Proposal to Build online Training Modules to Support the Underwater Radiated Noise (URN) Management in the Tropical Waters of the Indo-Pacific Strategic Space Advance Level Programs

The International Maritime Organization (IMO) has taken serious steps towards managing the Underwater Radiated Noise (URN) across the globe in multiple dimensions. The issue was discussed in the last few Marine Environment Protection Committee (MEPC) meetings and accorded high priority to make sure that the Acoustic Habitat Degradation due to low frequency ambient noise is managed effectively. The URN due to shipping has becomes the leading cause for stranding of big whales, as a result of direct relation to rising shipping traffic. The URN due to shipping is known to be the single ubiquitous source of low frequency ambient noise in the oceans. The steady rise of the shipping traffic as a consequence of direct link to the economic growth engines has been a cause of concern. In a democratic set-up with rules-based order, any new idea to fructify has to be political acceptable, socially desirable, technologically feasible, financially viable. administratively doable, judicially tenable, emotionally relatable and environmentally sustainable.

India has now been nominated as the lead nation for underwater noise in the Indian Ocean Region (IOR). The Director General (DG) Shipping has formed a national task force to drive this initiative on behalf of the Government of India as per the IMO directives. The tropical waters of the IOR, present very unique challenges and the technologies & knowhow from the west (designed & developed during the Cold War era in the temperate & polar region), do not apply directly in our waters. The socio-economic, socio-cultural and socio-political realities of the IOR, also needs to be factored, when we propose a solution to the underwater noise problem. The IOR is densely populated with aspirational young population who need to be meaningfully engaged. Thus, any solution has to include all the five aspects of research, knowledge, skilling, innovation and policy.

The Underwater Domain Awareness (UDA) Framework being progressed by the Maritime Research Centre (MRC), Pune and M/S NirDhwani Technologies Pvt Ltd (NDT), is well placed to manage the challenges & opportunities, arising out of such massive strategic push by the Government of India. The digital oceans through implementation of effective UDA framework will bring, far more transparency and ensure enhanced governance. The Marine Spatial Planning (MSP) has become the de-facto tool for digital transformation in the underwater domain. MSP implementation by the west is highly hardware intensive, so the developing nations in the region cannot afford such high cost. Such approach, make it difficult to implement a uniform global plan, which could have helped optimizations at the global scale. The paper forwarded by India (based on work done by the MRC) in MEPC 76, addresses these challenges and presents a viable option to effectively manage URN in the tropical waters and beyond.

An initiative led by the Director general Shipping (DG Shipping), to manage the URN in the tropical waters of the IOR and beyond can significantly ensure true implementation of the IMO directives. The UDA framework comprising of policy & technology intervention along with acoustic capacity & capability building will be the key to this initiative. The earlier ten modules dealt with appreciating the broad UDA framework and the core areas of applications. This series of twelve advance modules will address the specific URN management aspects in the tropical waters.

Proposal

The sensitization of the stakeholders and policy makers on the relevance and nuances of the URN management is a critical first step. A series of E-learning modules (three hours each) has been planned to provide a convenient and effective knowledge enhancement for the policy makers and stakeholders. The modules will address the various aspects of the capacity & capability building for growth in the URN management both for the marine and the freshwater systems. The beneficiaries will include policy makers at the global, regional, national, state and the local levels, the community representatives, support groups, foundations working on the ground, regulators, enforcement agencies and more. These advance modules will be for the specific URN management and sustainable development objectives.

The list of the twelve modules is provided below:

Modules

(a) Ambient Noise in the Oceans

The ambient noise in the ocean varies based on the spectral band. There are broadly three categories of sources of ambient noise. Low (below 1 kHz) frequency band is occupied by distant shipping noise, the second band is the 2-15 kHz band due to wind and the third is the biological noise, that is spread across all bands based on the type of species. This module will cover all the three categories and some other sources as well.

(b) Natural Vs Anthropogenic Noise

The ambient noise in the ocean is also categorized as natural and anthropogenic noise. The natural sources include biological sound from marine species and natural events like earth quakes, surface wave action, wind noise and more. The underwater ecosystem adapts well to these natural sources, however the sustainability concerns arise due to anthropogenic noise sources. These noise sources include shipping, seismic activities, underwater constructions, sonars, explosions and many more. Most of these are high power sources that have catastrophic impact on the underwater ecosystem. This module will cover both the sources and the specific characteristics of the low frequency ambient noise due to shipping.

(c)   Basics of the URN and its Manifestation.

The URN is the emission of noise from a marine platform as a result of its operations in the water body. The complete process of sound generation at source and its transmission within the marine vessel will be discussed. The module will present three sub-modules including the types of onboard noise, characteristics of in-hull & out-hull noise and the broad characteristics of the URN.

(d)   Source-Path-Receiver Model.

The signal recorded at the receiver comprises of the original source signal, that gets modified due to acoustic propagation in the underwater medium and also the ambient noise at the receiver location. The URN recorded at the receiver starts with a certain characteristic from source, however based on the source signal characteristics the underwater channel will distort the signal. The non-linear nature of the underwater channel is a critical aspect to be understood for signal analysis. At the receiver, based on the receiver specifications, the recorded signal will be further modified. This module will present the entire source-path-receiver dynamics for signal analysis.

(e)   Acoustic Habitat Degradation.

The underwater domain limits the propagation of any signal other than the acoustic signal. The underwater species use sound for multiple biologically critical functions, namely foraging, communication, navigation, breeding, avoiding predators and more. The increasing underwater noise is causing serious disruption in their perception of the ecosystem around them, referred as the Acoustic Habitat Degradation. This module will elaborate on the acoustic habitat degradation, based on the URN from shipping. The source-path-receiver model will be elaborated.

(f)   Tropical Characteristics.

The tropical waters present unique political, economic and strategic characteristics. The rich biodiversity and the wealth of underwater resources make it extremely sensitive geopolitically. The substantial acoustic propagation degradation is a cause of worry for the analysis of URN and its management. The module will discuss the varied aspects of the tropical characteristics for effective policy making.

(g)   Freshwater Systems.

The freshwater systems are becoming critical with the mega Inland water transport project being progressed. India and some parts of South Asia are prioritizing inland waterways for their significant contribution to sustainable development. However, one needs to appreciate that the any development plan needs to be progressed with a nuanced understanding of the sustainability concerns. Freshwater systems in this part of the world are a habitat to the unique freshwater dolphins that depend on acoustic vision to perceive the environment around them. This module will

address the aspect of acoustic habitat degradation in the freshwater systems due to Inland Water Transport.

(h)   Marine Spatial Planning (MSP).

The digital transformation, referred as Marine Spatial Planning (MSP) in the underwater domain, is an established governance tool for any development process. The conventional MSP has been ineffective due to hardware intensive approach, sometime criticized for ulterior profit motive. We propose a Modelling & Simulation (M&S) based MSP to optimize the resource deployment. It also brings a far nuanced policy and operational intervention tool across varied dimensions. This module will deal with MSP across the marine and the freshwater systems.

(i)   Sustainable Development Goals (SDGs).

The Sustainable Development Goals (SDGs) have become the United Nations (UN) mandated measures for sustainability. The URN management has become one the most critical aspects of SDG 14 (Life below water). This module will elaborate on the URN impact on the life below water both in the marine and freshwater systems.

(j)   Digital tool for URN Management.

The entire URN management has to be dealt with, in a transparent and effective manner. Connectivity both in the marine and freshwater systems need to be managed in the digital platform for effective and sustainable operations. The entire data acquisition to analytics and the final deliverable of effective management will be discussed in this module.

(k)   Acoustic Capacity & Capability Building.

Mega initiatives need equally massive capacity & capability building. The URN management will require acoustic capacity & capability building across the three steps of to see, to understand and to share. The tropical challenges will have to be mitigated before any inputs are used for decision making. This module will deal with the entire acoustic capacity & capability building for URN management.

(l)   Acoustic Stealth Vs Acoustic Habitat Degradation.

The stakeholder fragmentation is the biggest challenge for nuanced URN management. The strategic security community and the environmental regulators need to come together to build capacity & capabilities along with infrastructure to manage this aspect optimally. The acoustic stealth and acoustic habitat degradation, both have the same underlying technology knowhow requirement. The ship designers and ship builders need to also take inputs to build the silent platforms. This module will deal with the broader acoustic capacity & capability building requirement.

The Potential Participants

The potential participants for the E-learning modules will include:

(a)   The Fisheries Department.

(b)   The Water Resource Departments.

(c)   The Public Sector Undertakings (PSUs).

(d)   The Administrative Training Institutes under the Government of India.

(e)   Maritime Boards in all the nine Coastal States.

(f)   Environmental Regulators and Disaster Management Authorities.

(g)   Energy Regulators

(h)   Surface Transport Departments & Regulators

(i)   Auditors and Science & Technology Departments

The participants will be provided with significant amount of reading material, along with the presentation in the form of a video. The MRC runs four digital platforms, namely the UDA Digest, UDA Knowledge Center, UDA Dialogues and UDA Learning Center, that has body of work in varied formats. These are all peer reviewed by the specific subject matter expert and the in-house research team.

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