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NISHYABDHA NEETI: THE BATTLEFIELD DYNAMICS OF THE ABYSS

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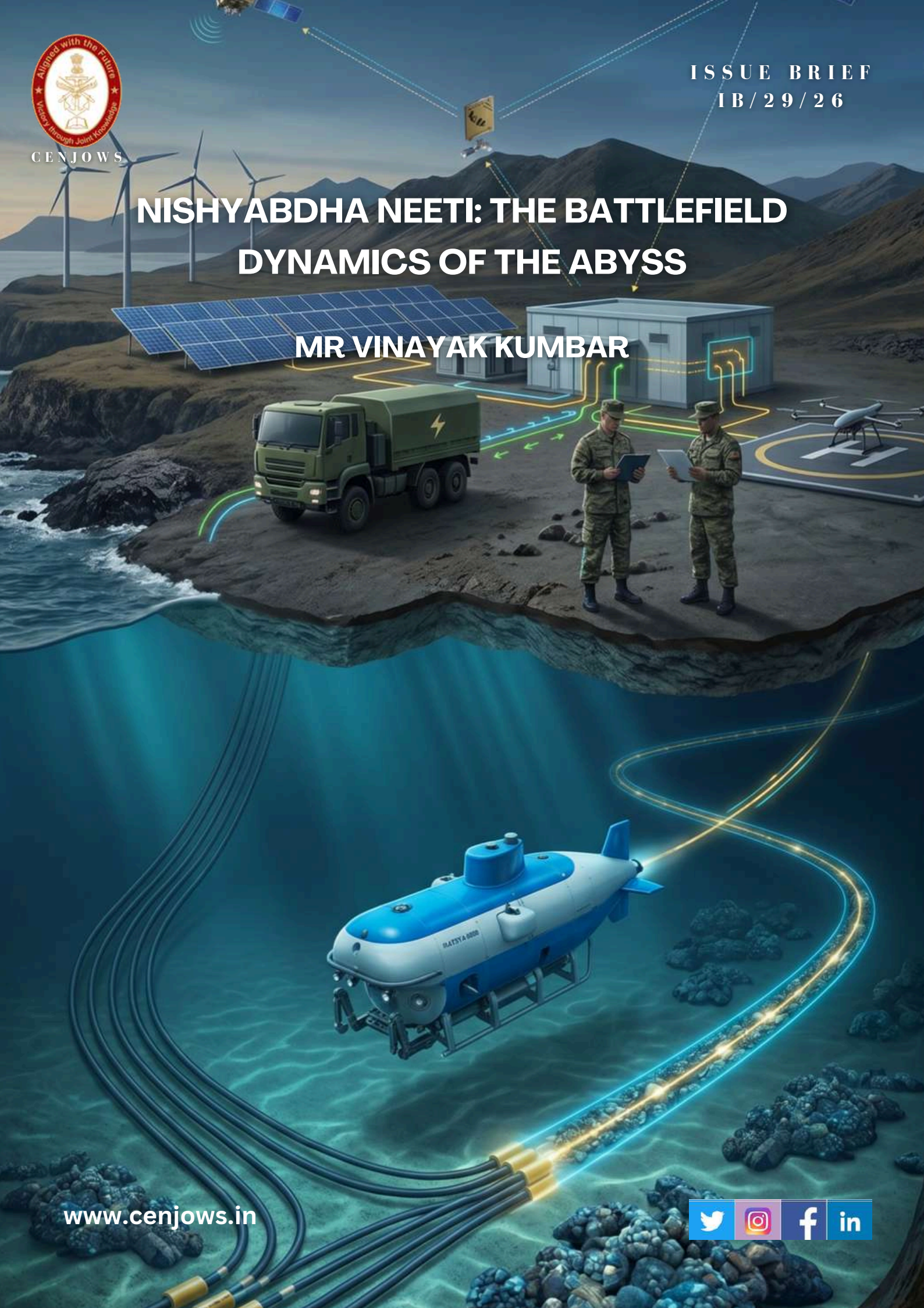

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Nishyabdha Neeti: The Battlefield Dynamics of the Abyss

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Introduction

The seabed is in constant transition from being a sanctuary of silence to a kinetic domain. This transition marks what one might call the most significant shift in naval warfare since the introduction of the Nuclear Submarine. In the last few years, the world has witnessed a series of unattributed maritime incidents. These have served as a blueprint for potential future conflicts in times to come. One best example would be of the severing of the C-Lion1 and BCS East-West submarine telecommunication cable interlink in the Baltic Sea. It was not merely a logistical hiccup. It, in turn, was a meticulously calibrated demonstration of "Denial of Connectivity." In such instances, the commercial vessels that act as state proxies utilise drag - anchor tactics to physically snap fibre-optic cables. This provides perfect plausible deniability because it mimics common maritime accidents. However, the synchronised nature of these breaks highlights a sophisticated intelligence operation that is designed to test the rapid repair

capabilities as well as the political resolve of targeted nations. An adversary does not necessarily need to destroy the undersea communication cable in order to achieve a strategic effect, they only need to create good enough interference or noise that would degrade the quality of data transmission. This would force a shift to slower and more expensive satellite backups, thus, creating a bottleneck in global communications. It slows down the reaction time of critical military command structures. India sits at the centre of the Indian Ocean Region (IOR). Hence, these developments can be considered as critical warning signals.

The seabed thus, is no longer a transit zone just for commerce. It is now an active front line where the first shot of a major conflict may be fired. These may not be necessarily with a bang but with a "silent severe severing" that could leave a nation blind before the first missile is launched.

The Fragile Superstructures Underwater

Modern civilisation can easily be labelled as a "networked through cables". Yet, this digitalised foundation remains vulnerable. More than 95% of all international internet traffic, including sensitive military data, high frequent trading data and diplomatic information, is carried by a network of submarine cables.[1] These in many places are thinner even than a garden hose.

We often speak of the cloud-based storages as an ethereal entity. This cloud is physically anchored to the crushing depths of the ocean floor. This vulnerability is further increased as these cables often converge at maritime chokepoints like the Strait of Malacca, the Suez Canal, the Bab al Mandab Strait or the Hormuz Strait. A coordinated strike at such nodes could result in a digital dark age for the region that is targeted. It results in decoupling the military command and control (C2) from its kinetic assets. This would also plunge the domestic economy into chaos. Furthermore, the transition to renewable and green energy is moving the power plant into the sea. Offshore wind farms and subsea high voltage direct current (HVDC) cables are critical components of national power grids now more than ever. Land - based power stations

can often be protected by walls, CCTVs, and anti-air batteries. But a subsea power cable that stretches over hundreds of kilometres across the continental shelf is almost indefensible target for any nation that lacks the Sub Sea Domain Awareness (SSDA).

In the context of the multi domain operations (MDO) framework, the subsea domain is undoubtedly the root system of the defence tree. If these roots were to be severed, the air, land, and space capabilities could lose their nourishment. This could be in the form of fuel, electricity, or the data that is required for precision strikes. Thus, the security of this domain becomes a pre - requisite for national sovereignty. A nation without an effective security for the same becomes a mere tenant on its own continental shelf and is often vulnerable to any actor with a deep - sea drone and a pair of industrial cutters.

The Underwater Silk Road: Trade Economy and Commerce

The economic impact and intensity of the seabed is expanding far beyond cables and pipelines. It is moving into the realm of deep-sea mining (DSM) and the Blue Economy. Terrestrial mines for critical minerals like cobalt, nickel, and manganese that are essential for the semiconductor, aerospace, and EV battery industries often face depletion or geopolitical gatekeeping. This is where the Poly Metallic nodules that are found at depths of 4,000 to 6,000 meters[2] add a new layer of commercial contestation. Sovereignty in the current era would easily be defined by a country's ability to protect its Exclusive Economic Zone (EEZ), not just on the surface waves but on the seabed floor where these multi - trillion-dollar resources reside. This hidden silk road of the abyss is the new highway for the industrial revolution in times to come. Any disruption to its security could well translate into a loss of also the technological momentum.

The "just-in-time" global supply chain is increasingly a "just-in-sea" chain when it comes to trade. Any "dark" activity on the seafloor can cause cascading delays in global shipping when subsea sensors are being integrated into port logistics and autonomous shipping routes. India handles a massive volume of global energy transit through the IOR. Therefore, the ability to guarantee the safety of subsea infrastructure becomes a "force multiplier" for its diplomatic stances. India could act as a "Net Security Provider"

in the subaquatic domain. Doing so, it can ensure that the trade routes stay open and are stable amidst grey zone tactics and coercive threats. This economic security can easily be considered as the bedrock of this emerging strategic high ground. It is extremely difficult for anyone to project power into the lunar orbit when the national economy is being bled dry from the abyss. Thus, the defence of the seabed at its core is the defence of a nation's future industrial viability and an assurance of a seat for it at the high table of global trade.

Material Marvel –The Submarine Cables

A submarine cable is nothing less of a miracle of material science. It is designed to survive under immense hydrostatic pressure and corrosive saltwater conditions for decades.[3] Their core is made of high-purity optical fibres. These are surrounded by a water-blocking petroleum jelly. Also, a copper or aluminium tube is used to carry power to underwater repeaters. These are further shielded with multiple layers of galvanised steel wire armour.

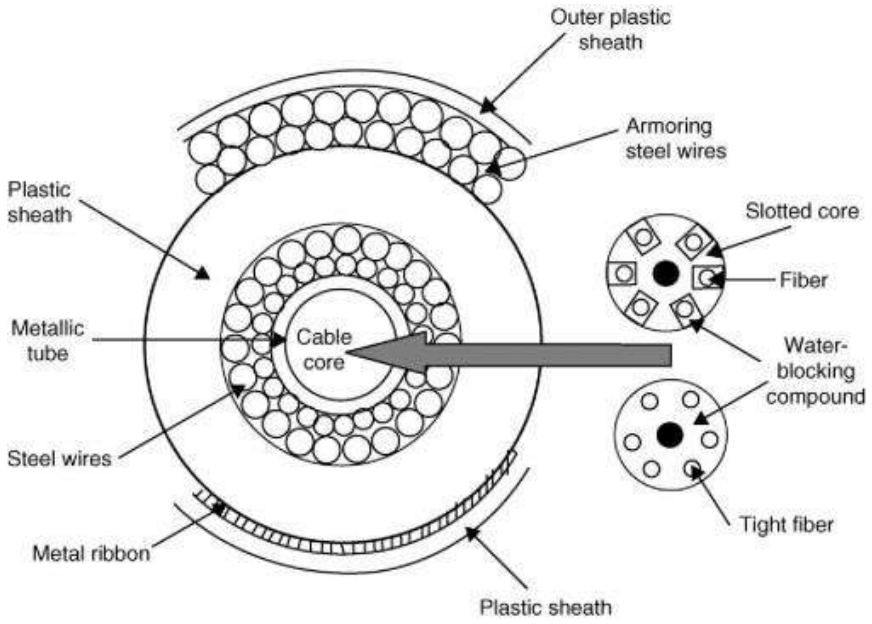

Figure 1: Basic structure of a submarine cable.

Source: ScienceDirect

This armouring is primarily to protect the cables against deep sea creature bites, from ship anchors, and from fishing gear. However, the shield is not for military grade sabotage or to prevent sophisticated espionage.

There is a concept of "Inductive Tapping," in modern warfare. Wherein, a hostile submersible wraps a sensor around the cable. This is done in order to intercept the electromagnetic leakage of the data pulses. This enables data theft without having to break the physical fibre optic core.[4] This makes it impossible to detect the breach from the surface using traditional signal-loss monitors. Recent discoveries in Quantum Key Distribution (QKD) are being actively integrated into subsea links to counter the above-mentioned threat. When data is sent as quantum states, any attempt to observe or tap the cable would theoretically collapse the wave function. This would instantly alert the operators to the intrusion. But the hardware required for underwater QKD repeaters to boost the signal every 60 - 80km is still in its nascent stage and is also incredibly expensive to maintain.

For defence planners, the goal is moving beyond thick armour towards an “Intelligent Cable" that uses distributed acoustic sensing (DAS). DAS allows the fibre - optic strands to act as a 1,000-kilometre-long microphone. This would be able to detect the minute vibrations caused by approaching divers or Under Water Vehicles (UWVs). Thus, a vulnerable asset is turned into a persistent defencive tool. It could provide a built-in surveillance network that utilises the very infrastructure it aims to protect. A hunted cable is eventually turned into a hunter sensor.

Breakthrough in Technology –The Torpedo Tube Launch and Recovery System (TTLR)

One of the most disruptive technological leaps in recent times is the TTLR system. The need for a specialised surface ship to deploy and, more importantly, retrieve them is the umbilical cord of Autonomous Underwater Vehicles (AUVs). This makes their operations highly detectable by satellite surveillance systems and also extremely weather dependent. The TTLR system allows for a standard attack submarine to function as an

underwater aircraft carrier[5] and provides a solution to these dilemmas. TTLR uses a sophisticated robotic docking arm. It extends from the torpedo tube, captures the returning AUV and then pulls it back into the pressure hull. It does so while also ensuring that the submarine is able to move at tactical speeds.

The technical specifications of AUVs have also seen an unprecedented evolution. They utilise Neuromorphic Computing (NC). Therefore, these drones no longer need to contact a human operator for receiving instructions. They can easily map the seabed in high resolution, identify unauthorised objects and decide on their own as to whether to neutralise them or to shadow them. They are able to do this all, while operating in an acoustic silence mode. Solid State Lithium Sulphur batteries power them. These batteries provide 40% more energy density than the standard Li-ion.[6] This allows for missions to span thousands of miles of the seafloor.

These technologies in a way "democratises" seabed warfare. A Nation that can afford a modest conventional submarine fleet can now project persistent power across the entire vertical of the water column. It can conduct surveillance or sabotage missions, which were previously an exclusive domain of global deep sea research giants.

Antar Jala Shoda: The Indian Deep-Sea Exploration

India’s strategic response to these threats in sub surface domain is rooted in the Deep Ocean Mission. It is a multi - ministerial initiative that aims to synergise scientific exploration and national defence. The crown jewel of this mission is the Matsya – 6000 (Matsya in Sanskrit means Fish). It is a deep submergence vehicle (DSV) that is designed to take three "Aquanauts" to depths of 6,000 meters[7] or appx 21000 feet (6 Kms or appx 3.75 Miles). Its main mission is of polymetallic nodule exploration. However, its dual use potential is also revolutionary for the Indian Navy. A vessel that is capable of reaching the deep ocean floor can easily inspect, repair, or defend subsea infrastructure that is currently beyond the reach of traditional standard naval assets. In seabed warfare context, Matsya 6000 could provide India with a deep-reach capability that can counter anti - national activities at depths where most submarines cannot go.

Matsya 6000 is managed by the National Institute of Ocean Technology (NIOT). It features a 2.1-meter diameter Titanium alloy sphere,[8] and is capable of withstanding pressures nearly 600 times that of what is on the surface.

This capability has enabled India to join an elite club of nations with deep-sea intervention and exploration power. In any possible conflict scenario in times to come, this platform could surely be used to deploy static, long endurance sensor pods on the ocean floor near the strategic territories like the Andaman and Nicobar or the Lakshadweep Islands to monitor the "underwater gateway" of crucial straits.

Integration of the Matsya 6000's deep reach with the Indian Navy's surface fleet and space based automatic identification system (AIS), India can create an effective vertical shield. It extends from the seafloor to the surface. This ultimately will ensure that the Indian Ocean's depth is not a vulnerable black hole for intelligence but, a transparent and a well-defended zone.

Enhancing the Naval Capability

In order to counter the threat of silent / invisible seabed actors and submarines, the Indian Navy has prioritised anti - submarine warfare shallow water craft (ASW - SWC**)** induction. In recent times, vessels like the INS Agray and INS Malwan have been delivered to the Indian Navy. These are designed specifically to enhance "coastal seabed awareness (CoSBA)." The traditional destroyers are optimised for high-speed blue water engagements, whereas, these water - jet propelled crafts are designed to tackle the complex, congested, and contested environments of the continental shelf. It is here that the cables are most vulnerable. They possess a shallow draft and provide high manoeuvrability. This allows them to operate in littoral zones that are generally inaccessible to larger warships. Thus, they provide a dedicated patrol for India's assets deep underwater. These crafts are equipped with indigenous low - frequency Variable Depth Sonars (VDS) and Active Towed Array Sonars (ACTAS). The former allows the ships to dip their sensors below the thermocline,[9] which is the layer in the ocean that

generally acts as a sonic shield for submarines. It thus eliminates the acoustic blind spots that adversaries normally exploit to sneak up on pipelines.

Furthermore, these ships are integrated into a tactical data link (TDL). TDL shares subsea contacts with aircrafts like the P-8I (Poseidon) and coastal batteries in real-time. This effectively ensures that the detection of seabed threats in the Arabian Sea can be met with an immediate multi-domain response. These vessels represent that active layer of seabed defence which turns sensor data into kinetic action upon identification of threats.

Gray Zone Defence: Countering the Under Sea "Salami Slicing"

One of the greatest challenges in this abyss that has been discussed so far is the problem of attributing sabotage to an identity. In recent years, several mysterious outages have occurred globally. Underwater sensors were often simply moved or blinded by acoustic jamming or suffered some mechanical failures.

These are classic grey zone tactics and actions such do fall below the threshold of an open warfare. However, they also degrade national security over time. It is completely possible for an adversary to engage in Salami Slicing to damage one sensor or one secondary cable at a time to test and see how the Indian forces respond. If in case the response is slow or soft – diplomatic one, it might give the adversary some kind of confidence to perform more such actions towards other assets like energy pipelines.

It is safe to say that deterrence in this domain must be "deterrence by detection." A nation can remove the "cloak of invisibility" that makes such grey zone tactics effective by deploying a denser grid of persistent Sub Sea Surveillance (SSS)**.** This in contemporary times requires the use of AI - driven systems that can analyse any patterns of life (POL) data on the ocean floor. These systems can effectively help distinguish between the normal movement of sea life or commercial ships and the mysterious or suspicious behaviour of a "research vessel" those hovers over a cable. If the adversary knows that it is being watched in real time and that its acoustic signatures

are being analysed by a cognitive AI system, the plausible deniability of a trawler accident might disappear.

The Dilemma in the Legal Arena

It is not wrong to say that the legal framework for seabed defence is as contested as the domain itself. The United Nations Convention on the Law of the Sea (UNCLOS) provides guidelines for the continental shelf and the international seabed. However, it lacks specific provisions needed to protect private infrastructure during certain hybrid / non-linear conflicts.

As per current status, a nation has the right to lay cables in international waters, but their protection employing military force can be viewed as an infringement in the freedom of navigation trough the seas. This leads to the creation of a legal vacuum that an adversary tends to exploit by using commercially flagged vessels to carry out military sabotage or espionage. The sea laws were written in a time when the seabeds were just empty void, whereas it is now an ill equipped high - tech battlefield.

There is a growing tendency, or even movements, to define subsea protection zones (SPZ) around critical infrastructure. This is in line with Air Defence Identification Zones (ADIZ). Any unidentified submersible or loitering vessel within these zones would be required to identify itself or face interception. Without legal safeguards to match the technological ones, the most advanced systems would get tied down by certain hesitations. Establishing efficient legal norms is necessary to prevent the Abyss from becoming a lawless zone vulnerable to perpetual sabotage.

Conclusion: Seabed as the Foundation of Integration

Ultimately, the seabed is the perfect and most vulnerable foundation for integrating architecture (Space, Land, Air, Marine, Subsea, Cyber and Cognitive) that this book is all about. It supports rest of the vertical in the said architecture. Without the data links in the sub - sea domain, the space domain will not be able to transmit hyper-spectral imagery to the ground. Without energy pipelines in the subsea domain, the air and

marine forces lack the fuel required to project power. One of the fundamental ideas behind this book is that the vulnerability of one is the vulnerability of all. A high-tech army on land can effectively be neutralised if its underwater data feed is hampered, and a satellite constellation is absolutely useless if its ground stations cannot share data through these subaquatic grids.

As we are about to move to Chapter 2: Distributed Maritime Operations (DMO), we must carry this "Abyss to Orbit" mindset forward. The surface fleet of the future may not be a collection of isolated ships but a mobile node in a vertical network. The AUVs launched from submarines could provide the targeting data for a hypersonic missile to defend a coastal city.

Securitisation of this abyss would ensure that the digital heart of the force remains beating. It would allow the cognitive battlefield mentioned in the subsequent parts (Part V) to function at the speed that is relevant**.** Securing the bottom of the vertical is a must in order to guarantee dominance at the top.

DISCLAIMER

ENDNOTES

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