

DRONES AND UNMANNED AERIAL SYSTEMS REVOLUTIONISING COMBINED ARMS WARFARE

Lt Gen AB Shivane, PVSM, AVSM, VSM (Retd)

Abstract

The introduction of unmanned aerial systems has revolutionised unmanned warfare by providing drones/UAVs as low-cost, high survivability, high payoff assets for the conduct of multi-mission tasks. This has the potential of transforming multi-domain combined arms warfare, through superior integrative technology, harmonising manned and unmanned systems, doctrinal reorientation, adaptive force structuring, and above all, empowered human capital. As the Indian Defence Forces undergo structural transformation at operational and tactical levels, this critical force multiplier must find due focus in its warfighting construct.

INTRODUCTION

Manoeuvre warfare is as old as the nature of warfare and has evolved to adapt to the changing character of warfare. The revolution in military affairs with its expanding domains, proliferating players, and emerging technologies has opened new opportunities for multi-domain manoeuvre warfare. This warfighting philosophy views the adversary as an interconnected, multi-domain system, whose cohesion, if shattered, would degrade his capabilities and sap his will to resist. The contemporary multi-domain manoeuvre warfare achieves its effects in a contested

integrated operational environment by the synergistic employment of manned and unmanned systems for combined arms joint force capabilities.

The combined arms concept as an integral part of manoeuvre warfare is also as old as warfare. Yet it has evolved in the 21st century as a multi domain synchronised joint force multiplier. What makes combined arms manoeuvre so potent is not the physical employment of multiple arms and capabilities in the battlespace but the cumulative and complementary multi-domain effect to generate rapidly deteriorating situations faster than the enemy can respond.¹ Combined arms warfare is less about mass and more about tempo and effects, dominating the key domain factors of time, space, force and information. Yet with multiplying domains, changing operational environments like urbanisation and multiple players cum arsenals, it has become more complex and challenging for generating desired effects.² The contemporary battlespace thus requires an in-depth understanding of combined arms warfare, emerging technology adaption, its redefined multi-domain application, a revitalised doctrinal construct, force restructuring and above all developing adaptive thought leaders in peacetime.

One of the most innovative technological innovations in warfare has been the introduction of unmanned aerial systems like drones and unmanned aerial vehicles (UAVs) for combined arms operations. While their primary application in a conventional war is unlikely to be for solely stand-alone operations, their combined arms force integration for multi-mission operations will revolutionise future warfare. Thus the employment of drones/UAVs as a critical component of combined arms teams for generating desired effects, at least cost and minimum time, is here to stay.

DRONE WARFARE TRANSFORMING COMBINED ARMS TEAMS

In the ever-evolving generation of nonlinear warfare, drones and UAVs have ushered in an era of unmanned revolution in military affairs. Their evolution has been revolutionised by technologies like sensors, shooters, electronic warfare, communication and now artificial intelligence, machine

learning and other disruptive technologies. They have transformed manoeuvre warfare and combined arms force application by providing enhanced intelligence gathering, precision strike capability, force protection, and combat support, enabling commanders to make informed decisions faster thereby shortening the OODA loop. This in essence is the quality of “first” in the competing “kill chain”.

The seamless employment of drones and UAVs has permeated the divide between war and peace, with lower escalation dynamics than manned combat aircraft.³ As low-cost, low detection and reduced-risk systems with multi mission capabilities, drones and UAVs have ushered an era of unmanned warfare moving from counter-terrorism targeting to active war zone multi-mission application. Their lower operation and maintenance costs per flying hour as compared to military aircrafts have enabled their proliferation as a preferred option.

Furthermore, with the development of computation modules and intelligence communication systems, the battlespace is moving to an era of networked autonomous systems, also known as swarming. The development of swarming tactics, where multiple drones operate cooperatively, will further augment their effectiveness. These UAVs have integrated seamlessly into the force application matrix, adding another dimension to the way military forces plan, prepare and execute their operations.

Simultaneously investment in countermeasures has seen increasing focus. As drones become increasingly prevalent in combined arms force application, countering enemy drones and protecting friendly forces from drone threats becomes paramount. Military forces are thus investing significant resources in developing effective counter-drone measures. These measures include the deployment of advanced electronic warfare systems for jamming and disrupting drone communications and navigation.⁴ Anti-drone systems employing various techniques, such as kinetic interception or directed energy weapons, are also being developed to neutralise hostile drones. Furthermore, evolving drone detection and tracking technologies for the early identification of potential threats are enabling proactive responses.

OVERVIEW OF DRONE CAPABILITIES

As technology and tactics continue to advance, drones will play an increasingly critical role in future military operations, generating more advanced capabilities.

Enhanced Situational Awareness. Drones equipped with advanced sensors, cameras, and imaging technologies offer unparalleled situational awareness to military commanders. These aerial platforms provide real-time data and imagery, enabling commanders to gather critical intelligence, monitor enemy movements, and assess the battlefield in intricate detail. The information collected by drones allows commanders to make informed decisions, rapidly adapt to changing circumstances, and exploit enemy vulnerabilities with precision. Furthermore, the integration of artificial intelligence (AI) and machine learning algorithms enhances the capabilities of drones in analysing vast amounts of data. This enables the extraction of actionable intelligence, such as identifying patterns, predicting enemy behaviour, and detecting potential threats, further augmenting situational awareness on the battlefield. AI-enabled technologies will not only increase the pace of operations but simultaneously increase force survivability in future battlespaces.

Intelligence, Surveillance and Reconnaissance (ISR). Drones play a pivotal role in conducting ISR missions, offering military forces an invaluable tool for gathering vital information about enemy positions, fortifications, and supply lines. Their ability to operate stealthily and navigate challenging terrains allows drones to access areas that may be hazardous for human personnel or difficult to reach by traditional means. By providing real-time advanced sensor feeds, such as multispectral and hyper spectral high-resolution imagery and live video feeds, drones facilitate the identification of targets and assessment of potential threats. This information assists in formulating effective strategies, planning manoeuvres, and executing precise actions while minimising risks to friendly forces.

Target Acquisition and Precision Strikes. Advancements in drone technology have led to the development of armed drones capable of

carrying out precision strikes on the battlefield. Armed with missiles or other munitions, these drones provide military forces with a means to engage high-value targets accurately and disrupt enemy operations at the least cost and in minimum time. Armed drones can be employed in various scenarios, such as neutralising enemy combatants, destroying critical infrastructure, or disrupting enemy logistics. Their precision capabilities reduce the risk of collateral damage and civilian casualties, enhancing the effectiveness and legitimacy of military operations.

Force Multiplication and Operational Flexibility. Drones act as force multipliers in combined arms warfare, augmenting the capabilities of military forces and enhancing operational flexibility. By integrating drones into existing military formations, commanders extend their reach and obtain a more comprehensive operational picture. Drones can provide aerial support, monitor key areas, and relay crucial information to ground forces. They can conduct rapid resupply missions, delivering essential supplies to troops in remote or hostile environments. Additionally, drones can act as communication relays, expanding the range and reliability of communication networks on the battlefield, thereby improving coordination and synchronization of manoeuvres. This force multiplication effect allows military forces to adapt quickly to dynamic and fluid situations, seize opportunities, and maintain the initiative against adversaries. Integrating unmanned systems with manned aerial and ground systems is another evolving field. Future multi-role fighter aircraft could operate as a team with semi-autonomous drones/UCAVs in multiple roles like ISR, SEAD, targeting and exposing enemy systems, well beyond enemy detection or engagement zones of the aircraft. Similarly, UCAVs/ drones could provide another dimension to the aerial manoeuvre arm of ground forces in a space-to-surface continuum.

Combat Application of Drones in Recent Wars and Lessons Learnt. The two recent conventional conflicts namely the Nagorno-Karabakh Conflict 2020 and the Russia-Ukraine War 2022, clearly demonstrate the role of manned and unmanned teaming, and the emergence of drones/

UAVs to direct and take action against adversaries as part of combined arms warfare.⁵ They have emerged as low-cost, high survivability, high payoff assets for the conduct of multi-mission tasks in both these wars. Their integration as part of a combined arms team and networks in a multi-domain environment optimised their capabilities in land, air, sea, maritime, cyber, and cognitive domains. Their fusion for a multi-layered multi-tiered integrated ISR architecture, as well as hunter shooter team was clearly visible. Further, their employment as electronic warfare platforms to degrade and destroy enemy communication and combat systems has proved invaluable. Yet UAVs and drones were seen to have terrain, weather, altitude, and persistent capability limitations, besides vulnerabilities to anti-drone kinetic and non-kinetic systems.

In Nagorno-Karabakh 2020 conflict, Armenia lost a vast track of its territory held earlier. One technological asymmetry Azerbaijan achieved was the use of unmanned aerial systems. These systems were used extensively to leverage advantage at a reduced cost, minimum time and with high payoffs. Besides combat and combat support missions Azerbaijan used An-2s as decoys against Armenian to reveal and suppress their air defence systems thereby gaining air dominance. In the initial phase which was restricted to the plains of Fuzuli and Jabrail regions, lack of cover facilitated both ISR and targeting. The use of Bayraktar TB2s for directing, targeting and strike missions in tandem with smaller UAVs like Orbiter caused heavy casualties to Armenian armoured columns. Their integration with other combat systems as part of the combined arms team proved a force multiplier. Yet the key question remained of harmonising ground manoeuvre or physical domination with such standoff capabilities as part of planning and execution of combined arms operations. During the second phase of the conflict in October, the battles were drawn into the Nagorno-Karabakh mountainous, with dense forests precluding visibility and effective application of UAVs/drones. Such close combat terrain complicated both hider finder dynamics and targeting by unmanned aerial systems. Although Azerbaijan used Turkish KARGU tactical ISR UAVs with small explosive payloads as loitering munition in this

phase, their effect was not decisive. In fact, the terrain facilitated Armenia as the defender to target these systems through kinetic and non-kinetic means. The clear lesson that emerged was UAVs/drone's cost-benefit of entry into combined arms teams both at tactical and operational levels holds tremendous advantage. Further, a range of missions would require an inventory of drones and UAVs with varied add-on payloads, endurance limits and operational conditions like terrain and weather/altitude. Another lesson of the conflict was the use of UAVs and drones by both sides for information operations for domestic support and global propaganda. Overall, the conflict demonstrated the emergence of an era of networked operations and UAVs/drones as part of the combined arms team.

In the Russia-Ukraine War 2022, both sides employed unmanned aerial systems and countermeasures extensively against each other in a multi-mission mode as part of a combined arms team. Both nations used a vast arsenal of UAVs and drones for ISR, targeting and strike missions. Russia has used a variety of multi-launcher UAVs including ZALA-421, Orion, Forpost-R, Orlan-10 besides Iranian Shaheed series UAVs. Ukraine too employed a vast arsenal of UAVs, ranging from long endurance Bayraktar TB2 to smaller hand-launched tactical UAVs like Leleka-100.⁶ Besides Western-aided UAVs, Ukraine also purchased some off the shelf from the financial aid provided. Their employment by both sides has been essentially for ISR and aiding targeting by air and ground combat systems as part of combined arms operations. These have been supported by networked communications, advanced mapping software and real-time downloads available to tactical commanders. Both Russia and Ukraine have also used drones and UAVs in waves for deep strike missions against ground, aerial and maritime targets. Using UAVs for information operations, decoys and deception also manifested in this war. UAVs fitted with electronic warfare payloads have also been extensively used. Unlike the Nagorno-Karabakh 2020 conflict, this conflict also saw the maturing of counter-UAV capabilities by both sides resulting in significant losses to UAVs and making their replacement a challenge. The focus had been seen to break the link between the ground controller and the

UAV. Overall, UAV/drone employment as part of a combined arms team with the redundancy of effort and a variety of platforms has matured during the conduct of this war.

Both these wars suggest unmanned aerial systems are invaluable low-cost assets as part of combined arms teams in the future battlespace. The UAV market is projected to grow from USD 26.2 billion in 2022 to USD 38.3 billion by 2027, at a CAGR of 7.9% as per the market report. This of course would include dual-use technologies as part of civil-military fusion. As per International Trade Administration, the Indian UAV market valued at \$830 million, is projected to grow at a CAGR of 14.5% during 2021-2026.⁷ In FY2022-23, drone start-ups attracted \$49.7 million in investments, compared to \$25 million in FY2021-22 and \$11.2 million in 2020-21, according to data from the research firm Tracxn Technologies.⁸ Reviewed government policies have also given a fillip to several start ups in this niche capability generation.

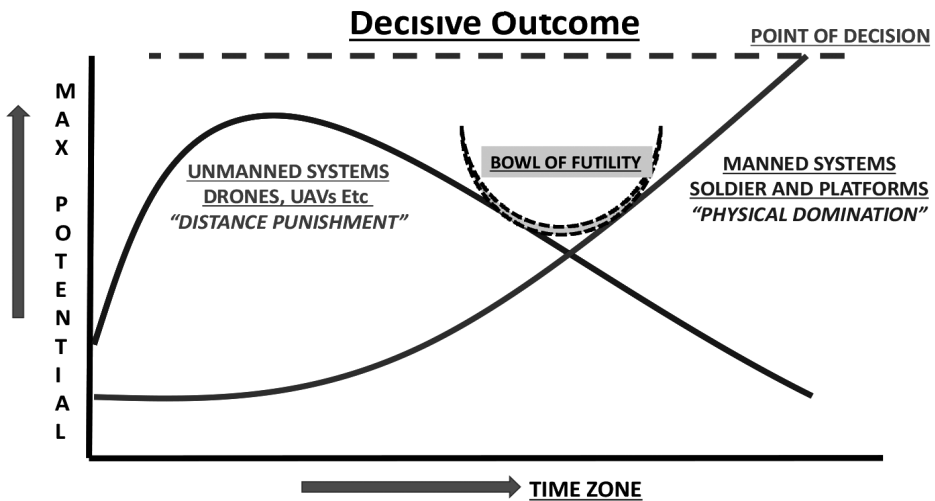
DEMYSTIFYING UNMANNED VERSUS MANNED SYSTEMS PARADOX IN COMBINED ARMS WARFARE

The modern battlespace demands the military to cope with increasing information overload, battlespace transparency, precision munition lethality, dispersion and logistical vulnerabilities. In such a battlespace it has been proven that distance punishment by unmanned aerial systems and standoff firepower unexploited by the physical domination of ground by troops and combat systems like tanks is a wasted effect.

The traditional relationship between Distance Punishment by standoff firepower and unmanned aerial systems and Physical Domination is illustrated in Figure 1 below. It is clear that although distance punishment can be paralytic in its effect, the effect is always fleeting and transitory. Dominant manned manoeuvre on the other hand builds up and seeks the ultimate point of decision in a cost-effective and time-sensitive domain.⁹ However, as illustrated a gap of futility in time and space exists between the two which

provides a critical breathing space to the adversary. This is essentially when there is a lack of integration between manned and unmanned systems as part of a combined arms team.

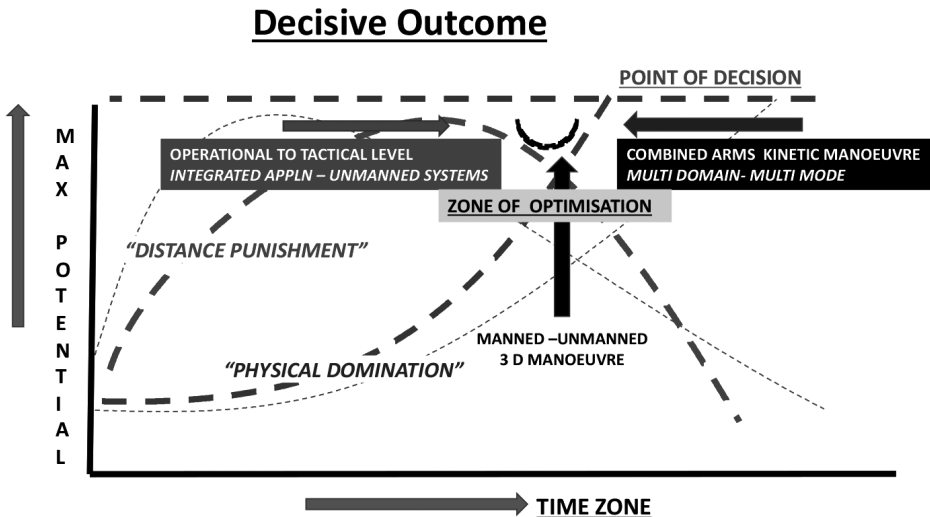
Figure 1: Unmanned vs Manned Systems



Source: Author Presentation on “Technology Empowered Manoeuvre Future Perspective”, at CLAWS, April 2019.

So how do we harmonise their capabilities? Firstly we need an agile 3D manoeuvre force from the present 2D complimenting force with strategic agility, capable of generating superior operational tempo and tactical mobility for a dominant manoeuvre. UAVs/drones integrated with long-distance firepower and aerial manned systems and ground forces manoeuvre de willpack the required punch. Secondly, this capability needs to seamlessly transcend from tactical to operational level. One without the other makes neither decisive. Thus manned and unmanned systems as part of a combined arms team must function in harmony to minimise the zone of futility and maximise the zone of synergy. The same is illustrated in Fig 2 below.

Figure 2: Harmonising Unmanned and Manned Systems



Source: Author Presentation on “Technology Empowered Manoeuvre Future Perspective”, at CLAWS, April 2019.

Overall, as technology revolutionises warfare with new systems such as UAVs/drones, the imperative is to integrate them with refined doctrines, structures, tactics and logistics, duly empowered by adaptive human capital to optimise their capabilities as part of a combined arms team in an essentially joint operational multi-domain environment.

RECOMMENDATIONS: INTEGRATING UNMANNED AERIAL SYSTEMS IN TO COMBINED ARMS WARFARE

The focus must be to transform the combined arms warfare capability, through superior technology, harmonising manned and unmanned systems, balanced indigenous procurement, doctrinal reorientation, adaptive force structuring, and above all, empowered human capital. The following areas thus merit focus.

- Acquire, adopt, and exploit technology in a surface-to-space continuum as part of multi-domain combined arms force application. UAVs/drones

must be integrated into the combined arms team and in particular Integrated Battle Group. Training, employment procedures and logistics must be inbuilt.

- Procure a broad inventory of UAVs and drones that can operate with varied payloads, a multitude of launch platforms, operate under different climatic and operational terrain conditions, varied endurance and with technologies to be survivable in a contested battlespace. Above all hardened network communication and real-time forward download technologies and system are most critical.
- UAV/drone ability to conduct varied missions like ISR, targeting for standoff attacks, strike, electronic warfare, information operations and other missions, must be integrated into planning, preparation and conduct of operations. Technical and tactical training including wargames and exercises must find focus.
- Simultaneously counter UAV/drone measures and technologies must find focus both at the operational and tactical levels. While kinetic and non-kinetic measures must be integrated into the larger Air Defence architecture, forward troops will need to be empowered also with such counter capabilities in the tactical battle area.
- Increase the tempo and velocity of Combined Arms Forces to dominate the kill chain for desired effects and influence. Supplement manned with unmanned systems and integrate kinetic by non-kinetic strike capabilities. Proliferate from the operational level to the tactical level.
- Establish a 24x7 “Unblinking Eye” over the battlespace integrating ISR drones and UAVs in the overall surveillance architecture. Pervasive and persistent C5ISR is only possible if there is pervasive and persistent communication.¹⁰ C5ISR will only be empowered if we shift from a platform-centric approach culture to a network-centric approach. The outcome will be a factor of networking sensors, decision-makers, and shooters.
- Adopt a centralised command, distributed control, and decentralised execution, network-enabled command and control architecture

integrating manned and unmanned systems. Proliferate UAVs and drones and distribute them downward. The lowest tactical level must be given the same relative advantage and decentralisation in superior situational awareness and precision strike capability.

- Integrate jointness and tri service interdependence to optimise the capabilities of unmanned aerial systems. Harmonise kinetic and non-kinetic capabilities in a joint force application and elevate to a new dimension of integrated command and control and seamless flow of real time information. UAVs being a tri service platform must find a tri service procurement, training, and logistics focus.
- Invest in human capital through a transformed Joint Professional Military Education. Leadership, particularly at the operational and strategic levels needs better understanding and superior orientation in executing multi-domain manoeuvre warfare. The need is for creating and nurturing strategically minded intellectual warriors, with a scientific temper as thought leaders, who demonstrate critical thinking, creative skills and technology adaption embedded in ethical military character.
- Review legacy doctrines and force structuring philosophies, with a focus on a 'capability-based approach with deterrence based on denial strategy'. Move from an attrition-centric orientation to a manoeuvre-centric orientation. Imbibe the ethos of combined arms warfare in an essentially joint operational environment.
- Optimise indigenous defence industry and start-ups for establishing a defence unmanned aerial system ecosystem along with a vibrant R&D foundation in this sector.
- Above all defence budget for new schemes like drones and UAVs must be enhanced to acquire such niche capabilities based on value and vulnerability analysis. The need is to upgrade the force restructuring philosophy from the present threat cum capability approach to the capability-based approach.

CONCLUSION

To conclude, manoeuvre warfare enabled by joint force combined arms team will be a critical enabler for prevailing in the future multi-domain operational environment. As technologies evolve and new threats emerge, harmonising manned and unmanned systems in a seamless surface-to-space continuum would be essential. UAVs/drones have emerged as part of a network of collaborative platforms and systems in a contested battlespace, an upgrade from the erstwhile standalone unilateral targeting for counter-terrorism operations. However, their effective employment for combined arms operations will require the continuous modernisation of critical components like payloads, endurance limits, sensors, and networked communications. The underlining capacity to optimise their capabilities will remain an empowered budget, trained human capital and indigenous defence ecosystem. As the Indian Defence Forces undergo structural transformation at operational and tactical levels, this critical force multiplier must find due focus.

Lt Gen AB Shivane, PVSM, AVSM, VSM (Retd) a second generation officer is an NDA alumnus and a highly decorated Armoured Corps officer with over 39 years of distinguished military service including a tenure in a UN mission. He has authored over a hundred publications on national security and matters of defence, besides two books and is an internationally renowned keynote speaker and a TEDx speaker. He is a Distinguished Fellow and held COAS Chair of Excellence 2021-2022 at the Centre for Land Warfare Studies. His book "PME for 21st Century Warriors" published in 2023.

NOTES

1. Shivane A B Lt Gen, Manoeuvre Warfare: A Critical Enabler In The 21st Century Battlespace, CLAWS Scholar Warrior Journal, Spring 2023, pp. 10-17, https://www.claws.in/publication/scholar-warrior_spring-2023/
2. Simoens Tom, Combined Arms Warfare As the Key to Success On the Contemporary Battlefield, The Defence Horizon Journal, December 2022, <https://www.thedefencehorizon.org/post/combined-arms-warfare-success-battlefield>

3. Hurst Jules, Drones and The Future of Aerial Combined Arms, War on The Rocks, March 2016, <https://warontherocks.com/2016/05/drones-and-the-future-of-aerial-combined-arms/>
4. Zachary Kallenborn, Swarm Talk: Understanding Drone Typology, Modern War Institute, October 2021, <https://mwi.usma.edu/swarm-talk-understanding-drone-typology/>
5. Seth G Jones and others, Combined Arms Warfare And Unmanned Aircraft Systems, CSIS Report November 2022, <https://www.csis.org/analysis/combined-arms-warfare-and-unmanned-aircraft-systems>.
6. 'A New Form of Combined Arms Combat' – How Drone Warfare Has Evolved in Ukraine, Kyiv Post, May 2023, <https://www.kyivpost.com/post/17693>
7. India's Unmanned Aerial Vehicle Market, International Trade Administration, September 2021, <https://www.trade.gov/market-intelligence/indias-unmanned-aerial-vehicle-market>
8. Pant Manish, Indian Drone Industry Flies High with 3x times Growth in Investment Over 3 Years, Business Today, March 2023, <https://www.businesstoday.in/latest/corporate/story/indian-drone-industry-flies-high-with-3x-growth-in-investments-over-3-years-374728-2023-03-24>
9. Shivane A B Lt Gen, Distance Punishment Versus Adaptive Manoeuvre, CLAWS Pamphlet for Young Officers, September 2021.
10. Shivane AB Lt Gen, C5ISR – Imperative Need for a Focused Approach, Raksha Anirveda September 2021, <https://raksha-anirveda.com/c5isr-imperative-need-for-a-focused-approach/>