

Multi-Domain Operations, Emerging Military Technology and the Future of Manoeuvre Warfare

Michael Mayer

Norwegian Defence Research Establishment
Instituttveien 20
2027 Kjeller
NORWAY

michael-john.mayer@ffi.no

ABSTRACT

Technologies such as artificial intelligence, autonomous systems, and ubiquitous sensors promise to alter the characteristics of the battlefield over the next decades. In anticipation of these changes, new doctrinal approaches such as multi-domain operations (MDO) seek to combine and leverage these assets in a coordinated and advantageous manner. Despite the deep uncertainty surrounding future events, it is valuable to assess the likely impact of individual technologies on the operating environment. One important analytical focus is to identify possible logical inconsistencies arising when technologically advanced military systems alter the context in which future operations will occur. An important debate has arisen over whether the combination of battlefield transparency and long-range fires will lead to more defensive oriented wars of attrition, thereby posing a conceptual dilemma for offensive-minded MDO manoeuvre warfare doctrine. This paper analyses the potential effects of emerging technology to assess the applicability of the current conceptualization of MDO doctrine and the future of manoeuvre warfare. The analysis finds that certain operational level challenges from emerging technologies are addressed by an MDO approach, while other more fundamental aspects of tactical manoeuvre such as surprise and mobility create difficult trade-offs between dispersion and the massing of forces. Future conflicts may evolve from a high intensity manoeuvre phase to one characterised by attrition warfare.

Keywords: Multi-domain operations, Manoeuvre warfare, Attrition warfare, Offense-defence theory

1.0 INTRODUCTION

Technology has influenced the conduct of military affairs throughout history, from combat weaponry and tactics to logistics and the organizational aspects of modern warfare. Failures to adjust to these technological changes can be devastating, as battlefield losses from the American Civil War and the trenches of World War I tragically illustrate. As the science of warfare again appears to stand on the cusp of another evolutionary jolt forward, defence planners and strategists are pursuing new warfighting concepts to harness the potential of emerging technologies. The most prominent of these new approaches is the multi-domain operations concept (MDO) currently being drafted by Nato, based on concepts developed within the US military.

Since its inception, scholars such as Franz-Stefan Gady, Robert Scales, and Heather Venable have questioned the viability of this approach [1]-[3]. In a persuasive 2021 *Survival* article examining the US conceptualization of multi-domain operations, Gady argued that the technological attributes of the future operating environment would undermine the foundational assumptions of an MDO approach, rendering it infeasible at best [1]. Failure to adjust correctly to the future battlefield may be as dangerous as not adjusting at all. Since the Nato alliance is actively developing a MDO concept, it is worth comparing the approach's internal logic with the anticipated features of the future operating environment (FOE).

The question is broader and deeper than it first appears. Gady's critique of MDO rests upon two longstanding and intertwined debates: the utility of manoeuvre doctrine as an overarching approach to warfighting, and whether modern technology provides an intrinsic defensive advantage in military operations. Manoeuvre warfare arguably has an inherent offensive bias, particularly as implemented within a "Western way of war". A mismatch between an offense-oriented operational concept and an operating environment that incentivizes defensive actions could result in ineffectual military operations or even defeat. The essential question addressed in this paper is whether emerging military technologies will undermine offensive-minded manoeuverist approach to warfare embodied in the MDO concept. The answer has wide-ranging implications for acquisition policies, force structure decisions, operational concept development, training regimes, and professional military education.

2.0 NEW TECHNOLOGIES, OLD DEBATES

Emerging technologies are likely to alter the character of future warfare. As sensors continue to increase in numbers and quality, the exponential growth in available data they generate about the future battlefield will be analysed in real time by artificial intelligence (AI). Enabled by new lightweight materials, improved energy storage, advanced manufacturing processes, and advanced machine intelligence, autonomous systems deployed together with manned legacy platforms will likely spur a renewed emphasis on mass as a decisive factor on the battlefield. Communications networks that fuse these systems together into an Internet of Military Things are likely to become even more robust and reliable. Quantum computing will – at least for certain types of calculations – enable more complex data analysis that enables further technological advances. Biotechnology will alter how humans interact with these intelligent machines as brain-computer interfaces improve. The resulting network of manned and unmanned systems will vastly improve situational understanding, shrink the time needed for decision making, transform command and control structures, and improve the speed and range of effectors [4]-[6]. These and other technologies are poised to significantly transform the modern battlefield.

Significant portions of this vision of the future are hardly new. In the midst of the Vietnam War, the American general William Westmoreland spoke in 1969 about a future battlefield in which "enemy forces will be located, tracked, and targeted almost instantaneously through the use of data links, computer assisted intelligence evaluation, and automated fire control" [7] p. 923. Encouraged by the successful use of military technology during the 1991 Gulf War, many analysts and officials advocated for a high-tech network-based military. Nearly three decades later, many of these earlier proposals regarding networked warfare may now have the technological foundation to finally be realized, but in a reimagined form that emphasizes data-driven decision making as much as the network itself.

A second idea with well-established historical roots has re-emerged as well: the dominance of either the offense or the defence in tactical military operations. As Stephen Biddle explained, offense-defence theory posits that "changing technology shifts the relative ease of attack and defence (the offense-defence "balance") for all states in the international system" [8] p. 15. T.X. Hammes examined each of the warfighting domains and concluded that military technology has shifted the balance back to the defence at the tactical level [9]. The late David Johnson, observing trends that culminated with the Russian-Ukrainian War, wrote in August 2022 that "what I believe we are witnessing is a pivotal moment in military history: the re-ascendance of the defence as the decisive form of war" brought about by ubiquitous sensing and long-range fires [10]. Biddle has resisted this "expectation of epochal change to a technologically determined era of defence dominance" as he argued for the continued relevance of offensive manoeuvre [11].

This leads us to a third well-established debate: whether the most appropriate overarching organizing doctrine for military operations should be based on the concept of manoeuvre, attrition or positional warfare. Whereas a doctrine of attrition seeks to defeat an adversary through their physical destruction, the manoeverist approach is primarily focused on “shattering the enemy’s overall cohesion and will to fight, rather than their forces and equipment” [12] p. 37. A third approach is positional warfare, which Amos Fox defines as using force “to move an opponent from one position to another for further exploitation or to deny them access to an area for further exploitation” [13] p. 18.

Although defensive manoeuvre is indeed possible, many view the principles of manoeuvre warfare as inherently offensive in nature, particularly given the predilection among Western militaries for offensive tactics [11], [14]. Analysts most often emphasize the manoeuvre-attrition dichotomy, but all three concepts can be employed in a military conflict. Nato doctrine stresses that “there will always be a need to fix the enemy, deny them access to routes and objectives, and secure vital ground and key points” but that these are simply means to eroding the enemy’s understanding, will, and cohesion [12] pp. 38–40. The manoeverist approach is therefore more aptly understood as “manoeuverish” with an “underlying appetite for attrition” [15].

At this point, it should be emphasized that manoeuvre as a concept is applicable at all three levels of warfighting. Strategic manoeuvre that involves the movement of forces and logistical support to relevant areas of operation, as well as the theory of victory based on an opponent’s will to fight and cognitive state. Operational manoeuvre, the level at which conversations about manoeuvre warfare are most often relevant and the intended level for the MDO concept, comprises the organization, deployment, and utilization of forces within an area of operation to create unsolvable dilemmas for opponent that disrupts their operations and breaks their cohesion. Tactical manoeuvre is nearly synonymous with mobility, but often emphasizes the advantageous positioning of forces in relation to the enemy.¹

3.0 MANOEUVERING INTO A MULTI-DOMAIN FUTURE

These three debates – the value of networked warfare, systemic offense-defence advantage, and the manoeuvre-attrition dichotomy – coalesce in the debate over multi-domain operations. Is the offensive-oriented manoeuvre MDO approach on a collision course with the growing relevance of defensive-oriented attrition warfare in a high-tech operating environment?

Technology was in fact the impetus for the creation of the multi-domain concept in the first place. The United States has been developing an operational concept to fight in a synchronized fashion across all five domains of land, sea, air, space, and cyberspace [18] p. 6. Modern warfare is inherently multi-domain, but American strategists believe the operating environment has expanded. This includes the types of actors on the battlefield, the temporal aspect (particularly the reduction of decisionmaking times at the operational level), the number of contested domains, and battlefield geography as long-range fires (including cyber effects) erode the traditional delineations of back, close, and deep areas. A principal conundrum has been the burgeoning anti-access and area denial (A2/AD) capabilities of its adversaries, the speed and range of these and other modern long-range fires, and the potential challenge of retaking territory after an adversary’s successful *fait accompli*. The answer to this and other military problem sets became the foundation for the US Army and Marine Corps multi-domain approach, which has evolved into the broader Joint All Domain Operations (JADO) concept. As the multi-domain approach further evolves within Nato, it has retained the more generic MDO label.

¹ Numerous historical examples illustrate successful manoeuvre at the tactical and operational level that successfully disrupt an adversary’s operations and unit cohesion. Examples of the successful application of manoeuvre approach with strategic effect – that is, creating a situation in which manoeuvre shatters the adversary’s will to fight and leads to a positive resolution of the conflict – are rare, and attritional warfare instead often determines the outcome of military conflicts [16], [17].

The principle organizing idea of MDO is the rapid coordination and synchronization of effort across warfighting domains from the tactical to the global/strategic level, taking advantage of a broad network of sensors and effectors tied together with robust digital command and control infrastructure. The idea would be to achieve synergies between capabilities across domains to create “overmatch” situations that, in accordance with a manoeuvre warfare approach, would lead to “breaking the physical, virtual, and cognitive cohesion of enemy formations, causing their defeat” [19] p. 43. The Nato definition similarly emphasizes “orchestration” and “synchronization” to deliver “converging effects at the speed of relevance” [20].

One of the fundamental elements needed to realize this vision, and one that distinguishes MDO from existing joint combined operational concepts, is the creation of a Joint All Domain Command and Control (JADC2) architecture. If sensor data is to be collected, analysed and quickly acted upon across domains, that situational understanding must come from a single, highly automated network that enables an “any sensor, any shooter” concept. According to the US Congressional Research Service, JADC2 will create an Internet of Military Things that provides “a cloud-like environment for the joint force to share intelligence, surveillance, and reconnaissance data, transmitting across many communication networks, to enable faster decisionmaking” [21] p. 2. In other words, JADC2 is the information hub that enables the functionality of MDO. This decisionmaking is only possible when information can be collected and fused to create a holistic picture, thus the inclusion of a data storage “combat cloud” element within the digital architecture that enables data fusion and analysis [22].

Although not emphasized in earlier MDO descriptions, the sheer volume of information being fed into the system and the speed at which some tactical engagements are likely to occur suggests that artificial intelligence will have a central role in data analysis and decision support functions. One well-known conceptualization of this type of decision support is a manoeuvre concept known as Mosaic warfare, in which artificial intelligence performs an optimization role in matching available resources to tasks, such as pairing effectors with targets. This version of “decision-centric” JADC2 within an MDO framework would, as a recent RUSI rapport noted, “represent a major shift from network-centric warfare to data-centric warfare” [23] p. 5.

These concepts, along with the technology that will form the connective tissue to realize them, are still under development and the specific architecture has yet to be finalized. The advantages of such an approach are clear, however, particularly since a key element of manoeuvre warfare consists of conducting decisionmaking (observe-orient-decide-act or OODA) loops more rapidly than an opponent to weaken their cohesion and fighting effectiveness [16]. One challenge in a data-rich operating environment full of sensors is the ability to avoid being paralysed by the flood of information and instead quickly leverage it into actionable options. On a mostly transparent battlefield, speed (both in terms of physical mobility and decisionmaking) may increase survivability. One way to increase operational tempo is through the collection and processing of data that provides the basis for better and quicker decisions.

4.0 MANOEUVRE OR ATTRITION IN THE FOE

Despite the intuitive logic of an MDO concept combined with a digital architecture that enhances and accelerates decisionmaking, we are nevertheless faced with the essential question of whether an offensive manoeuvre warfare approach is even a feasible concept for the operating environment of the future. How technology will manifest itself on the battlefield is difficult to predict, especially when each new capability is countered by another capability in an endless competition. A simpler approach might be to assess the concept against the nascent technologies currently available, particularly since some analysts already see the outlines of a future dominated by the defence. The combination of sensors, long-range fires, inexpensive unmanned systems, and loitering munitions are among the systems that led Hammes and Johnson to conclude that the tactical defence has become dominant again [9], [10]. Stephen Biddle remains sceptical, however, and cautioned against “redesigning modern militaries around an assumption that new technology

has made effective offensive manoeuvre either impossible or available on demand” since that approach, while difficult and time consuming, can offer “decisive outcomes when conditions allow it, and such conditions recur with enough frequency to suggest that its demands are worth meeting” [11].

Among these fundamental conditions for successful manoeuvre at the tactical level are an ability to move faster than one’s adversary (“asymmetric mobility”) and terrain conducive to rapid mobility [16] p. 14. Terrain is clearly context-dependent, but technology has enabled significant advances in the lethality, range, and precision of offensive fires over the past decades whereas, as Robert Scales has argued, the speed of ground manoeuvre has barely changed since World War Two [2]. A vastly improved ability to identify and strike targets therefore favours hardened stationary positions with layered air and electromagnetic defences. In this environment, attacking forces must move slowly and deliberately under their protective air and electronic warfare (EW) shields. Improved battlefield visibility combined with an anticipated reduction in operational tempo is likely to undermine the potential to achieve surprise, another important principle of manoeuvre [1] p. 137. Whether this lack of surprise hinders an attacker in presenting multiple unsolvable cognitive dilemmas for an opponent, as Gady argues, is uncertain. It might still be possible to observe an adversary creating a set of undesirable options resulting in the erosion of one’s own unit cohesion, and still not have the assets available to alter the outcome.

We must be cautious when extracting lessons about future wars based on current conflicts, but certain recurring tendencies are at the very least worth contemplating. The response to greater battlefield transparency and precision fires has thus far resembled the three main adjustments following increases in firepower precision, range, and volume during the previous century: entrenchment, deception and camouflage, and dispersion [24]. All three options appear to be relevant in Ukraine, and one preliminary analysis of the conflict highlighted dispersion, entrenchment and mobility as the keys to survivability. An additional observation revealed that deception also remains important, particularly within the increasingly contested electromagnetic spectrum (EMS). The authors deemed securing EMS access essential to retain the benefits of precision fires, but also risk-filled because retaining this access often entails increasing one’s own electromagnetic emissions that can then be targeted [25]. The technological competition between new EMS capabilities and countermeasures is likely to intensify and will be fundamental to successful manoeuvre in the future. Autonomous systems may eventually play an important role – particularly in the maritime, air and space domains – in balancing dispersion and mobility to ensure survivability.

For offensive manoeuvre, the trade-off between dispersion and mobility presents a particular and persistent challenge. Mass is necessary to sustain offensive operations, achieve breakthroughs and impose dilemmas, but risks exposing forces to precision fire [11]. Within MDO, this challenge is addressed by proposing to “concentrate fires from disaggregated locations” before forces temporarily “mass from dispersed locations on multiple axes to defeat opposing adversary forces in swift close manoeuvre, then quickly disperse, and manoeuvre to subsequent objectives” [26] p. 46. Gady argues that the potential overmatch effects from other domains such as cyber (or, presumably, electromagnetic effects) may not be sufficient to pose additional cognitive dilemmas on an adversary, leaving the traditional physical domains as the only viable option for massing [1] p. 138. At the operational level, however, the MDO solution to the limits of relying on tactical mobility to ensure survivability appears to be increased operational tempo and improved decisionmaking speed regarding such things as movement of assets and targeting decisions. Still, given adequate firepower on both sides, it is difficult to see how concentrated fires from “disaggregated locations” followed by “swift close manoeuvre” does not become a matter of attrition rather than manoeuvre.

Perhaps the choice is a false dichotomy, Frank Hoffman has argued, and it is better to “drop the simplistic attrition versus manoeuvre debate and seek a more holistic understanding of warfare” [27]. Hoffman advocates persuasively for an operational approach that combines various “defeat mechanisms” (comprising destruction, dislocation, degradation, and disorientation), viewing this as a more plausible concept than strategic paralysis or creating cognitive dilemmas [27]. Embracing both manoeuvre and attrition has a certain appeal and is consistent with the current approach. Many current and planned military systems can be

deployed in accordance with either approach, and the network platform acting as the “digital glue” can be designed in an agnostic fashion. It may even be the case that refraining from emphasizing one operational approach over the other is the best path forward.

Although the current conflict in Ukraine is primarily land-based and brutally kinetic, future military conflicts may be a mixture of unconventional, hybrid, or conventional measures in a variety of domains that occur below the threshold of a major interstate conflict. Responding effectively in these situations while retaining control over the levers of escalation may be the principal challenge for future defence planners. A conventional conflict may even pass through several phases, beginning with high intensity manoeuvre-based warfare as electromagnetic and cyber effects combine with manned and unmanned systems and long-range fires to target larger platforms and systems. This may be followed by a longer, more attrition-based phase as the “easier” targets are eliminated, stockpiles begin to run low, and the combatants increasingly rely on logistical infrastructure and production capacity to continue the fight. The MDO approach in its current form fits well into this initial phase, while attrition advocates will recognize the latter phase.

These escalation risks are one of the motivating factors behind MDO. As one US Army report phrased it, “how does the Army enable the Joint Force to achieve a rapid military victory in a *fait accompli* scenario...without signing up for a major protracted conflict?” [18] p. 3. Paradoxically, however, the measure for escalation control is lacking in the doctrine’s current form. There is logic in the argument that a robust and credible conventional warfighting concept has deterrent value for conflict prevention, thus preventing war in the first place. The risk of a protracted major power conflict escalating to a nuclear confrontation is not even addressed in the MDO approach, however, apart from simply noting an assumption that nuclear weapons will not be employed [19] p. A-1. A potential consequence of this uncertain escalatory risk towards nuclear war, particularly when coupled with the additional uncertainty of escalatory controls when autonomous systems and AI-support decisionmaking are fully integrated on the future battlefield, may even push great power competition further towards the sort of proxy warfare seen during the Cold War. In that case, both manoeuvre and attrition approaches may be relevant.

5.0 CONCLUSIONS

Discussions regarding a manoeuvre or attrition-based approach are more than a purely academic endeavour. Doctrine serves as an organizing principle that provides direction even if it is not rigidly followed, and therefore important that it match the current and anticipated future realities of the battlefield. The correct warfighting concept can potentially avoid the disasters of previous centuries when strategists and tacticians refused to adjust to technological advances in warfare. The fact that new warfighting approaches are under development is a positive sign. Whether defence planners will be able to choose a defensive or offensive oriented approach may be ultimately be a situation that is forced upon them – responding to an incursion requires the defence to take the offensive, after all. It also seems clear that the most advantageous approach in the future remains the *fait accompli* that quickly establishes territorial control and erects robust defensive fortifications to take advantage of the ostensible defensive dominance. Further conceptual planning that continues to address this longstanding threat without unnecessary escalatory risk should be a priority.

The preceding discussion also illustrates the challenges for defence planners regarding acquisition policies. The requirements of an integrated network such as JADC2 are likely to eventually force allied partners to adhere to similar standards to avoid interoperability issues. Although the academic solution of combining both approaches seems elegant on paper, it represents an almost untenable force structure challenge for smaller states. Materiel for short-lived, high-intensity manoeuvre campaigns will likely be quite different (and with a much higher price tag) from the systems necessary for a protracted campaign of attrition. Unfortunately, the best approach appears to be a combination of the two. Regardless, the fact that the Alliance has begun this discussion represents a positive step towards ensuring that NATO’s warfighting approach matches the anticipated future operating environment as the multi-domain concept continues

to evolve.

6.0 REFERENCES

- [1] F.-S. Gady, ‘Manoeuvre versus attrition in US military operations’, *Survival*, vol. 63, no. 4, pp. 131–148, Jul. 2021.
- [2] R. Scales, ‘The great duality and the future of the Army: Does technology favor the offensive or defensive?’, *War on the Rocks*, Sep. 03, 2019.
- [3] H. P. Venable, ‘Accelerate change and still lose? Limits of adaptation and innovation’, *Æther*, vol. 1, no. 1, pp. 57–70, 2022.
- [4] C. Brose, ‘The new revolution in military affairs’, *Foreign Affairs*, vol. 98, no. 3, pp. 122–134, 2019.
- [5] TRADOC, ‘The Operational environment and the changing character of warfare’, US Army, Pamphlet 525-92, 2019.
- [6] D. F. Reding, A. De Lucia, A. M. Blanco, L. A. Regan, and D. Bayliss, *Science & Technology Trends 2023-2043*, NATO Science and Technology Office, Brussels, March 2023.
- [7] A. Bousquet, ‘Chaoplexic warfare or the future of military organization’, *International Affairs*, vol. 84, no. 5, pp. 915-929, 2008.
- [8] S. Biddle, *Military Power: Explaining victory and defeat in modern battle*. Princeton: Princeton University Press, 2004.
- [9] T. Hammes, ‘The tactical defense becomes dominant again’, *Joint Forces Quarterly*, vol 103, Oct. 14, 2021.
- [10] D. Johnson, ‘Ending the ideology of the offense, Part II’, *War on the Rocks*, Aug. 25, 2022.
- [11] S. Biddle, ‘Ukraine and the future of offensive maneuver’, *War on the Rocks*, Nov. 22, 2022.
- [12] NATO, ‘Allied Joint Publication 3.2: Allied Joint Doctrine for Land Operations’, NATO Standardisation Office (NSO), February 2022.
- [13] A. Fox, ‘A solution looking for a problem: Illuminating misconceptions in maneuver warfare doctrine’, *Armor*, vol. 129, no. 4, pp. 17–26, Fall 2017.
- [14] M. Weissmann and P. Ahlstrom, ‘Mirror, mirror on the wall, who is the most offensive of them all? – Explaining the offensive bias in military tactical thinking’, *Defence Studies*, vol. 19, no. 2, pp. 170–188, 2019.
- [15] P. Barnes, ‘Maneuver warfare: “Reports of my death have been greatly exaggerated”’, *Modern War Institute*, Mar. 09, 2021.
- [16] A. C. Fox, ‘Manoeuvre is dead?: Understanding the conditions and components of warfighting’, *RUSI Journal*, vol. 166, no. 6–7, pp. 10–18, Nov. 2021.
- [17] C. J. Nolan, *The allure of battle*. New York: Oxford University Press, 2017.

- [18] E. J. Wesley and R. H. Simpson, ‘[Expanding the battlefield: An important fundamental of multi-domain operations](#)’, Association of the United States Army, Arlington VA, Apr. 2020.
- [19] TRADOC, ‘[The US Army in multi-domain operations 2028: TRADOC pamphlet 525-3-1](#)’, US Army Training and Doctrine Command (TRADOC), Ft Eustis VA, Jun. 2018.
- [20] NATO, ‘[Multi-domain operations: Enabling NATO to out-pace and out-think its adversaries](#)’, Allied Command Transformation (ACT), Jul. 29, 2022.
- [21] J. Hoehn, ‘[Joint all-domain command and control: Background and issues for Congress](#)’, Congressional research service (CRS), Washington, D.C., Jul. 2021.
- [22] H. Saur, ‘[Multi-domain combat cloud: A vision for the future battlefield](#)’, Joint Air Power Competence Centre (JAPCC), Kalkar Germany, 2021.
- [23] J. Bronk and S. Cranny-Evans, ‘[Building the capacity to conduct Joint All-Domain Operations \(JADO\): Considerations for the UK](#)’, Royal United Services Institute (RUSI), London, Nov. 2022.
- [24] M. Van Creveld, *Technology and war: From 2000 BC to the present*. New York: The Free Press, 1991.
- [25] M. Zabrodskyi, J. Watling, O. Danylyuk, and N. Reynolds, ‘[Preliminary lessons in conventional warfighting from Russia’s invasion of Ukraine: February–July 2022](#)’, RUSI, London, 2022.
- [26] TRADOC, ‘[Army Futures Command concept for maneuver in multi-domain operations 2028](#)’, US Army Training and Doctrine Command (TRADOC), AFC Pamphlet 71-20-1, Jul. 2020.
- [27] F. Hoffman, ‘[Defeat mechanisms in modern warfare](#)’, *Parameters*, vol. 51, no. 4, pp. 49–66, Nov. 2021.