

If Technology is Redefining Warfare How Should we Deal with this Paradigm Shift

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“Space technology is an example of what security will mean for any strong nation in future. Various challenges in this area have been reviewed and identified by the three services. We have to work fast to solve them”.

*Prime Minister Narendra Modi
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Abstract

A number of technologies are being adapted to warfare, as we have noticed in Ukraine, Nagorno-Karabakh and Israel. The use of advanced weapon systems, techniques and tactics has significantly accelerated the pace of these wars. Emerging and disruptive technologies will shape warfare even further. To maintain their combat edge military leaders will need to develop a deeper understanding of technology, adapt and innovate to deal with this paradigm shift.

Introduction

Heraclitus, the Greek philosopher once said, ‘Change is the only constant in life’. Wars have increasingly become more complex in the last three decades or so. We are witnessing a number of technologies that are being adapted for purposes of warfare in Ukraine, while some instances were evident in the 2020 Nagorno-Karabakh war and 2021 Israel Palestine conflict. The wide range of available weapon systems, their accuracy, the destruction power of ammunition, novelty in employment, speed in execution of manoeuvres by combat forces and civilian contribution force us to look at changes in doctrine, force structures and military training.

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The recent passing of a significant Act on access to technologies by USA distinctly brings across its importance for national security. "It (CHIPS and Science Act of 2022) will strengthen American manufacturing, supply chains, and national security, and invest in research and development, science and technology, and the workforce of the future to keep the United States the leader in the industries of tomorrow, including nanotechnology, clean energy, quantum computing, and artificial intelligence".² As accessing, adopting and applying technologies to tools of warfare becomes the norm, such restrictions are bound to be imposed by those nations who possess it. The gap between technology 'haves and have-nots' may only get bigger and have national security implications.

What most Militaries Need and Some are Getting

Militaries make several demands for developing capabilities. Detecting an opposing force's disposition and movement prior to attempting any manoeuvre is one. This is achieved in a complex operating environment through a fused process of Intelligence, Surveillance and Reconnaissance (ISR). Target Acquisition (TA) then gets added to this endeavour. Collection, collation, analysis and dissemination constitute a typical intelligence cycle, which has to be accurate, timely and well-integrated. Surveillance and Reconnaissance are more specific functions built around intelligence.

During the Ukraine war small, relatively cheap and expendable drones have been employed in abundance for ISR purposes against armoured columns, heavy artillery guns and vehicle convoys. Add to this 'picture-taking and geotagging' of battle zones by civilians in forward urban areas, that has served to provide targeting cues for the Ukrainian military. "Indeed, much of the Ukrainian military's existing drone fleet consists of modified commercial drones, the Turkish Bayraktar TB-2 being a notable, successful exception".³ The Russians also have various sensors on drones/UAVs for collecting intelligence. 'The Russian-made kamikaze UAV KUB-BLA was used in hostilities in Ukraine near Kyiv. The operation of KUB-BLA is based on artificial intelligence algorithms, so it can autonomously identify the target and destroy it'.⁴ Thus, ISR has helped decision makers plan based on the threat and analysis of anticipated adversarial manoeuvres, while simultaneously protecting friendly forces.

The proliferation and widespread use of drones is changing battle dynamics. Countering drones by electronic warfare (EW) and air defence (AD) systems has hence gained attention. “Unmanned Aircraft Systems (UAS) can also be neutralised or destroyed using guns, nets, directed energy, traditional air defense systems, or even trained animals such as eagles”.⁵ One of the big challenges for any defender, thereafter, has been the cost of employing such systems against the use of cheap drones by an attacker.

Another important aspect is achieving a fair degree of invisibility through camouflage and concealment from the enemy. “The technology, developed by Israel-based Polaris Solutions Ltd, provides multispectral concealment to the soldiers at battle in both thermal and visual Called the Kit 300, the product uses thermal visual concealment (TVC) material to combine microfibres, metals, and polymers that renders soldiers on the battlefield literally invisible to a range of thermal cameras”.⁶ These features help soldiers and equipment from getting picked up by various sensors to survive in combat. Increasing battlefield transparency demands greater research in this field.

As troops, formations and weapon platforms move, this must be done faster than the adversary to suffer less amount of attrition. What acts as a force multiplier is the speed of gathering, processing and acting on data. “It’s not HIMARS that’s winning the war for Ukraine, nor is it traditional artillery duels, It’s their ability to process information at a faster clip than the Russians that is having a big impact here”.⁷ Such differentials always become a battle winning factor.

Communications are the glue that keeps soldiers, units, platforms and formations functioning as a well-oiled war fighting entity. Secure communications are then a sine qua non. “It (Starlink) has since helped in basic communications in the country, in addition to assisting its military effort through linking drones for targeting strikes.....Russia sought to jam the systems, but Starlink technicians were able to bypass them”.⁸ On the other hand, Russian soldiers suffered from using unsecured communications which compromised their operational security and sometimes revealed their low morale. Network-centric operations will warrant secure communications, if they are to be effective.

Space is becoming the medium critical to military intelligence, reconnaissance, communication, navigation and missile warning. Timely space situational awareness to provide a combat edge for land, maritime and air dimensions has consequently become vital. “Its (Palantir’s) AI-driven software is able to collect various data from the battlefield via different sources such as satellite images, report any suspicious activity to the general staff, and provide real-time solutions to particular problems on the field, making it more efficient to navigate through the fog of war”.⁹ Some countries are countering their adversary by developing space weapons, carrying out cyber and electronic warfare, while planning for ground site attacks and directed energy weapons. “The disabling of several key satellites is enough to introduce chaos into basic Earth operations that rely on communication and timing”.¹⁰ Space warfare presents huge challenges not only for nations at war, but also for all other space users. Space is now emerging as a unique domain by itself, linked yet distinct from air, and undoubtedly a quintessential part of multi-domain warfare.

The ability to hit at longer ranges is fundamental to any force that intends to cause casualties by battlefield interdiction. Apart from ‘sensor to shooter’ links and ‘shoot and scoot’ abilities, if artillery, rocket and missile systems are coupled with smart ammunition it makes them that much more potent. “Ukraine is currently using HIMARS forstriking high-value Russian targets behind enemy lines to deprive frontline troops of supplies and artillery support”.¹¹ To neutralise such weapons the rival’s counter-battery systems then play a very significant role.

Adapting with Speed and the Need to Innovate

The US articulates the importance of technologies in its vision of fortifying national security. “By modernising our military, pursuing advanced technologies, and investing in our defence workforce, we will have strengthened deterrence in an era of increasing geopolitical confrontation, and positioned America to defend our homeland, our allies, partners, and interests overseas, and our values across the globe”.¹² Thus, acquiring advanced defence technologies becomes a part of modernisation, while adapting with speed to the demands of warfare gains more salience.

Can every situation that might occur during war be anticipated accurately? Not really, as some can be visualised but in others

there will be huge variations. Technology aids both sides, however, the one which adapts swiftly to changing circumstances and is more resolute ends up being victorious. Russian Armed Forces adapted to Ukraine's staunch defence by modifying their strategic aim, consolidating forces and switching to attrition warfare instead of carrying out multiple manoeuvres. The Ukrainians too adapted by training quickly on diverse Russian and Western weapon systems for success in battle.

Innovating then becomes essential to stay ahead of the adversary. "Defense contractors are toeing that line by equipping Ukrainian MiG-29 and Su-27 fighter aircraft with anti-radar missiles designed for more capable Western jets. It typically takes the U.S. military a year or two to integrate new weapons onto a jet for the first time. In Ukraine's case, the process took just a couple of months".¹³ Innovations, such as these, will need an enabling environment, deep focus and lots of enterprise.

The Russians too have innovated by using messaging apps to aim its artillery better. "The agency (SBU) said that it had discovered that Russian intelligence was using smartphone games to induce youngsters to snap and upload geotagged photos of critical infrastructure, military and civilian".¹⁴ The Israel Palestine conflict also saw an AI based innovation for operations by the Israeli Air Force. "During the recent conflict, massive AI machinery for Big Data Analytics provided support at every level- from raw data collection and interception, data research and analysis, right up to strategic planning- with the objective of enhancing and accelerating the entire process, from decision-making about prospective targets to the actual carrying out of attacks by pilots from F 35 cockpits".¹⁵ Military leaders need to develop a close understanding of technology accordingly.

How do Emerging Technologies and Concepts Shape Warfare

So, will emerging technologies then shape warfare further?" As an equal-opportunity enabler, technology will enhance the abilities of all participants in a conflict to do more, which means more messaging and content from all sides, greater use of robots and cyber weapon, and a wider range of strategic targets to strike".¹⁶ We have noticed how some key technologies that have been developed for use in drones/UAS, loitering munitions, precision weapons, satellites, space weapons, communication and jamming equipment, rocket and missile systems are redefining warfare.

There are a number of disruptive ones too that are likely to impact warfare in the future, with some at various stages of development or induction. Robotics, autonomous unmanned systems, stealth materials, nanotechnology solutions, additive manufacturing, synthetic biology, quantum computers and communications, once operationalised, will revolutionise weapon systems further and accelerate the pace of any conflict.

A robust scientific culture has greatly benefited Western advancements in technologies and consequently their speedy assimilation in weapon systems. AI has already been employed gainfully to increase the speed and scale of operations. It is likely to see many more forms as we go ahead. “We are entering a new era. I call it the ‘Singularity’. It’s a merger between human intelligence and machine intelligence and is going to create something bigger than itself”.¹⁷ Intelligence augmentation promises to be quite a game-changer for decision-making.

Russian (Maj Gen Vladimir Slipchenko) military thoughts on harnessing technology in the information age have been significant. “Superiority over an enemy will be achieved through an advantage in the acquisition of various types of information, mobility, and rapidity of reaction; and in precise fire and information effects in real time against numerous structures of his economy, military objectives with the minimum possible risk for one’s own forces and means”.¹⁸ The present war will shape and refine everyone’s thoughts further.

China too appears to have gained from their strategy of Military-Civil Fusion, as they are moving meaningfully towards their goal of prosecuting ‘intelligentised’ warfare. “Furthermore, when China enters the phase of intelligentised warfare, it will have created a command system that integrates humans and machinery, in which artificial intelligence and game theory will be utilised to analyse and determine the opponent’s intentions”.¹⁹

Another interesting phenomenon taking place is the role played by big technology companies in modern wars. “Technology companies ranging from Microsoft to Silicon Valley startups have provided cyber-defense, surveillance, and reconnaissance services—not by direction of a government contract or even as a part of a government plan but instead through the independent decision-making of individual companies”.²⁰ Social media is being

used by netizens for information warfare which at times may be crowd-funded. Such issues would need to be catered for, by those planning national security.

The progress in technologies is making weapon systems complex and formidable. Their impact against an enemy's aggregation of troops and weapon platforms can be devastating, prompting changes in military force design and application. To achieve a combat edge, smaller entities, reduced signatures, distributed disposition and the ability to converge/disperse swiftly will be attributes of any future force, entailing a doctrinal shift.

Where are we Placed

"India will aim to become a developed nation within 25 years, Prime Minister Narendra Modi said, with policies to support domestic production in power, defence and digital technology".²¹ While other progressive developments such as better health, education, infrastructure, jobs, per capita income are being attempted, it would be prudent to greatly augment the defence sector, given our enduring security threats. As our Ex-President, Prof APJ Abdul Kalam once described "The confluence of civilian and defence technologies is leading to a situation where most new technologies are basically 'dual use' in nature".²² Hence technology must be developed to not only drive all growth indices but also to strengthen national security.

The Indian Armed Forces have always aspired to acquire weapon systems with emerging/disruptive technologies. "To prosecute a future war, it is necessary to build infrastructure that ensures the ubiquitous and seamless connectivity of all sensors and shooters in a particular theatre, both airborne and on the surface".²³ The quest for a technological edge goes on. "Systems at the drawing board stage will have to be even more futuristic if they have to be around at the turn of the next century. This calls for a truly transformative approach with a dynamic interplay between doctrine and technology so that the armed forces get what they need and do not have to adapt to what is available by default".²⁴ In its own interest our military must participate in development of defence technologies and nudge doctrinal changes. Further, being agile and adaptive will definitely pay rich dividends.

New technologies invariably affect military capabilities and change the operating environment at all levels of warfare. So, how does one plan for the future? In 2015 the Technology Information, Forecasting and Assessment Council (TIFAC) produced its Technology Vision (TV) 2035 document, following up on lessons learned from the previous TV 2020 document. It clearly articulated five segments of technology that define our capabilities and constraints. The armed forces on their part have identified technology requirements in Technology Perspective and Capability Roadmap (TPCR) 2018 as a sequel to the TPCR 2013 document. The Defence AI Council is tasked for the development of AI for armed forces. The Army has an Army Design Bureau, AI Centre and Quantum Lab, the Navy has the Naval Technology Acceleration Council (NTAC) and the Air Force a Directorate of Aerospace Design. But obviously, much more needs to be done comprehensively.

The Way Ahead

Can we attempt more going ahead? At the apex, a cogent technology review must be undertaken and a concomitant defence technology strategy devised. The defence industrial base needs suitable expansion, building on existing defence (scientific and technological) clusters that include institutes and laboratories. The designated defence industrial corridors could focus on specific weapon systems and the attendant ecosphere. Till now defence R&D was primarily confined to the DRDO and defence PSUs. But with the recent provision of 25 per cent annual R&D budget for projects spearheaded by start-ups and private companies, a pool of wider talent that innovates should merge. Private industry will also need to put in much more for R&D to develop weapons of world class standards. One way to proceed further is that DRDO and DPSUs focus on weapon platforms which involve critical and strategic technologies, while the private industry concentrates on those that are commonly used. Start-ups and defence MSMEs could support both segments.

With the new CDS steering jointmanship and integration to fight future wars, customised ways of assimilating new technologies can be found. Joint doctrines and training methods will need to be crafted as force structures are altered to exploit technologies at strategic, operational and tactical levels. A 'Whole of Nation'

approach for a technology development strategy becomes imperative. From the armed forces, a clear integrated roadmap to acquisition and capability development for the coming decade(s) is called for.

Conclusion

Warfare is constantly evolving. Recent wars have exhibited the imaginative use of emerging technologies by various militaries. Commercial grade technologies are proliferating and getting better by the day. Hard-core scientists and technologists will develop usable technologies but militaries remain responsible to assess, adapt and be innovative in their use to keep up their combat edge. While all endeavours should be made to prevent wars, strategic and military leaders must closely observe the impact of technologies on warfare and be prepared to deal with paradigm shifts that are taking place. Only then can we secure our nation robustly.

Endnotes

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