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Mosaic Warfare: A Model for the Indian Armed Forces

Col Vineeth V Nair



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Abstract

Mosaic Warfare, a war fighting philosophy that treats military platforms as individual tiles that can combine to form rapidly reconfigurable force packages and resilient Kill Webs, gained attention post the recent US-Iran conflict. A transformation to this new form of warfighting is today increasingly necessitated by the vulnerability of expensive, high-value platforms or monoliths in an era of total battlefield transparency. Lessons from Iran's decentralised command and asymmetric maritime swarms demonstrated how distributed lethality could create insoluble dilemmas for a superior conventional power. For the Indian Armed Forces, a proposed model for Mosaic Warfare involves 'replacing traditional monolithic structures with a right mix of manned and unmanned platforms and prioritising resilience, reconfigurability and distributed lethality'.

Keywords: Mosaic Warfare, Monoliths, Decentralisation, Resilience, Reconfigurability, Distributed Lethality, Kill Webs, Unmanned Platforms, Asymmetric Technologies

Introduction

The term Mosaic Warfare was coined by the US Defense Advanced Research Project Agency (DARPA) in the mid -2010s under its Strategic Technology Office (Magnuson, S. 2018). It is a warfighting model that 'treats military capabilities as individual warfighting pieces or tiles rather than an integrated, mammoth puzzle piece'. The concept then was an American response to rising A2/AD (Uber. R, 2020) capabilities of China and Russia, which posed significant threat to American high value military platforms such as Carrier Battle Groups. These came to be loosely termed as monoliths. While traditional platforms such as Carrier Battle Groups and fighter squadrons are engineered for specific roles, Mosaic Warfare proposes 'replacing these with smaller tiles that are cheaper and often attritable like autonomous systems that can be fluidly combined for specific missions'.

Three primary attributes define this model—Distributed Architecture, Heterogeneity and Rapid Composability and Reconfigurability (Gulden, T.R., Lamb, J., Hagen, J., and O'Donoghue, N.A. 2021). Its objective is achieving decision superiority viz. achieving victory by making decisions faster than the enemy's OODA loop can process and, at the same time, imposing overwhelming complexity and uncertainty for the enemy by posing him with multiple threats. Structurally, it also 'replaces linear, brittle Kill Chains (DARPA, 2020) in monolithic

platforms with decentralised Kill Webs'. Such an architecture also renders an innate self-healing resilience, wherein the loss of one tile or platform does not collapse the system as information automatically re-routes through other available tiles and the mission is pursued and accomplished.

Figure 1: Mosaic Warfare Attributes



Mosaic Warfare must also be distinguished from Network Centric Warfare (NCW). While NCW operates on centralised control and hierarchical command structure, it utilises a Kill Chain concept wherein the failure of a single node can disrupt the entire sequence. Mosaic Warfare, on the other hand, utilises multiple Kill Webs. Its architecture is decentralised and does not require the entire force to be networked to execute a specific kill.

Need for transformation to Mosaic warfare

The modern-day battlefield is undergoing a fundamental transformation. The proliferation and democratisation of unmanned systems happens to be the most metamorphic change that calls for a complete reset of war fighting philosophies. These systems have transformed the way wars are fought and the way war fighting is viewed today world over. To put this in perspective, Elon Musk in 2020 argued that, the era of traditional fighter jets is long

over, while in 2016, the House of Commons in UK's Parliament contemplated discontinuing manufacture of battle tanks. As we look back, we tend to wonder how we came to be where we are today. Tanks and fighters, once the undisputed pillars of military power and the backbone of twentieth-century warfare, today stands at the cusp of a transformative era, wherein their dominance is increasingly challenged by emerging technologies. As we look deeper into the issue, we realise this has been by and large the result of availability of cheaper scalable alternatives that can do the same job as tanks and fighters at a fraction of the cost of these platforms.

Once upon a time, Chemical Weapons were considered the poor man's Atom Bomb, similarly, drones and UGVs are today the poor man's fighters and tanks. If, in yester years, the quality of fighters and tanks differentiated 'Victor' from the 'Vanquished', today this is decided by the quality and quantity of unmanned platforms that a country has in its inventory. This was reaffirmed in Nagorno-Karabakh (John, A.F. 2022) conflict in 2020, wherein, Azerbaijan brushed aside neighbouring Armenia by riding on the sheer strength of their UCAVs. Fundamentally, this is a transformation from limited number of niche multi-role platforms of yester years to multitude of basic distributed platforms of today that are linked together. For India, this is a defining moment in the aftermath of Op Sindoor as the country tries to strike a fine balance between niche platforms and cheap disruptive battlefield equalisers in her modernisation efforts.

Traditionally, India as a country, has relied on her monolithic structures i.e., multi-role platforms and structures that are exceptionally capable but prohibitively expensive. We have always prioritised induction of our fighters, battle tanks and expensive air defence systems to safeguard our borders. As was seen during recent conflicts, the reliance on these platforms creates a paradox wherein the 'loss of a single high value asset becomes an irreparable tactical and narrative loss'. Specifically, for the smaller power in a conflict, taking down a high value asset of the stronger power gives an easy tactical victory in the information space, irrespective of the final strategic outcome of the conflict. In this backdrop, Mosaic Warfare offers a viable solution by breaking monolithic structures such as Carrier Battle Groups, Fighter Squadrons and Strike Corps into a mosaic of cheaper, specialised platforms that achieve collective lethality through a distributed (O'Donoghue, N.A., McBirney, S. and Persons, B. 2021) architecture.

The need for transformation to Mosaic Warfare can thus be summed up as under: -

- ***Vulnerability of Monoliths.*** Enhanced battlefield transparency remains the hallmark of any modern-day battlefield. The prevailing rule is: 'What is big is

seen, what is seen is hit and what is hit is destroyed'. Therefore, modern day battlefield structures and platforms should ensure substantial reduction in size to avoid their detection and eventual destruction.

- **Signature Problem.** Traditional entities like Carrier Battle Groups, Fighter Squadrons and Strike Corps, emits enormous electronic signatures, making them difficult to conceal. This renders them vulnerable to modern precision-guided munitions.
- **Burden of Value.** Assets such as AWACS, refuellers and niche fighters have today become strategic burdens. Their loss/destruction, in addition to resultant disruption in operation, provides the adversary with a powerful information warfare narrative, as was seen during US-Iran war and other recent conflicts.
- **Escalation Concerns.** The mammoth size of traditional structures can sometimes limit their employment as their deployment itself may be viewed as an unintended escalation. In the Indian context, this aspect has severely limited our response and employment options of our strike formations in a limited high intensity conflict such as Op Sindoor. It is a classic paradox of modern warfare wherein the most potent instrument of power remains strategically restrained and its effective employment being limited by self-imposed escalation thresholds arising from its sheer scale and destructive potential.

Lessons in Mosaic Warfare: The Iranian Case Study

Iran provides a functional model for Mosaic Warfare. The recent conflict in Middle East demonstrated as to how distributed, decentralised operations by a smaller power can frustrate a superior conventional power. Iranian strategy during this conflict incorporated several elements of a mosaic approach:-

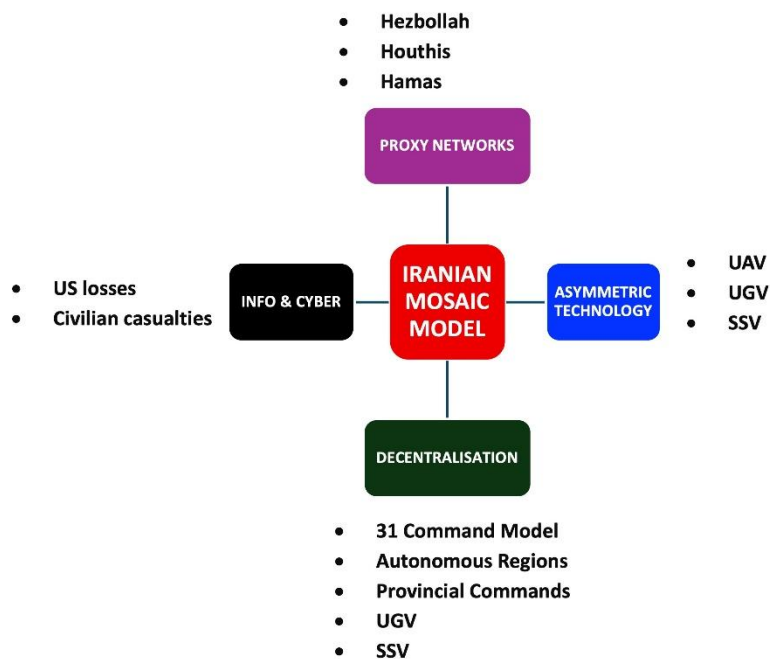
- **Proxy Networks.** Sprucing up a string of militias across the Middle East— Hezbollah in Lebanon, Houthis in Yemen, Islamic Resistance in Iraq, Palestinian militant groups in Gaza and West Bank, as well as other Shia militia groups in Syria, remained the cornerstone of Iran's proxy strategy. Diversification of proxies in terms of groups, ideology and geographical span bestowed Iran the capability to create multiple simultaneous criticalities for US and its allies in the Middle East. This

seriously complicated and disrupted American response matrix to various contingencies during the conflict.

- ***Asymmetric Technology.*** The integration of low-cost UAVs, UGVs and SSVs for reconnaissance and strikes, alongside small boats and mines in the maritime chokepoint of Hormuz, threatened even the most advanced American Naval forces. Herein, it created an embarrassing situation for a superpower wherein, US forces relying on their monolithic hi-tech platforms and structures, failed to keep a 33 Km wide strait open. Americans also ended up investing substantial time, energy and resources in protecting these niche platforms from cheap Iranian drones, UAVs, mines and SSVs. On the contrary, Iran, a country drained by five decades of sanctions with a near non-existent Airforce and Navy, managed to target these High Value Assets with ease and impunity using cheap expendable platforms.
- ***Decentralisation.*** Iran had learnt its lessons from the fall of Saddam Hussein regime in 2003 and Israel's decapitation campaigns in the Middle East. It used a decentralised command structure that could withstand leadership collapse, communication breakdowns and psychological shocks. Specifically, the C2 structure of IRGC was designed differently to absorb attrition and leadership losses and still preserve regime continuity. Consequently, replacement commanders appeared rapidly, missile launches continued despite assassinations and proxy operations did not stop despite repeated strikes. Iranian regime had also divided the country into independent semi-autonomous regions and provincial IRGC commands through the 31 Command model. The model ensured that Isfahan could continue to operate even when Tehran was bombed, Bandar Abbas could undertake independent missile launches and Khuzestan could mobilise local Basij and IRGC assets without the need of any kind of central approval.
- ***Information and Cyber Layers.*** Iran also used cyber operations and psychological warfare innovatively to demoralise adversaries and disrupt communications, thus adding a layer of complexity to the physical battlefield. Specifically, the IW content disseminated during

the conflict focused on highlighting losses of American High Value Assets such as the MQ-4C Triton drone, an F-35 jet and damages to USS Gerald Ford aircraft carrier and casualty to innocent civilians from missile strike at an elementary school in Minab which significantly eroded Trump's and America's credibility. This galvanised global solidarity for Iran and complicated US targeting by creating an information environment wherein any further military responses by US and Israel risked international condemnation.

Figure 2: Iranian Mosaic Warfare Model



Source: Prepared by the Author

A Proposed Model for India

India can take a leaf from Iranian operations to evolve its own concept of Mosaic Warfare. The need to breakdown some of our archaic monolithic structures and distribute lethality that is currently concentrated in them across a wider array of cheaper, autonomous and semi-autonomous systems, remain a *sine qua non* for our armed forces.

Air Domain

The current Indian Air Force model relies on standard 18-fighter squadrons, which are high-value, high-signature monoliths. Pakistan learnt her lessons from Op Sindoor and is already investing heavily in thickening the country's AD grid, given the impunity with which our Air Force targeted Pakistan's bases. In such intense AD environments of future, targeting bases using fighters may get extremely complicated. Therefore, a reconfigured deployment as under may be contemplated: -

- ***Command Tile.*** Instead of a full 18-jet squadron, a limited number of manned fighters can act as mobile C2 centres. These platforms focus on battle management while staying outside the enemy's BVR missile ranges.
- ***The Probing Tile.*** Cheap, single-use UAS may be deployed ahead of the manned platforms. Their role should be to force enemy radars to emit and reveal their positions without risking loss of expensive platforms and pilots.
- ***The Kinetic Tile.*** A mix of standoff missiles, loitering munitions and fighters, spread across the battlefield, linked via an AI-enhanced Kill Web, should form the kinetic tile. Once an HQ-9 or SAM site opens up or is detected, a machine-enabled system should identify the closest shooter tile, which may be an air-launched missile, a ground-based rocket, or even a loitering munition to execute the strike in real-time. In this regard, even legacy transport aircrafts may also be used as arsenal planes to launch swarms of low-cost UAS from standoff ranges, keeping the expensive manned assets reserved for targets that are critical.

Maritime Domain

There may be a need for India to move beyond its Carrier Battle Group-centric model, which acts as a strategic burden in the ultra-transparent modern-day battlespace: -

- ***Small-Boat Swarms.*** Emulating Iranian asymmetric success, we may invest in large number of small, missile-armed fast-attack craft and Unmanned Surface Vessels. Such

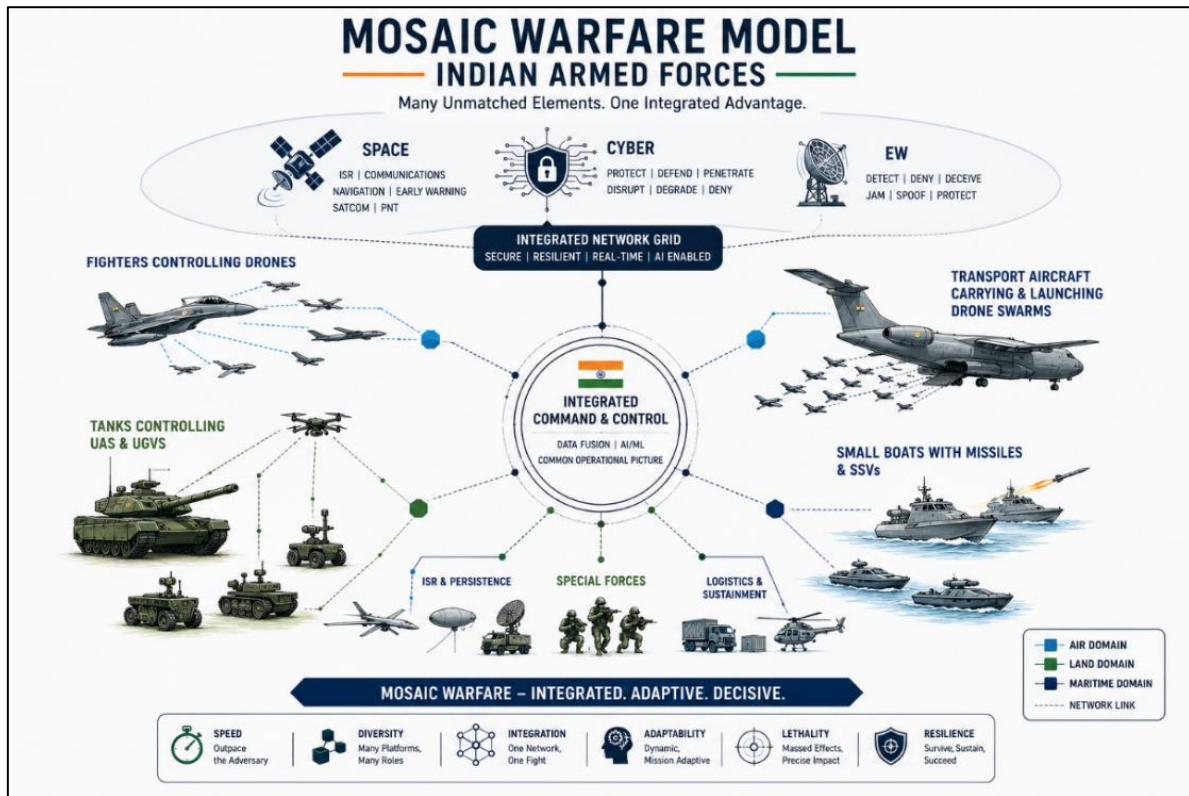
tiles are difficult to target with anti-ship ballistic missiles and can collectively overwhelm a larger Chinese/Pakistani flotilla, if required.

- ***Distributed Blockade.*** Rather than one large paraphernalia of ships enforcing a blockade of Karachi or Malacca, a Mosaic of mines, micro-UUVs and land-based standoff missiles can create a more potent blockade and an insoluble dilemma for Pakistan/Chinese maritime trade transiting through the region.

Land Domain

The Indian Army's structures are massive, monolithic entities whose employment invariably risks an unintended escalation in limited high intensity conflicts like Op Sindoor. A Mosaic model, therefore, may require disaggregation of these formations into a decentralised mesh. For example, applying Mosaic Warfare to offensive operations require a fundamental shift from massing physical forces to massing firepower through distributed, disaggregated tiles. In modern day battlefields, 'the one who sees first hits first'. Consequently, traditional monolithic formations are proving to be extremely vulnerable. In such a backdrop, offensive operations in developed terrains may be reimagined based on Mosaic principles of 'fractionation, heterogeneity and rapid composability'. For example, massing a Battle Group, at selected crossing points, creates a high-signature target which makes it easier for enemy's precision systems to pick and engage. Therefore, the need may be to reconfigure existing Divisional sized Task Forces into Bn/Regt sized task forces capable of operating independently and achieving shallow and limited objectives. Once these limited objectives are achieved, it gives multiple options for progressing operations as per the evolving situation through reconfiguring of forces.

Figure 3: Mosaic Warfare Model for Indian Armed Forces



Source: Prepared by the Author

However, to undertake such operations, our Armoured Regiments, Mechanised Infantry Battalions and Infantry Battalions need to be reconfigured suitably. For example, the standard 45 tanks based Armoured Regiment may be reconfigured into a limited number of tanks acting as manned C2 centres, managing a palette of UAVs and Unmanned Ground Vehicles for local ISR, mine-clearance and initial bank-securing, which can transform an Armored Regiment into a tile that can function independently. Similarly, Infantry Battalions that form a major portion of forces in our offensive formations must undergo a complete reconfiguration through mass induction of UAVs, UGVs, Loiter Munitions and Drone Swarms. This reconfiguration can be undertaken through reduction of certain number of tanks from the Armoured Regiment and bayonet strength from the Infantry Battalion to make the transformation economically viable. Further, taking cues from Ukrainian model of GIS Arta, call for an artillery engagement should not remain reserved to Arty OPs, FOOs & Infantry MFCs. Instead, it should roll out a federated structure, wherein any sensor tile viz. a soldier with a smartphone or a micro-UAS, is able to bid a target to the best-positioned gun or loiter munition, thus reducing the sensor-to-shooter loop to seconds.

Lastly, the traditional trunk and branch resupply system remains the backbone of all our operations and is highly vulnerable to precision strikes. There may be a need to replace these with a distributed inventory and a 'Just in Time model'. A predictive model also may be considered to identify where the mosaic is likely to break. Further, UGVs and small teams based on ATVs may be the way to look at logistics in future rather than archaic high visibility structures.

Key and Emerging Domains

In the Mosaic Warfare model, Space, Cyber and Electronic Warfare holds overarching importance because they directly target or protect the network backbone that links disparate warfighting tiles into a coherent force. While traditional monoliths are vulnerable due to their high physical signatures, the primary vulnerability of a Mosaic force is its dependence on the information environment to function as a distributed Kill Web. Mosaic Warfare moves away from linear kill chains to decentralised, mesh-like Kill Webs; as these webs rely on the constant flow of data between sensors, decision-makers and shooters, the networks themselves become the strategic centres of gravity. Space, Cyber and EW have the unique capability to disrupt these networks, thereby making them critical for both offensive operations and defensive resilience. Control of the electromagnetic spectrum is thus vital for a Mosaic force to maintain its own communication while degrading the adversary's.

Similarly, Space is recognised as a fundamental domain for all operations within the Mosaic framework. Space-based assets provide the critical Positioning, Navigation and Timing (PNT) data and satellite communication links required for distributed autonomous systems to coordinate their actions. Commercial and military satellite reconnaissance also acts as high-altitude sensor tiles. Cyber operations are integrated into Mosaic force packages to target the network space of the adversary. The war in Ukraine also demonstrated importance of these domains, wherein, Ukrainian (Hoog, B. 2026) forces utilised a heterogeneous communication architecture to include Space (Starlink), Commercial (Cellular) and ad-hoc radio links to remain functional despite intense Russian jamming. This mosaic-style adaptation proved that while communications are constantly contested by EW—a distributed mesh can route around losses to maintain decision superiority.

Command, Control and the Kill Web. The backbone of this model is the shift from Network-Centric Warfare to Mosaic Warfare wherein there is a transformation from Kill Chains to Kill Webs. Traditional kill chains are linear—if one satellite link is jammed, the chain breaks.

Therefore, the need of the hour is to operate on Kill Webs, where information automatically reroutes through any available tile for example from a drone to a tank to a satellite to ensure mission completion. By presenting multiple, small, specialised tiles rather than a few identifiable monoliths, the adversary is forced to either attack everything or nothing. This degrades his OODA loop and creates the decision (Bryan, C., Patt, D. and Schramm, H. 2020) superiority required for a rapid, favourable conclusion to a conflict.

Tactical and Strategic Benefits

Unlike a jigsaw puzzle wherein a missing piece ruins the picture, a Mosaic is likely to remain much more resilient. Even if 30% of the forces are lost to a precision strike, the system will retain the ability to reroute through remaining tiles to complete the mission. Further, losses in Mosaic operations are likely to be predominantly in the form of cheap, unmanned units as compared to high end platforms in traditional monolithic structures. By generating mass through distributed firepower rather than massing physical forces, one can achieve a faster OODA loop, thus ending the engagement favourably before the adversary can effectively orient his defences.

Since concept of mosaic warfare aims at breaking down complex and sophisticated platforms into smaller and basic ones, it may enable easier incorporation and adoption of newer technologies. Forces equipped with such simpler platforms may also be able to experiment with newer tactics, techniques and procedures and adopt them at a more rapid pace. In essence, 'adoption of Mosaic warfare is likely to create a force that is difficult to detect, harder to destroy, faster to expand and capable of generating proportionate combat effects'.

Challenges in Implementation

Challenges in implementing Mosaic Warfare models in India are manifold. The country is currently struggling to balance modernisation efforts with fiscal constraints in an ever-turbulent world. While Mosaic Warfare utilises cheaper, attritable tiles, the initial transition requires a fundamental shift in how the defence budget is allocated. Instead of funding specific platforms which are point solutions, we would need to shift towards mission-centered budgeting that funds interoperability and battle networks. India's current inventory consists of heterogeneous mix of equipment from various global suppliers. Composing these into a Kill Web is constrained by a diversity of communication standards and a lack of translation systems. Unlike exquisitely engineered monolithic platforms that only work with specific partners, Mosaic tiles must be pure plug-and-play. Tools like DARPA's (DSIAC, 2019) STITCHES,

which auto-generates connections between different electronics without hardware upgrades, would be essential but these are not yet standard in the Indian inventory.

The Indian military, like many traditional structures, often relies on hierarchical arrangements. Transitioning to Context-Centric (C2), wherein command follows communication availability rather than a rigid rank structure, challenges existing military culture. For example, our hierarchical model expects subunits to probe ahead, obtain information and pass it back to enable higher commanders to take a decision. However, Mosaic Warfare necessitates a higher commander to gather the information through all resources available at his disposal and feed it to a subunit commander operating ahead to empower him to take the right decision. Essentially, this is kind of a role reversal, for which we must be prepared.

Further, managing thousands of small, specialised units may also create an orchestration problem for human staff. Therefore, there may be a need to develop robust AI-enabled (Grayson, T. P. and Lilliu, S. 2021) decision aids to manage this dimensionality. This model also demands a new military function—Combat Support Tech Squads which are forward-deployed technical teams capable of wiring together bespoke architectures on the fly using software tools.

Conclusion

The transition to Mosaic Warfare represents a fundamental shift in the way we fight. It necessitates moving away from vulnerable, platform-centric monoliths towards a distributed and resilient mesh of specialised warfighting tiles. For the Indian Armed Forces, this model provides an exit from the unsustainable fiscal burden of high-value assets, offering instead a cheaper self-healing Kill Web architecture that prioritises decision superiority over traditional attrition. Ultimately, as battlefield transparency continues to render traditional massed formations obsolete, the shift towards a decentralised, rapidly composable force remains the most viable path for India to turn complexity into an asymmetric advantage.

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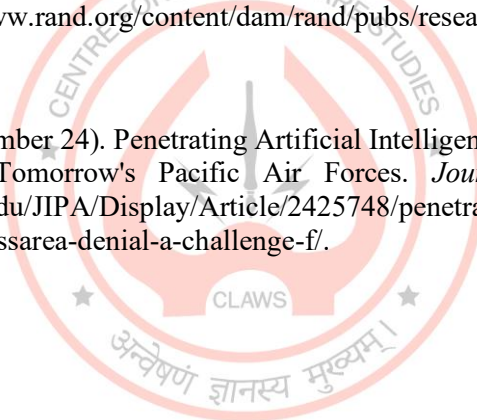
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About the Author

Colonel Vineeth V Nair was commissioned into 4/1 GR in December 2008. He is an alumnus of National Defence Academy, Pune and Defence Services Staff College, Wellington and has had Instructional tenures at Officers Training Academy, Chennai and Indian Military Training Team, Bhutan. He has had field tenures with his Bn both on the LC and the LAC in J&K, Sikkim and Arunachal Pradesh. He also had a Grade 1 Staff tenure at Military Operations Directorate, IHQ of MoD. He is presently commanding his Battalion in Delhi as part of a reserve formation.



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