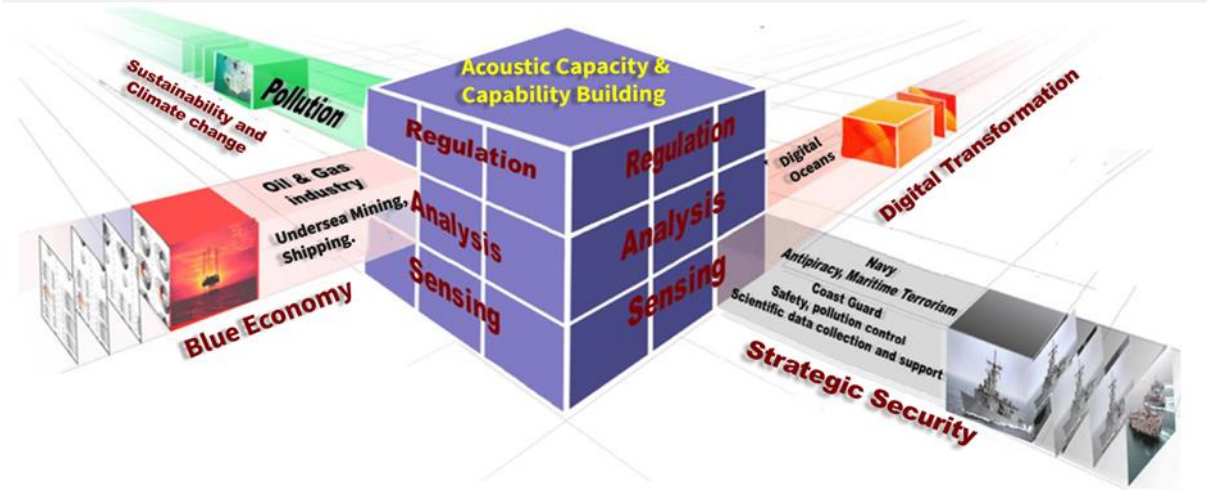

Figure. Comprehensive Perspective of the UDA Framework

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.