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Can Information Displace Mass? Armour In The Future Operating Environment[1]

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Introduction

Mobile and heavily protected forces are mainstays in the conduct of land combat. The platform best exemplifying the characteristics of mobility, protection and firepower for land forces is the tank. The last century of land warfare featured the dominance of the tank as a decisive tool of battle. Tanks were crucial to overcoming the stalemate of the trenches during battles in the last years of the First World War. They decided battles in the European, North African, and Eastern theatres during the Second World War. Heavy armoured forces formed the nucleus of a credible conventional deterrent force

[1] "This paper is a scholastic document, and thus contains facts and opinions which the author alone considered appropriate and correct for the subject. It does not necessarily reflect the policy or the opinion of any agency, including the Government of Canada and the Canadian Department of National Defence.

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during the Cold War. Most recently, tanks delivered unparalleled protection to ground forces and lethal fires as an infantry support weapon during counter insurgency operations in Iraq and Afghanistan. Maintaining a heavy armour capability, however, comes at significant costs in terms of capital, personnel and resources. In an era of increased resource competition and where technological advances promise to offset conventional applications of hard power, many question if tanks remain operationally relevant. Have tanks become ill-suited to match the challenges of the future operating environment?

Detractors of the tank's utility in future warfare argue that technological advancement in the era of information, air, and missile dominance renders the tank unsuited to the demands of the modern and increasingly lethal land operating environment. Contrary to this opinion, I submit that the tank's unrivaled balance of survivability and precision lethality highlights a viable role for the tank in future warfare, providing ground forces with a reliable, flexible and capable means to dominate an increasingly lethal operating environment across the broad spectrum of conflict. This paper explores whether technological dominance and reliance on information age technology can displace industrial age heavy tanks, and demonstrates why heavy armour will continue to be required across future conflict scenarios. Despite entering an age of purported technological primacy, the indomitable tank will remain an indispensable tool of land warfare for the foreseeable future, able to meet emerging threats of the future operating environment.

The Future Operating Environment

Much speculation surrounds the nature of the future operating environment. One can surmise, however, that the nature of conflict will remain fundamentally human, a contest of will and endurance rather than a technological matter.[2] While the essence of war will remain largely unchanged, the future poses unique challenges. The hybridization of warfare and the emerging primacy of non-traditional war fighting domains will necessitate a review of methods for future military engagement, as competitors adapt to an evolving operating environment.

[2] Australia, *Future Land Warfare Report 2014* (Canberra: Directorate of Future Land Warfare, 2014), p. 4.

Recent western military engagements have predominately been marked by irregular, asymmetric threats from non-state actors. Future conflicts, however, will likely be more complicated, characterized by complex permutations of conflict somewhere between state and non-state, and perhaps operating below what has traditionally been considered the threshold of visible conflict.[3] In most likely threat scenarios, states will seek to achieve national aims through a sophisticated wielding of soft power via diplomatic, informational, and economic means, reinforced by low intensity military actions occurring just below a level likely to elicit a strong western military counter action.[4] Russia provides the most recent examples that demonstrate an emergent doctrine relying on a lack of clearly defined state borders within the evolving information sphere as a means of exerting direct influence on the security of adversary states.[5] In such conflicts, traditional battlefield lines become blurred. The resultant operating environment will be increasingly complex, lethal and fast paced.

Future conflict will be hybridized. Operating amongst states, against non-state actors, and outside of traditional military domains greatly complicates the operating environment and increases the nature and types of operations that may be required of conventional forces. States, western and adversary, no longer have the luxury of tailoring militaries for single purpose missions, unless they accept the ensuring costs of significantly larger armed forces.[6] Few western militaries are moving in this direction. In fact, the opposite is true. Across much of the western world, militaries are becoming smaller and much more resource constrained. Robust multi-purpose forces capable of operating throughout the entire spectrum of conflict and rapidly transitioning between missions are required to be effective in the future operating environment.

Current and projected future operating environments will see the emerging primacy of the newer space, cyber, and information domains. Interconnectedness of the internet battlefield of things serves to integrate intelligence and information sharing

[3] Michael Rouleau, *"How We Fight": Commander CJOC's Thoughts* (Ottawa, February 10, 2019), p. 4.
[4] "*DEFENSE; New Reality of Future Wars Shift Hostilities into information Sphere – Gerasimov*," Interfax: Russia & CIS IT & Telecom Weekly, March 04, 2019. https://search.proquest.com/docview/2189603570?accountid=9867.
[5] Ibid.
[6] Frank G. Hoffman, *Conflict in the 21st Century: The Rise of Hybrid Wars* (Arlington, Virginia: Potomac Institute for Policy Studies, 2007), p. 46.

systems with command and control systems and strike platforms.[7] In information-enabled environments, the digitization of combat forces will be required in order to manage the volume of available combat data, and ensure effective cross domain coordination of joint effects amongst coalition forces.[8] The interconnectedness of the battlefield promises to drive transformative effect on both the speed and lethality of future battlefield engagements, particularly for those with the expertise and means to harness its verging power.

Technology, particularly at the cutting edge, can be expensive. At present, significant cost barriers confront states and non-state actors to research, develop and acquire technologies to operate within the high-end realm of military capability. As information availability reduces technological barriers, however, diffusion of lethal technologies into the battle space will increase the accessibility of such weapons to both state and non-state actors. A realm of technological combat that was once the sole preserve of modern western militaries may be opened, to a degree, to many more actors within a conflict area. This in turn will create an environment that is not only more lethal, but also more contested and congested by the diversity of actors seeking to exert influence and limit freedom of manoeuvre within the battle space.[9] Decreasing barriers to entry into technical conflict challenges the assumptions about western technological superiority, long considered the status quo of modern warfare. The likelihood of both state and non-state competitors achieving asymmetric advantage to counter the overwhelming conventional advantages of the western alliances is a very real.[10] To remain flexible in the future threat environment, states must maintain a sufficiently robust mixture of forces to counter unanticipated asymmetric technological emergence on the battlefield.

[7] Stephen Russell and Tarek Abdelzaher, "The Internet of Battlefield Things: The Next Generation of Command, Control, Communications and Intelligence (C3I) Decision-Making." *MILCOM 2018 - 2018 IEEE Military Communications Conference (MILCOM), 10/2018* (Los Angeles, CA: IEEE, 2018), p. 738.
[8] Australia, *Future Land Warfare Report 2014*, p. 11.
[9] United Kingdom, *Strategic Trends Programme: Future Operating Environment 2035* (Shrivenham, UK: Ministy of Defence, 2015), p. 44.
[10] Jesse Ellman, Lisa Samp, and Gabriel Coll, *Assessing the Third Offset Strategy* (Washington, DC: Center for Strategic & International Studies, 2017), p. 1.

The future operating environment will remain human centric, complicated by increased weapons lethality, increased battle tempo, and blurred battlefield lines. The security problem posed to future western militaries will be complex.

Unpacking Assumptions

Given the interconnectedness and complexity of the operating environment, some western assumptions regarding their capacity to wield hard power in the current and future operating environments should be reconsidered. Strategic adversaries will undoubtedly strive to rebalance the global arena towards multipolarity. Conventional deterrence and the risk of major state-on-state land conflict will remain relevant considerations in the future. Western dominance of the military operating domains will diminish, as the gap between the west and the rest rapidly closes. Assumptions concerning monopoly on all domain dominance may no longer be accurate, with potentially far-reaching consequences. Western involvement in conventional conflict over the recent past may have reinforced predicable patterns and outcomes, but relying too heavily on outdated assumptions about conflict is both risky and dangerous in the future operating environment. The adversaries of the west have studied its way of war, and are challenging western supremacy on many fronts. If the west is to remain the preeminent global force, it must carefully consider its assumptions regarding the emerging dynamics of an increasingly contested future operating environment.

The Stable World Order

In the face of a stable American global hegemony, the re-emergence of state-based strategic competition, recently identified as the central threat to American prosperity and security in the United States' 2018 National Defense Strategy, threatens to upset the relatively stable western world order enjoyed since the end of the Cold

War.[11] Owing to the emboldening of regional powers challenging the global status quo, the security and stability afforded by an accepted state of post-Cold War unipolarity can no longer be guaranteed. What remains is a potentially more instable multipolar world.

Challenges to Hegemony

A shift away from unipolarity results in subtle changes to the systems implicitly governing the manner in which states interact with one another. The instability of a multipolar world order results from the contrasting dialectics of dominate states who seek to reduce the unacceptable risks of war with emerging powers, while also seeking limited intervention conflicts to prevent them from upsetting the status quo.[12] In a multipolar world, the desire to maintain spheres of influence may result in an increased likelihood of conflict. This risk is primarily a consequence of miscalculations regarding the intentions of other states, and their perception of the risk to balance of power. Regional actors such as China, Iran, and Russia will continue to seek means to dominate and influence their regional spheres. These emerging powers are likely to seek establishment of systems supporting regional hegemony and are likely to take measures to reduce the impact of western interference in pursing these objectives.[13] These states are also likely to work together in alliances, or lesser forms of cooperation, against the western global system lead by the United States, its strategic allies, and its satellites. Given the increased confidence and relative strengths of these regional powers, the likelihood of state-based or state-sponsored hybrid conflict against western forces operating within these developing spheres may increase, as states evaluate their means to enforce regional hegemony and remove or reduce western regional influence.

[11] United States, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: Department of Defense, 2018), p. 2.
[12] Hans-Georg Ehrhart, "Postmodern warefare and the blurred boundaries between war and peace." *Defense & Security Analysis* 33, 3 (2017): p. 264, https://doi.org/10.1080/14751798.2017.1351156.
[13] United States, *Global Trends - Paradox of Progress* (Washington, DC: National Intelligence Council, 2017), p. 220.

As international systems shift towards multipolarity, regional powers may seek to reinforce regional control via military dominance over their respective zones of influence. Where regional powers deem the risk of military engagement with the west to be an acceptable means to protect their interests, these modern and emerging powers have the capability to create lethal operating environments involving risk to western forces. In such heavily contested environments, only heavy and protected forces can operate with acceptable levels of risk.[14] In lethal and denied environments where state actors possess an ability to coordinate overwhelming joint effects across multiple domains, the tank provides a protected mobile platform to survive the battle space, and a gun to generate the overwhelming firepower required to close with and destroy the enemy.

The Risk of Major Land Conflict

While the possibility of land centric state-on-state conflict may seem objectively remote to many western decision makers, threat of major land combat remains a real possibility in certain situations against states with such means. Around the globe, states engaged in simmering regional conflicts are not only modernizing their armoured fleets, but also increasing capacity to engage in armoured warfare through significant investments in the quantity and quality of these forces. The reemergence of state-based strategic competition, the regional instability caused by internal conflict within weak and fragile states, the increased spectrum of terrorism threats, and the spread of disruptive and lethal technologies combine to form a future where major land combat is no longer a remote possibility.[15] Within this future operating environment, the versatility and flexibility of the tank to operate across the spectrum of conventional conflict, while also defending against non-conventional threats, reinforces a viable future for tanks.

[14] David E. Johnson, *Heavy Armor in the Future Security Environment*, Occasional Paper (Santa Monica, CA: Rand Corporation, 2011), p. 4.
[15] United States, *Global Trends - Paradox of Progress* , p. 215.

Many Asian states, in particular, are making significant investment in heavy armour. [16] This is in line with their growing economic power and concerns regarding regional security, and is taking place alongside other major military modernization programs. The scale of the conventional land force armament occurring within Asia is staggering by western standards. The two largest Asian armies of China and India alone boast approximately 10,000 main battle tanks of relatively modern capability.[17] The increase in tank procurement by these states has coincidently resulted in an arms race of conventional weaponry in regions of potential conflict, on the periphery their respective spheres of influence. On the Korean Peninsula, North Korea, a nation widely recognized as a strategic threat to western interest, also possesses significant armour capability. [18] While much of their force is of less quality and may be considered inadequate and obsolete in terms of its capacity to survive contact with modern western armour, the size of their tank force is such that it still poses a significant threat to all land platforms that do not possess tank-like protection, including much of the South Korean and American armoured fighting vehicle fleets in location.[19] North Korean tanks represent a viable mobile striking force for fast invasion of the peninsula, serving to put military and political pressure on its neighbour. Defense of the peninsula may rely heavily on countering an armoured threat, and for this defence to be credible the immediate and maneuverable anti-armour capability afforded by modern tank forces may be required.

Simmering conflicts between Asian states such as India and Pakistan, China and Taiwan, and North and South Korea can erupt rapidly and could devolve into intense state-on-state conflicts begin fought across multiple domains and with the means immediately available. In high-intensity conflict, tanks will be employed as a primary land combat platform, acting in conjunction with other conventional systems. As many of the Asian continental powers are also capable of tactical nuclear operations, there also exists a possibility of a combination of nuclear and conventional war on the

[16] Ankit Panda, "Main Battle Tanks in Asia: Useful Junk. Why Asia's militaries will hang on tanks, even as the United States moves on," *The Diplomat*, 13 January 2015, https://thediplomat.com/2015/01/main-battle-tanks-in-asia-useful-junk/.
[17] Ibid.
[18] United States, *Summary of the 2018 National Defense Strategy*, p. 2.
[19] Kyle Mizokami, "North Korea Has Lots of Tanks (But can they Fight?)," *The National Interest*, 29 April 2017, https://nationalinterest.org/blog/the-buzz/north-korea-has-lots-tanks-can-they-fight-20400.

continent. In this combat scenario, tanks are particularly well suited. With their environmental protection and ability to rapidly exploit gaps in defensive lines created by a nuclear exchange, supported by air and joint fires, tanks can strike deep into adversary lines. In Asian conflict scenarios, tanks would undoubtedly be integrated within the force packages of any campaign plan, as it is clear that many Asian states see clear value in their possession. Given significant western interests within the Asian continent, friendly allied nations could be drawn into such state-on-state conflicts. A continental Asian battlefield could see significant employment of heavy armour forces.

The global shift towards multipolarity has resulted in the rise of regional powers shaping local international systems away from the western dominated global order. Short of rapprochement, China, Iran, and Russia will continue to exert influence over their spheres, and take measures to decrease western influence.[20] While it is more likely that these states will continue to fight amongst themselves and with their regional neighbours, there remains a possibility that the west could be drawn into conflict by alliance and bi-lateral commitments with nations on the periphery of these conflicts. Should the west be drawn into conflict, these regional powers are capable of attacking western interests across multiple domains simultaneously. They may seek military intervention to protect against western influence. In open conflict with China, Iran or Russia, it is probable that tanks will figure prominently within the adversary's campaign plan. If such conflict cannot be deterred, a robust western land force with significant armour capability will be required to ensure the survivability of our own forces, and provide sufficient overmatch over the land domain.

The Viability of Deterrence

Deterrence of strategic adversaries underpins western doctrine. While diplomatic soft power approaches to avoiding conflict are generally favoured, for soft power to be effective it must also be backed by credible military hard power.[21] The prevailing logic of this strategy is that the possession of sufficient military force, and the willingness to

[20] United States, *Global Trends - Paradox of Progress* , p. 220.
[21] Julian Lindley-French, "The Futility of Force? Western European Armed Forces in the Future Operating Environment." *Strategie Und Sicherheit ... 2014, no. 1* (2014): p. 391, http://dx.doi.org/10.7767/sus-2014-0135.

use it, will deter adversaries from committing aggressive acts. Adversaries must retain a belief that in conducting aggressive acts they will suffer unacceptable consequences.[22] Deterrence of adversaries previously relied upon the concept of mutually assured destruction, wherein the risk of nuclear warfare and unacceptable loss during retaliation dissuaded states from entering into major combat. In the modern era and foreseeable future, however, state and non-state adversaries will increasingly conduct aggression within a grey zone of conflict, where retaliation resulting in annihilation may no longer be an appropriate response. While high end destructive capabilities will continue to play a role in constraining major international actors, deterring in a future operating environment requires that states not only maintain an annihilation capability, but also a mix of conventional capabilities to deter, and as appropriate respond, across the full spectrum of military options with the minimum required level of force. [23] As part of the conventional force package, massed tanks will continue to be relevant in providing credible deterrence to adversaries due to their capacity to operate below the nuclear threshold with rapid manoeuvre, survivability and firepower as part of a larger combined arms package.

Deterring state rivals will remain a priority for the world's great powers. Technology will provide more integrated and lethal land combat systems, capable of adding credibility to deterrent posturing. As the speed of technological improvements increases, deterrence strategies based on technological overmatch may not be fiscally sustainable.[24] As such, a cornerstone of many western nations' deterrence strategy is the maintenance of a robust and combat capable conventional army with capacity to project globally in conjunction with allies and partners. [25] Most likely threat scenarios involve hybrid conflicts short of state-on-state combat. Consequently, conventional forces must be both credible as a deterrent to conventional state adversaries, but also capable of meeting the expected unconventional threats facing western militaries.[26] In a resource

[22] Michael J. Mazarr, *Undestanding Deterrence.*, RAND Corporation, (2018), pp. 9-10.
[23] North Atlantic Treaty Organization, "Deterrence and defence." *North Atlantic Treaty Organization,* 12 October 2018, https://www.nato.int/cps/en/natohq/ topics_133127.htm (accessed 10 March 2019).
[24] Kimberly Amerson and Spencer B. Meredith III, "The Future Operating Environment 2050: Chaos, Complexity and Competition," *Small Wars Journal* (2016), https://smallwarsjournal.com/jrnl/art/the-future-operating-environment-2050-chaos-complexity-and-competition.
[25] United Kingdom, *Strategic Trends Programme: Future Operating Environment 2035*, p. 37.
[26] Ibid.

restrained environment, heavy armour stands apart from other land combat systems as it is uniquely capable of effectively operating throughout the spectrum of conflict with minimal reorganization and restructuring. Light and medium forces are generally incapable of scaling-up to meet the possible high-lethality environment presented by state adversaries. Without capability, there is no credibility in the deterrence. [27]

The Grey Zone

Below open inter-state hostilities exists a complicated realm of "nearly war." States and non-state actors instigate conflict just underneath the threshold of open war in a "grey zone" of conflict. In such hybrid environments, friendly land forces will be required to operate across the spectrum of conflict in support of peace support initiatives and counter insurgency operations, in an ill-defined joint operations area with potentially unidentifiable enemy or only a loose collection of threats. Complicating matters, operations in the grey zone may occur outside of the traditional battle space, with conflict occurring near or interspersed amongst a civilian populace.

In future hybrid conflicts, significant western intolerance towards civilian casualties will drive requirements for greater accountability and scrutiny on both the precision and proportionality of weapons effects.[28] Additionally, as adversary forces adopt asymmetric means to offset western technological advantages in both firepower and reconnaissance, the ability to identify combatants will be degraded.[29] Operating in the grey zone will be hostile actors with access to modern stand-off and precision weaponry and limited unmanned aerial vehicle capacity, increasing the lethality of the conflict zone. [30] In all cases, friendly forces will be required to tailor forces in such a manner as to produce local overmatch to defeat enemies in close contact with civilian populations. During such grey zone conflicts, the tank provides the land force with survivability to operate within this contested space. Tanks deliver precision lethal fires with reduced risk of collateral damage as compared to traditional artillery, missile and

[27] Johnson, *Heavy Armor in the Future Security Environment*, p. 6.
[28] United Kingdom, *Strategic Trends Programme: Future Operating Environment 2035*, p. 17.
[29] Hoffman, *Conflict in the 21st Century*, p. 15.
[30] United States, *Global Trends - Paradox of Progress*, p. 20.

air joint effects.[31] Capable of reducing the risks to own forces and able deliver lethal force with discernment in a complex operating environment, the tank retains a viable role in an increasingly congested hybrid future operating environment.

All Domain Dominance

While the capacity of the west to dominate with hard power in a conventional conflict is significant, recent admissions amongst western leadership suggest that uncontested western dominance across all domains – land, sea, air, space, and information – may be nearing an end and can no longer be taken for granted.[32] By implication, contested western dominance has required western nations to adapt and seek offsets to maintain relative superiority over adversaries within conflict domains.

The Information Domain

Western military doctrine places a premium on the concept of manoeuvre. Enabling manoeuvre doctrine are intricate communications networks that allow the synchronization of assets to generate overmatching effects.[33] To overcome the great comparative advantages of western military forces in terms of battlefield manoeuvre, our adversaries have dedicated significant resources towards denying the information domain through advanced electronic warfare systems capable of degrading the usage of wide bands of the electromagnetic spectrum.[34] In future operating environments, uncontested dominance over the information domain may not be a safe assumption. Resultantly, western forces must be capable of delivering overwhelming effects in degraded information environments where network enabled systems may be unavailable or unreliable.

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[31] David B. Haight, Paul J. Laughlin, and Kyle F. Bergner, "Armored Forces: Mobility, Protection and Precision Firepower Essential for Future," *Armour. November-December 2012 CXXI, no. 5* (2012): p. 7.
[32] Adam Biggs and Rees Lee, "The Role of the Human Operator in Third Offset Strategy," *Naval War College Review 71 [2018], no. 3* (2018): p. 111.
[33] United States, *Russian New Generation Warfare Handbook* (Fort Meade, MD: Asymmetric Warfare Group, 2016), p. 17.
[34] Ibid.

Strategic competitors appreciate the self-imposed vulnerabilities of western militaries' heavy reliance on the information domain. Accordingly, they concentrate on the space and cyber realms to jeopardize the integrated electronic command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) suites utilized by the western alliances.[35] In a denied information environment, the credibility of the informational inputs into military decision making and command systems become unreliable and open to question, reducing the comparative advantage of the west over their adversaries.[36] In such environments, human-machine systems that remain capable of operating independent of integrated networks, such as tanks, will retain flexibility for land combatants to deliver effects within contested information environments.

Interconnected battlefield systems' transformational effects increase the speed and fidelity of battle space understanding and decision making, but could come at a price. Where information domain denial is probable or likely, reliance on the electromagnetic spectrum as a panacea to defence problems will need to be reduced in order to operate effectively.[37] In large-scale modern warfare, it is likely that these systems will go down quickly, as they are susceptible to many means of dislocation including by enemy action of electromagnetic pulse. Accordingly, leaders able to operate independent of the information domain should these battle management systems become degraded or otherwise compromised will be vital in the conduct of future wars.[38] In information denied environments, industrial aged hardware paired with skilled and trained human teams will be the deciding factor in the ultimate success or failure of battlefield engagements. In such environments, where the land force's capacity to communicate and coordinate joint effects is degraded, the value of the tank's capacity to provide manoeuvre, survivability and lethal fires to land forces resides in their ability to deliver effects and operate independent of the interconnected battlefield systems.

[35] Ellman, Samp, and Coll, *Assessing the Third Offset Strategy*, p. 1.
[36] Biggs and Lee, "The Role of the Human Operator in Third Offset Strategy," p. 109.
[37] United Kingdom, *Strategic Trends Programme: Future Operating Environment 2035*, p. 21.
[38] United States, *Russian New Generation Warfare Handbook*, p. 48.

The Air Domain

Another tenant of recent western military intervention has been a reliance on the rapid establishment and maintenance of air superiority over contested operations areas. Superiority of the air domain has enabled western militaries relative freedom of action in all conventional manoeuvre domains – land, sea and air. As was clearly demonstrated during interventions in Bosnia, Iraq, Afghanistan, and Syria, enemies foolish enough to engage western forces in open land conflict were handily destroyed by the overwhelming dominance of the air domain. In foreseeable future operating environments, however, complete air dominance may no longer be a valid assumption.

Potential state and hybrid adversaries will operate unsophisticated and non-integrated anti-air / area denial (A2AD) capabilities, such as hand launched anti-air missiles, as was evidenced during the Balkans campaigns of the 1990s and the wars in Iraq, Afghanistan, Libya and Syria throughout the 2000s through 2010s. Having witnessed the asymmetric advantage afforded to western militaries by their air domain dominance, adversaries have invested heavily in A2AD capabilities which significantly jeopardize the relatively unrestricted access of western militaries to project hard power abroad. In doing so, they have threatened a central element of the western way of war, and have significantly disrupted the traditional military planning approaches for foreign interventionism.[39] When confronted with the significant integrated A2AD capabilities demonstrated by modern, technologically advanced state adversaries, western nations will no longer be able to assume superiority and may at times only be capable of momentary windows of relative air superiority in support of land forces.[40] When land forces cannot rely on air dominance during the conduct of operations, the protection and mobility afforded by the tank becomes critical. Tanks not only provide survivability, but also capacity to generate precision lethal effect independent of the other domains.

Another tenant of modern western warfare is the significance of air to land integration in operations. Without relative assurances of air superiority, the ability of land forces to conduct joint integration to achieve overwhelming effects within the land

[39] Ellman, Samp, and Coll, *Assessing the Third Offset Strategy*, p. 1.
[40] United States, *Russian New Generation Warfare Handbook*, p. 9.

domain will be compromised, and will be inconsistent with the manner in which western nations have conducted land-based warfare over the course of recent decades.[41] The importance of protected, manoeuvrable, and lethal land platforms operating in direct support of forces will be critical to western armies' ability to close with and destroy adversaries. Where joint effects are impractical or impossible, heavy armoured forces provide survivability, lethality and persistence on the battlefield, enabling the combined land force to seize and hold terrain.

The Land Domain

To achieve destruction of an adversary, direct and close engagement is often required. Proliferation of increasingly lethal land combat systems means larger areas of the battlefield can be affected by adversary fires. The increasing range and lethality of land systems renders light forces vulnerable, and necessitates an increase in the level of protection and battlefield mobility required to operate effectively.[42] To close with an enemy employing standoff systems, such as missiles, artillery and heavy machine guns, heavy armoured forces have greater survivability than medium armour (example: Canadian LAV) or dismounted forces due to their ability to survive surprise enemy engagements.[43] Without protection and lethal overmatch capability, land forces cannot close with and fulfill the primary role of destroying the enemy with an even chance of survival. Heavy armour, with its integral firepower, mobility and protection, provides an all-weather, lethal, and survivable capability to enable the ground force to achieve overmatch of an adversary.[44] In future battlefields marked with lethal standoff weapons, survivability will be a critical consideration for the land force to mitigate standoff capabilities and allow the combined land force team to close with and destroy the enemy.

[41] Ibid., p. 49.
[42] Australia, *Future Land Warfare Report 2014*, p. 14.
[43] Johnson, *Heavy Armor in the Future Security Environment*, p. 2.
[44] Australia, *Future Land Warfare Report 2014*, p. 14.

The land domain, as with the other domains, is increasingly digital and interconnected. Communications and shared situational awareness are critical force enablers that help mitigate the uncertainty and risk of war. Such means aid commanders in accelerating their decision cycle, and enable better battle management. These systems, however, are vulnerable within the information domain as well as physically vulnerable in the land domain. Operating within internet battlefield of things, modern tanks can provide an optimal platform to provide a survivable and mobile hub for battlefield communications and situational awareness.[45] Capable of rapidly transiting through contested battle spaces, they can serve as a forward coordination node for the integration of joint effects onto the battlefield. As a tactical command platform, heavy armoured forces can leverage the information domain and maximize joint lethality across multiple domains simultaneously.

Adversaries learn, and appreciate well the advanced battlefield surveillance and reconnaissance capabilities of western nations. Despite massive technological advancements, humans are adaptive and creative, and "no amount of computing power can anticipate the varied moves and the implications of an enemy's capacity to adapt in unexpected ways."[46] After conflicts, enemy combatants quickly adopt tactics and techniques to avoid detection and mitigate western advantages in the fields of surveillance and reconnaissance.[47] In such cases where the location and intent of an adversary cannot readily be ascertained, the value of combat forces gaining close contact with the enemy to garner situational awareness is critical. Heavy armour allows friendly forces the capacity to absorb the shock of surprise, survive the initial engagement, and shape the land battlefield.[48] Combat reconnaissance, as can be provided by heavy armour, is a significant combat enabler that provides flexibility in time and space for the land force commander.

The increasing lethality and pace of future land battles demands forces that can effectively move, shoot, and communicate to achieve decisive effects. Whether surviving explosive devices during peace support and counter insurgency operations,

[45] Ibid.
[46] F. G. Hoffman, "Will War's Nature Change in the Seventh Military Revolution?" *Parameters* 47, 4 Winter (2017–18): pp. 23-24.
[47] Johnson, *Heavy Armor in the Future Security Environment*, p. 4.
[48] Ibid., p. 2.

or seizing terrain during high-intensity combat, heavy armour has an unmatched combination of mobility, lethality, protection, all-weather capability that provides the land force with flexibility and overmatch across the spectrum of conflict when properly employed.

Heavy Armour: Worth Keeping?

Employment of heavy armour has both merits and drawbacks in the future operating environment. As western military force employment scenarios foresee military intervention in relatively low-risk operating environments, suitability of heavy forces for low-intensity combat and tactical deployability of the assets will be key considerations. As western nations are likely to maintain the technological edge over most adversaries, networked suites of highly technical equipment supported by advanced artificial intelligence are likely to enable overmatch over peer competitors' current and projected conventional capabilities.[49] When compared to smaller, but more tactically deployable and technically advanced networked forces, vast armies of cumbersome tanks may be obsolete in the future operating environment.

The most likely force employment scenarios for western militaries in the near future are low-intensity, limited intervention wars such as capacity building and counter insurgency operations. Such operations necessarily favour the employment of light forces – primarily infantry and field engineers. Armed forces continually labour under limited resources. Disavowing tanks as a required capability and optimizing for the most likely threat scenario with increased light forces makes both intuitive and economic sense. Forces optimized for irregular warfare, however, cannot easily scale-up to defend against the highly lethal stand-off threats that both hybrid and state adversaries can bring to bear.[50] In such cases, lightly armoured forces simply do not have the protection and mobility to survive on the contested battlefield. The lack of light force survivability was recently evidenced by the Israeli Defense Force fighting hybrid conflicts during the 2006 Second Lebanon War and operations in the Gaza, where only heavy forces were able to manoeuvre and survive within the combat zone

[49] Ellman, Samp, and Coll, *Assessing the Third Offset Strategy*, p. 3.
[50] Johnson, *Heavy Armor in the Future Security Environment*, p. 6.

littered with effective adversary stand-off weapons, specifically anti-tank missiles and man portable air defense systems.[51] While light forces will be required to operate in close contact in complex terrain, getting light forces to battle will continue to require a heavy force to spearhead the land force throughout the battle space.

The requirement for rapid tactical build-up of forces in sufficient quantity and capability is paramount to achievement of military aims. With tanks, however, rapid tactical deployment is not without difficulty and great expense due to the size and weight of the platforms, and the inescapable sustainment systems required to support the capability in theatre. Transiting armour to global conflict areas relies on a combination of air and sea movement, which necessarily implies a level of dominance in those domains to mitigate the risk of loss of the limited tank and strategic transport resources. In many cases, this necessitates costly pre-positioning of assets into predicted conflict areas before the commencement of hostilities. The tactical mobility of light and medium forces favours their use in low-intensity conflict, but is not without risk if the adversary is capable of employing advanced land combat systems and joint stand-off capabilities. While such a scenario may represent the most dangerous threat environment, it is not outside the realm of possible. To survive in these opposed battle spaces may require the deployment of heavy armour. Tanks enable flexibility across the spectrum of conflict, preserving the required protection and lethal fires required to survive in a contested peer state conflict.

Emerging technology and the networking of forces are transforming land combat. Future technological solutions will enable first-echelon forces with unparalleled levels of lethality and precision.[52] Despite the likelihood of the west maintaining significant technological advantage over most potential adversaries, an expected high initial attrition of high-end technological platforms would quickly render such capabilities prohibitively expensive to replace in sufficient quantity during high-intensity conflict.[53] In the event of major land conflict, a realistic and credible risk of significant adversary stand-off weapons and armour capability within the battle space

[51] Johnson, *Heavy Armor in the Future Security Environment*, p. 4.
[52] Jasmin Diab and Nate Finney, "Whither the Hover Tank? Why We Can't Predict the Future of Warfare," *Modern War Institute.* 12 June 2018, https://mwi.usma.edu/whither-hover-tank-cant-predict-future-warfare/ (accessed 11 March 2019).
[53] United Kingdom, *Strategic Trends Programme: Future Operating Environment 2035*, p. 5.

complicates matters. In such environments, tanks provide reliable and available mobility and protection to manoeuvre within the battle space, to close with and destroy the enemy under the suppressive umbrella of coordinated joint fires.[54] Despite the importance of technology, the venerable tank will remain a reliable and available means to dominate the land battle space.

Conclusion

The fundamental nature of war has not changed. While future wars may be primarily waged in the domains of sea, air, space and cyberspace, war will continue to be won in the presence of people, where human struggle will be required to win land-centric contests of states in close contact with an enemy. Many assumptions taken for granted over the past decades are no longer guaranteed. While the importance of competing and winning in the emerging domains of information, space and cyberspace in future warfare cannot ignored, dominance of these domains has yet to demonstrate an adequate substitute for firepower, mobility, and protection on the battlefield.[55] The form of a future tank is less important than the recognition that such a capability, able to integrate within the internet of battlefield things but equally capable of providing precision lethal effects when such networks are denied or degraded, will remain a key military capability in the future. Tanks are a weapon of choice, and many countries are making significant investments in this capability and including them in their militaries. Despite perceived weaknesses of heavy armoured forces, so long as taking and holding land remains a tenant of war, the balance of mobility, firepower, and protection afforded by the tank will prove useful for joint and land force commanders. While the future is uncertain, lethal and flexible tank-like capabilities will remain an irreplaceable staple of the combined land force, reinforcing a viable future for heavy armour.

[54] Johnson, *Heavy Armor in the Future Security Environment*, p. 4.
[55] Halton, "The Re-Transformation of the Armoured Corps,"p. 74.

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