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# ABHEDYA: THE STRATEGIC SHIELD OF THE AUTONOMOUS ARSENAL

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## CENJOWS

**Abhedya: The Strategic Shield of the Autonomous Arsenal**



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This paper is an attempt to examine the emerging role of Large Unmanned Surface Vehicles (LUSVs) within the broader framework of Distributed Maritime Operations (DMO). It argues that these platforms are evolving from being an auxiliary asset into critical nodes of a distributed sensor-to-shooter kill web. When equipped with artificial intelligence, autonomous navigation, modular payloads, resilient communications, and advanced weapon systems, LUSVs could enable manned fleets to operate out of hostile engagement zones whilst projecting combat power into contested waters. An emphasis is also placed on the 'sacrificial shield' concept. Here the unmanned vessels that are equipped with Directed Energy Weapons (DEWs), electronic warfare suites and decoy signatures absorb or neutralise incoming threats before they can strike high-value manned assets. Drawing an inspiration from the Mahabharata, Ghatotkacha's calculated sacrifice is interpreted as an early example of deceptive deterrence, where expendable platforms compel the adversary to prematurely exhaust critical capabilities on suboptimal targets. The paper further evaluates India's evolving unmanned maritime ecosystem under the iDEX framework and argues that indigenous LUSV development will be central to enhancing deterrence, survivability, and operational persistence in the Indian Ocean Region.

## **Introduction**

This paper builds upon the foundational discussion involving the subsea domain that was presented in chapter one. It further extends the analysis upward into the increasingly contested surface warfare environment. While the earlier chapter examined the strategic significance of the underwater battle space and the growing role of subsea systems, this chapter attempts to explore how the surface layer of the maritime vertical is being transformed by LUSVs, artificial intelligence (AI), and DMO. The transition from the abyss to the ocean surface reflects the broader evolution of modern warfare into an interconnected and vertically integrated battle space. In this context, the information, autonomy, and survivability define the operational success. Traditional naval doctrines that are centred upon heavily manned capital platforms are increasingly vulnerable to long range precision strikes, electronic warfare, and unmanned swarms. As an effective response to these vulnerabilities associated with manned systems, contemporary naval strategy is evolving toward distributed and network-centric operational models that disperse combat capability across interconnected manned and unmanned nodes. Thus, one can say that, in this framework, LUSVs are emerging as critical force multipliers that are capable of functioning as autonomous missile carriers, sensor platforms, electronic warfare nodes, and sacrificial defensive shields. In context of the Indian sub - continent, the growing strategic contestation in the Indian Ocean Region (IOR), makes the development of unmanned maritime systems a strategic imperative for future deterrence, survivability, and multi-domain operational dominance.

### **LUSVs: Adaptable Workhorses of the DMO Architecture**

The LUSV's can easily be termed as the workhorse of the DMO architecture. They typically range from 60 to 100 meters in length and can offer a displacement of 1000 to 2000 tons.<sup>1</sup> These are designed to function as 'Exoskeletal Magazines' for manned fleets. The latest generation of LUSVs offers high endurance and comes with flexible propulsion systems.<sup>2</sup> These are capable of remaining at sea for up to 30 days without any human intervention.<sup>3</sup> They can even be equipped with Modular Vertical Launch Systems (VLS), often 16 to 32 cells.<sup>4</sup> This makes them capable of carrying a mix of

missiles, long-range surface-to-air interceptors, and anti-submarine rockets. The forces can offload the missile magazine to an unmanned platform. This will allow the "Parent" ship to stay minimum 200 miles outside the enemy's primary engagement zone while the LUSVs move into the high-threat zones to attack.

These vessels can be equipped with a "Cognitive Navigation" system. This system can integrate data from LiDAR, High-Definition (HD) optical cameras, and automated identification systems (AIS). This becomes critical when operating in the crowded shipping lanes (such as the Strait of Malacca or the Hormuz). It is important to ensure that the AI on board is capable of distinguishing between a neutral fishing trawler and a hostile decoy. It should be trained enough to adjust its path autonomously while maintaining its position within the distributed formation. The LUSV also features "Modular Payload Bays," that allow for rapid reconfiguration.<sup>5</sup> This would in turn enable them to switch from a missile magazine to a specialised electronic warfare platform. This versatility makes the LUSV the most adaptable asset in an integrated warfare framework that efficiently synergises the coastal defence and deep-water power projection.

### **Distributed Lethality: Sensor to Shooter Decoupling**

When it comes to a distributed environment, the LUSV is not just a missile carrier but acts like a critical eye and ear in a multi-spectral 'Kill Web.' In conventional naval warfare, a ship had to see a target with its own radar in order to shoot it. In the DMO model, on the other hand, the sensor, the decider, and the shooter are essentially decoupled. An LUSV that operates in a passive-only mode can receive targeting coordinates from a High-Altitude Long Endurance Unmanned Aerial Vehicle (HALE UAV) or a Cis-lunar satellite to remain invisible to enemy radar. The data can be rapidly processed by an AI-assisted combat system on a manned command ship that is located even hundreds of miles away. Once the decider, i.e., the human commander, authorises the attack, the command is sent via a low-probability-of-intercept (LPI) data link to the LUSV that prompts it to launch its missiles. This architecture will ensure that the platform that is firing ammunitions / missiles remains unmanned and expendable. In

case the enemy succeeds in retaliating against the launch point, they will only be hitting an empty LUSV. It effectively ensures that the human commanders and high-value sensors remain safe and untouched. This kill web relies heavily on the platform integration and interoperability. The LUSV must maintain constant connectivity with space-based Position, Navigation and Timing (PNT) to ensure that the distributed nodes actually act as a singular, synchronised system. The challenge lies in processing sensor data from the Ocean Surface and the Orbit to provide a clear fire control solution in just a few milliseconds. In recent times, the edge computing on LUSVs is allowing them to filter out noise and only transmit high-priority target data.<sup>6</sup> This significantly reduces the bandwidth required to maintain the kill web and makes it more resilient to enemy jamming.

### **Overcoming the ‘Bandwidth Desert’: Communications in Contested Waters**

Maintaining connectivity in a ‘Command and Control in a Denied/Degraded Environment (C2D2E)’ is one of the greatest technical hurdles for DMO. An adversary would put jamming satellite links to isolate unmanned nodes with sophisticated Electronic Warfare (EW) capabilities as its priority. This eventually would turn them into drifting bricks. One option to counter to this would be to integrate LUSVs with Laser Communications (LaserCom). LaserCom normally use narrow, highly focused beams of light to transmit data at gigabit speeds.<sup>7</sup> This beam is extremely narrow hence, it becomes very difficult (almost impossible) to intercept or jam from the side. This in turn offers a secure digital pipe between the LUSV and its parent ship. In case of LaserCom degradation by atmospheric conditions like heavy fog or rain, the vessels can switch to high-frequency (HF) skywave radios. These are capable of bouncing signals off the ionosphere which helps them maintain long-range and low-bandwidth connectivity.<sup>8</sup> In case where even such links are severed, the LUSVs can revert to the autonomous intent. They can do so using pre-programmed mission parameters and Neuromorphic Edge AI. These technologies enable the vessel to continue its patrol or move to a pre-designated rally point without manual guidance. Furthermore, the DMO doctrine when utilising a ‘daisy chaining’ (a string of LUSVs could act as a physical relay bridge and pass on data from the deep-sea abyss sensors to the surface fleet and back up to the

atmospheric wingmen) can effectively create a resilient 'Mesh Network'. In this kind of network, the loss of one link would trigger an automatic rerouting of data through the remaining functional nodes.

### **Defensive LUSVs: The 'Sacrificial Shield in the Sea'**

Along with offensive capabilities, a significant portion of the LUSV fleet should be dedicated to the defensive duties. In a high-intensity conflict, a group of unmanned vehicles could be deployed several kilometers ahead of a manned task force. These vessels can carry high-power Electronic Warfare (EW) suites and Signature Emulators.<sup>i</sup> These can manipulate radar returns and infrared signatures that could make a small, low-cost LUSV appear as a large aircraft carrier or an amphibious attack ship. By creating such ghost fleets, the defender can force the adversary to waste their limited supply of expensive munitions on expendable decoys or suboptimal targets. This by deceptive deterrence is a core pillar of the DMO strategy. One can even recall that in the Mahabharata, Ghatotkacha's devastating and deceptive battlefield tactics forced Karna to prematurely use the Vasavi Shakti, which had been reserved for Arjuna. His calculated sacrifice neutralised a strategic threat and shifted the balance of deterrence in favour of the Pandavas.<sup>9</sup> This can be a loose yet relevant interpretation of allowing the real manned fleet to remain hidden and preserve its own ammunition for the decisive engagement.

Beyond deception, these Unmanned Surface Vehicles (USVs) can also act as kinetic shields. When equipped with, let's say, a Directed Energy Weapons (DEW) or short-range surface-to-air missiles (SAMs), they can be programmed to intercept incoming threats far before they could reach the manned fleets. If an incoming swarm of anti-ship drones is efficiently detected, the LUSVs can engage them first, acting as a buffer that would absorb the initial strike. This is a 'sacrificial shield' concept that can radically change the math of naval survival. While in a traditional fleet loss of one destroyer could be a national tragedy as it could turn out to be a massive blow to capability, on the other

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<sup>i</sup> Naval devices and systems designed to replicate the acoustic, magnetic, and electromagnetic (EM) emissions of real ships and submarines.

hand, in a DMO fleet, the loss of multiple LUSVs would merely be a calculated 'equipment expenditure.'

### **The Indian story of Navigating the DMO**

India's maritime strategy is witnessing a rapid evolution to incorporate the DMO principles. These efforts are primarily aided through the Innovations for Defence Excellence (Idex) framework. There is an urgent need to recognise that one won't be able to match regional competitors and adversaries through traditional shipbuilding alone. There must be an active deployment of technological asymmetry to bridge the gap. One such example of a success story would be that of a Pune-based startup, Sagar Defence Engineering. It successfully dispatched the first batch of the first of its kind in the country, two unmanned Fast Interceptor Crafts (FICs), to the Indian Navy to be deployed along the western coast.<sup>10</sup> Designed, developed, and manufactured entirely in India, these FICs could potentially serve as the technological precursor to full-scale LUSVs and stand as a testament to the nation's vision of self-reliance in defence technologies under the iDEX - DIO framework.

The Andaman and Nicobar Command can be the perfect laboratory for DMO because of its geography. A string of islands that overlooks the world's busiest maritime chokepoint definitely demands a distributed and persistent presence. The deployment of swarms of indigenously developed LUSVs at the mouth of the Malacca Strait can help India in creating a potential blockade that would be both scalable and deniable at will. These vessels, utilising "swarm intelligence" algorithms, can coordinate their movements without the need for a central controller. This capability would allow them to surround and identify unidentified vessels in 'Gray Zone' scenarios. This indigenous push is critical for Atmanirbhar Bharat, as it would ensure that the brain of the unmanned fleet, the AI algorithms and data links, is developed locally, preventing any back door interference from external vendors. India should not be just a consumer of this technology but rather a pioneer in tailoring DMO for the unique water challenges in the Indian Ocean.

## **Sustaining the Logistics: The Unmanned Supply Chain**

Distribution of a fleet across thousands of miles of open ocean can create a logistical nightmare. The obvious questions would be 'how to refuel, rearm, and repair unmanned ships without bringing them back to a vulnerable, stationary port?' An effective solution to this dilemma is the development of on demand 'Autonomous Watercrafts (AWCs).'<sup>11</sup> These are specialised LUSVs which can function as mobile gas stations and missile warehouses. They work using the 'Underway Replenishment (UNREP)' technology, which uses robotic arms and automated station to keep transferring fuel and modular missile canisters to combat LUSVs while in motion.<sup>12</sup> This kind of self-sustaining kill web would allow the fleet to stay on-station for months, rather than weeks, thus increasing the persistent presence of the navy significantly. Along with this, one more potential solution could be the integration of large-scale additive manufacturing (3D printing) on larger, manned ships. This allows for the on-site-on-demand production of drone components, propellers, circuit boards and other such crucial components. If, say, an LUSV's sensor gets damaged by sea spray or a minor collision, the parallel ship can print a replacement and have it instantly installed. For India, this "Logistics of the Vertical" becomes extremely essential for maintaining a presence in the far seas. The logistics layer is the silent partner of the larger integrated architecture. Without it, the most advanced LUSV would get reduced eventually to an expensive piece of floating metal.

## **MUM-T: The Cognitive Heart of the Command and Control**

One of the most common misconceptions in the defence audience is that the unmanned means no humans. The DMO model actually requires sophisticated human involvement, but the role shifts from that of a direct operator to a mission orchestrator one. On a manned destroyer, a single unmanned systems officer may be able to oversee a group of LUSVs while the AI part handles the minute-by-minute activities of engine throttles, rudder adjustments, and sensor fusion. This Man - Unmanned - Teaming (MUM - T) becomes the 'Cognitive heart' of the battlefield vertical. It demands

a new breed of naval officer, the data warrior, the one who is trained in algorithmic logic and cyber security as in traditional skills of seamanship.

One of the challenges associated with MUM - T is that of 'Trust Calibration.' If the commander starts trusting the AI way too much, there is a chance that a subtle sensor glitch might get overlooked. If, on other hand, they trust it too little, they will micromanage the vessels and can potentially end up losing the speed of relevance advantage. The Indian Navy should explore possibilities of implementing 'Explainable AI (XAI)' in its naval command centres. XAI refers to machines providing valid reasoning behind their tactical recommendations during strategic operations.<sup>13</sup> This could allow the human commander to make urgent or immediate ethical and strategic decisions with a proper and full context. The result would be a symbiotic relationship that makes the force greater than the sum of its manned and unmanned parts.

### **Littoral Jungle and the Green Water Complexity**

The 'blue water' DMO focuses on vast ocean expanses, while the 'Green Water' focuses on the littoral environment, such as the Palk Strait or the Sundarbans, which can present a different set of technical problems. These areas are cluttered environments that are filled with civilian fishing 'dhows', shifting sandbars, and unpredictable currents. A heavy LUSV that works perfectly in the open Arabian Sea may struggle to distinguish a hostile insurgent boat from a neutral trader in such crowded areas. An effective solution for this will be equipping LUSVs with Multi-Spectral Sensor Fusion. It is a combination of standard radar with Short Wave Infrared (SWIR) and Hyperspectral Imaging.<sup>14</sup> This will allow for the AI to see through tropical haze and maritime smog and accurately identify the specific heat signature of a military-grade outboard motor versus a commercial one.<sup>15</sup> By populating this green water with hundreds of smaller versions of these vehicles, India can create an anti-access zone that becomes impenetrable to larger hostile destroyers. This littoral mastery could further ensure that the surface layer of the vertical battleground that the book is based around is protected even in the most chaotic and crowded maritime corridors.

## **LUSVs as a Floating Powerhouse**

One of the most significant revolutions would be to integrate High-Energy Lasers (HEL) and High-Power Microwaves (HPM) onto the LUSV platforms. When in a swarm vs. swarm conflict, traditional missiles become too expensive and limited in quantity to handle incoming small drones that might range from hundreds to thousands in numbers. The LUSVs with a large deck space and dedicated power generation can act as a 'mobile power node' for the fleet. Carrying a 100kW laser can enable LUSV to potentially provide an infinite magazine defence. This helps shoot down swarms of low-cost aerial drones. One more advantage is that it does so at the cost of a few litres of diesel per shot. However, the technical challenge lies in Thermal Management, i.e., dissipating the massive heat that would be generated by a laser firing in a humid, salty maritime environment. When an LUSV gets deployed as part of DMO architecture, this energy shield becomes an important component that would be capable of providing a hard-kill capability against the atmospheric threats which will be discussed in subsequent chapters of the group. By turning the LUSV into a high-tech weapon, the navy could effectively ensure that its distributed nodes are not just offensive magazines but resilient fortresses which can efficiently counter the storm of a multi-domain attack.

## **Conclusion: The Sea Surface as the Connective Tissue**

The DMO and LUSVs represent the surface layer of an integrated architecture that the book is based on. It acts as crucial connective link between the 'Abyss' and the 'Orbit.' An LUSV is essentially a floating sensor-and-weapon node which can effectively synergise the subsea acoustic data and space-based targeting. If the subsea cables are the 'nervous system' as presented in the previous chapter, the LUSV fleet is the 'muscle' that responds appropriately to the stimuli. The Navy that can, master the art of distribution will eventually be able to transform itself from a target into a network a resilient, invisible, and lethal force that can project power from any point on the ocean's surface.

As we move into Part II of the book, the lessons of DMO, dispersion, autonomy, and the kill web are being mirrored on the ground. The future of warfare is not just about who has the biggest ship or the heaviest tank but about who can most effectively distribute their cognitive advantage across the entire vertical of the battlefield. By securing the surface through DMO, India can effectively ensure that its maritime boundaries are not just lines on a map but an active, intelligent, and impenetrable shield that protects the nation's interests from the seabed to the stars. This distributed future is the only way to maintain sovereignty in an era where the battlefield has no boundaries and the vertical is the ultimate direction that matters.

### **Declaration**

I declare that this manuscript is being submitted exclusively to CENJOWS for publication consideration, is original, and has not been published or submitted elsewhere. I further certify that it contains no classified, restricted, or sensitive information and is based entirely on open-source material suitable for publication in the public domain.

## ENDNOTES

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