

India's Pursuit of Emerging Military Technologies: Implications for Regional Security

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Abstract

Emerging military technologies have become central to state's strategic endeavours and contribute significantly to achieving military-cum-political objectives. The strategic competition for these advanced military technologies has not remained restricted to major powers nay, has created a spill over effect in South Asia. In this backdrop, this paper aims at discussing India's quest to integrate emerging military technologies into its force structure and its emphasis on key areas. Moreover, it will analyse impact of these technologies on force posture of India, notably with respect to Pakistan. The research is significant as it underlies ramifications of India's relentless quest for emerging military technologies on regional security. The theoretical framework employed is Regional Security Complex Theory (RSCT) by Barry Buzan and Ole Waever. The methodology used is qualitative whereas the type of research is exploratory in nature. This research concludes that India's quest and merger of emerging military technologies in its force structure will disturb the conventional and nuclear military balance in South Asian region and therefore is horrendously detrimental to regional security.

Key words: Emerging Military Technologies, India, Pakistan, Regional Security Complex Theory (RSCT), Regional Security.

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Introduction

Militaries all over the world have been under technological transformation owing to emergence of new and disruptive military technologies. In contemporary times, various military powers have been incessantly incorporating different and novel technologies in their arsenal such as AI-Artificial Intelligence, Hypersonic weapons-HSWs, LAWs-Lethal Autonomous Weapons, DEWs-Directed Energy Weapons, quantum, and cyber technology. These technologies known as emerging military technologies carry massive potential to generate new domains of warfare, increase state's existing capabilities, horrendously disrupt security calculus alongside existing balance of power.

Besides strategic competition for these advanced military technologies among the major powers, the spill over effect of this competition is palpable in South Asian Region. India's quest and merger of emerging military technologies in its force structure will disturb the conventional and nuclear military balance in South Asian region and therefore is horrendously detrimental to regional security. India is taking strident leaps in various domains of emerging technologies. Amongst the various emerging military technologies, India is working to integrate Artificial Intelligence, Directed Energy Weapons, Hypersonic Weapons, and Cyber technologies in its military forces. India's pursuit of emerging military technologies will have colossal repercussions for South Asian regional security complex.

The South Asian Security Complex is grounded in India-Pakistan rivalry and given the high security interdependence between both states, India's acquisition/development and integration of such technologies immensely increases military asymmetry between both countries, disrupts nuclear equilibrium in South Asia, make India's force posture more aggressive towards its rival Pakistan and therefore increase the chances of inadvertent escalation. It also leads to another arms race in the region and cumulative impact of all the development and their potential ramifications will severely undermine the regional security. In this backdrop, this paper aims to addresses the key questions: a) What are key focus areas for emerging military

technologies in India, and how is it advancing in each of these domains? And b) How India's integration of emerging military technologies in armed forces has been implicating South Asian Regional Security Complex?

Theoretical Framework: Regional Security Complex Theory

In 1983, Barry Buzan first used the term 'Regional Security Complex' in the landmark work 'People, States, and Fear', whereas this theory further underwent development in post-cold war era. Barry Buzan and Ole Waever from the Copenhagen school of thought are the key proponents of RSCT- Regional Security Complex Theory. As per this theory, although states in system are entrapped in security interdependence global web; however, military and political threat moves faster over miniscule distances causing insecurity to be primarily lined with geographical proximity. Fear mainly arises from the neighbours rather than states that are distant (Sudurski, 2022).

In an international system characterised by geographical diversity, RSCs Regional Security Complexes or simply regional based clusters signify the pattern of state's security interdependence. States within RSCs have more acute security interdependence rather than states that are outside RSC. This theory emphasises security relations between states with relative intensity that in turn beget unique regional patterns framed by past behaviour of animosity and cordiality as well a distribution of power. Previously Buzan has defined security complex as set of states whose key security concerns and perceptions are intertwined to such an extent that makes it impossible to analyse and resolve their national security issues separate from each other.

However, this definition later acquired a constructivist touch and is now defined as set of units with interlinked key process of either securitisation or securitisation, or even both, causing to analyse or resolve their security issues in conjunction with each other (Buzan, 2003). With respect to South Asian Region, India's incessant quest for emerging military technologies have horrendous impact on Regional Security Complex of South Asia that in turn would be grounded in arch rivalry between Pakistan and India.

In the context of Regional Security Complex Theory (RSCT), the overall security of India and Pakistan is closely linked to each other and their broader regional dynamics. Security concerns primarily manifest within South Asia, where the interactions between these two states significantly influence regional stability. The multi-level interactions between India and Pakistan reveal a complex web of amity and enmity, heavily shaped by their security interdependence. In this region, clear patterns of cooperation and conflict characterize the security landscape, illustrating how the security of one state directly affects the other.

Given the geographical proximity of both states, their security interdependence is extremely high and any security development in one state causes a threat perception for another. Difference in power distribution between states is also huge; however, the nukes have remained source of strategic stability between both states. But with India's relentless acquisition and incorporation of emerging military technologies in its armed force structure, the military asymmetry between both states tremendously surge, endowing India to adopt an aggressive force posture towards Pakistan that in turn would heighten the probability of inadvertent escalation.

Within same security complex, India's quest for such technologies cannot be separated from security of other states such as Pakistan, thereby impacting the strategic equation between nuclear rivals. Given the geographical proximity, Pakistan's security is highly interdependent with respect to India and in case of emerging military technologies its efforts substantially lag behind India. These technologies when weaponised by India not merely detrimentally impact escalation ladder and blurs distinction between nuclear and conventional attack, these will catalyse another arms race in region.

Emerging Military Technologies and India

The volatile security environment in South Asia is shaped by various factors that intensify the region's threat perceptions. One significant factor is the ongoing rivalry between the two nuclear-armed neighbours, India and Pakistan, who share a

lengthy border. A thorough analysis of the strategic stability in South Asia reveals that India has adopted a pre-emptive counterforce doctrine. This shift involves bolstering its conventional and strategic precision-strike capabilities to conduct offensive operations deep into the territory of adversaries. Additionally, India's military modernisation and strategic communication efforts align with these overall trends (Masood and Baig 2023). In tandem with this, India has embarked itself on a quest for emerging military technologies to enhance its military capabilities vis-à-vis its rival states in the region.

The term 'emerging military technologies' implies advanced and novel technological developments that are currently being tested, researched, as well as implemented for military uses. Such technological advancements imply a leap in strategy, capability, and efficiency, as they are created for furthering effectiveness of military in various domains such as air, land, sea, and even cyberspace. These technologies include Artificial Intelligence, Directed Energy Weapons, Lethal Autonomous Weapons, Quantum computing and cyber technologies, and hypersonic technologies (Saylor, 2024). India, one of the key players in South Asia has been constantly working on such technologies in order to increase its military effectiveness.

Two significant transformations within the Indian Armed Forces. The first is a shift towards 'Atmanirbharta' or self-reliance, while the second involves a heightened focus on emerging technologies. While promoting self-reliance or indigenisation in defence has invigorated the entrepreneurial drive of the Indian private sector and is crucial for maintaining the country's strategic autonomy, integrating emerging technologies is equally vital due to the evolving nature of modern warfare (Upadhyay, 2023). It is essential to consider the rationale behind. India's pursuit of dual-use technologies. The burgeoning capabilities in nano-technology, missile, and space, may be attributed to strategic partnership between US and India that in turn is to contain China's ascendancy. Moreover, India's threat perception from China as well as Pakistan also play a vital role in India's rapid modernisation in its military apparatus to fulfil capability gaps to curb various threats by acquiring disruptive technologies.

'The Technology Perspective and Capability Roadmap' of India emphasises the technological developments primarily for joint warfighting. As per this plan, to ensure national security in the 21st century, the Indian military must excel across a spectrum of operations, ranging from humanitarian aid to conventional warfare. This requires a strategic approach where the Department of Defence shapes the security environment in ways that align with national interests, responds effectively to diverse crises, and anticipates future challenges. Central to achieving this broad operational capability is the acquisition of information superiority and the advanced technologies that facilitate it. The combat forces need to be more agile, mobile, and lethal, with technology playing a crucial role in this transformation.

Investments in defence must prioritise research and technological development to address emerging and unpredictable threats. Technological superiority will be essential for maintaining a military edge. Our technology investment strategy will focus on three key areas: harnessing the rapid advancements in technology, advancing the Information-based Revolution in Military Affairs (RMA), and addressing asymmetric threats. By prioritising these areas, the Indian military can enhance its operational effectiveness and maintain a decisive advantage in the face of evolving security challenges (MoD, 2018). Following are the key areas upon which India is working with respect to emerging military technologies.

➤ **Artificial Intelligence**

India's integration of AI in military domain dates back to 2018 when DoD-Department of Defence for the first time issued 'Artificial Intelligence Strategy' (Levesques, 2024). As per this strategy, India's inability to integrate AI will beget legacy system inconsistent to people's defence, undermining collaboration among partners and allies coupled with diminished access to various market detrimental to living standards and prosperity. Consequently, 75 new AI technologies were launched by Defence Minister of India, Rajnath Singh in 2022 during AIDef- AI in Defence Symposium (Standard, 2022). For institutionalization of AI in defence domain, India's

Department of Defence formulated a task force in February 2018 for '*Strategic Implementation of AI for National Security and Defence*' and based on its recommendation, DAIC-Defence AI Council alongside DAIPA – Defence AI Project Agency were constituted in 2019.

DAIC's key purpose is provision of significant guidance for enabling development of different AI operating frameworks and, structural support alongside changes at policy-level for integration of AI in military domain. As far as DAIPA is concerned, its primary aim is to adopt and develop standards with regards to development of technology for Artificial Intelligence projects. Moreover, DAIPA is tasked to review adoption plan of AI enabled-cum-led processes and systems with user's groups. India's defence ministry has decided to allocate \$12 million or Rs 100 crore to DAIPA on annual basis for initiating AI projects, capacity building in AI, developing AI-related data and infrastructure (Mansoor, 2024).

India's CAIR- Centre for Artificial Intelligence and Robotic is an organisation solely responsible for carrying out research in robotics and artificial intelligence. It is primary institution that nurtures India's R & D in Artificial Intelligence. The key tasks of CAIR includes formation of autonomous technologies in the fields of path planning, underwater mine detection, combat, logistics, sensors, localization, and target identification. In 2018, India indigenously built UCAV - Unmanned Combat Aerial Vehicle named as Rustom-2 that flies at medium altitude having long-endurance. Additionally, various projects are underway such as MARF- Multi Agent Robotics Framework system for reconnaissance and surveillance, integrated early warning systems, UUV–Unmanned Underwater vehicles named Matsya for surveillance under the sea, and AURA-Autonomous Unmanned Research Aircraft.

Furthermore, in 2017 India ordered production of 200 DAKSH robots to diffuse bombs, notably in the difficult terrain. Another achievement in AI domain is successful testing of unmanned aerial vehicle named Rustom II built for surveillance up to 250km (Arif, 2019). Indian army has been developing drones for ISR-intelligence, Surveillance, and Reconnaissance purpose and it demonstrated this capability in 2021

by displaying swarms of 75 UAVs in Dakshin Shakti exercise. Although exact nature, number, and extent of public-private partnership with regards to AI military technologies remains unclassified, various revealed AI projects are dedicated to imagery analysis, ship-tracking, drone-collision avoidance, and atmospheric visibility. Each armed service branch of India has AI-application centres: Navy has INS Valsura; Army has Military College of Telecommunication Engineering; and Airforce possesses Air Force Station at Rajokri. Another key development by Indian Navy is IMSAS-Indigenous Maritime Situational Awareness System which is state-of-art system for enabling real-time command and control (Ali, 2023).

➤ **Hypersonic Technologies**

India's pursuit of hypersonic weapons dates back to 2007 when Dr. Abdul Kalam addressed the DRDO's Defence Research and Development Organisation Director's conference and envisaged hypersonic cruise missiles as indispensable defence systems for India in upcoming 15 years. The quest of hypersonic technology of India is grounded in successful testing of Brahmos supersonic cruise missile also titled as PJ-10 which is medium range missile that in turn can be launched from submarines, ships, air, and land (Bhan, 2022). Being regarded as the state-of-art fastest supersonic cruise missile, it was a product of joint venture between NPO Mashinostroyeniya company of Russia and India's Brahmos Aerospace.

There is an ongoing hypersonic missile program at India's Brahmos Aerospace with the key objective of developing Brahmos-II missile modelled on Tzirkon Russian missile, an anti-ship missile with scramjet engine with the ability to climb to 28km and travel at Mach 9 (Simha, 2024). India is expected to build hypersonic missile by 2028; however, these Brahmos hypersonic and supersonic technologies can only be used by Russia and India as later is signatory to MCTR-Missile Control Technology Regime which forbids export and sale of missile with 300km range and ability to carry 500kg payload to any other state excluding Russia.

For the export of Brahmos missile, Philippine signed deal with India in 2022 but that deal will entail missile with reduced range of 290km in accordance with MCTR (Singh, 2024). Given the unpredictable behaviour of state with regards to imposition of sanctions on state in past, India has also been carrying out parallel program for acquiring hypersonic capability to curb the impact of sanctions on India. Since 2008, India's DRDO has been working on HSTDV-Hypersonic Technology Demonstrator Vehicle in order to test performance of scramjet at Mach 6 and altitude up to 20km. This project has dual applications which can be used in launching satellites for civilian purpose at low-cost and simultaneously propelling long-range cruise missiles. In June 2019, India tested HSTDV for the very first time which was followed by second successful test in September 2020 with the speed Mach 6 and 30km altitude (Mike Yeo, 2021). More recently, India tested this technology for third time on 27 January, 2023 and has become fourth state in world after US, China, and Russia to successfully test this hypersonic technology (Tripathi, 2024).

The demonstration of that vehicle implies possession of various key technologies such as aerodynamic configuration with regards to hypersonic manoeuvring, employing scramjet propulsion for dual purpose of ignition as well as sustained combustion alongside the separation mechanism of vehicles as hypersonic velocities. As per the scientists of DRDO, this vehicle possesses the capability to launch long-range cruise missile as well as hypersonic missiles. HTDV prototype built with \$4.5 million requires three more tests in upcoming five years to fully develop a hypersonic weapon that can carry nuclear and conventional warheads (Yeo, Pittawey, Ansari, Raghuvanshi, & Martin, 2021).

➤ **Directed Energy Weapons**

One of the key emerging technologies is the DEW-Directed Energy Weapons which employs direct lethal force created by concentrated particle beams, microwaves, and laser onto target with matchless speed. Various advantages of DEWs over conventional weapons include low detectability, low -cost per shot, logistical benefits, and unmatched

accuracy as well as lightning speed. As far as Indian DEWs program is concerned, it's mostly a classified defence program; however, as per open sources and reports, the integration of DEWs into India's arsenal is evident from various initiatives such as DURGA-Directionally Unrestricted Ray-Gun Array and KALI-Kilo Ampere Linear Injector that have been under development for several years. These program's classified nature implies particular parameters in secrecy, operational rage, implying sensitivity and strategic significance of these advanced weapon systems. Moreover, the proposed systems which are said to be inducted by 2024 may possess the ability to obliterate incoming projectiles and missiles during flight' terminal phase up to 25km range (Baruah, 2023).

One of the most vital offshoot of DEW program is evident from India's anti-drone system which has been mutually developed by BEL-Bharat Electronics Limited and DRDO-Defence Research and Development Organisation and deployed by India for last two years. This anti-drone system has both soft kill and hard kill options. Soft kill implies use of concentrated and intense beams to disable and disrupt communications, PNT-Positioning, Navigation, and Timing Systems, and Command and Control of the target; whereas hard kill implies destruction through direct collision (Siddiqui, 2023).

Moreover, the Defence ministry of India announced on march 11, 2022 regarding identification of 18 key platforms for design and development by defence industry. It entailed Directed Energy Weapons with or more than 300 kilowatts, mainly, High-Powered Laser Devices and High-Powered Electromagnetic Devices (Baruah, 2023). One of the most pertinent organization in this regard is HQ IDS- Headquarters Integrated Defence Staff which is joint service headquarters of Indian Arm, Airforce, and Navy and serves to be the point organization for emergence of policy, doctrine, procurement, and war fighting.

Head Quarters Integrated Defence Staff has identified DEWs as one of the significant technologies to be prioritized until 2025 as documented in 'Technology Perspective and Capability Roadmap,' defence document which provides private and public defence industry of India a strategic direction in accordance with which Indian

armed forces aim to pursue capabilities in upcoming fifteen years that would steer development processes of present and future technologies. (Head Quarters Integrated Defense Staff, 2013).

For instance, in case of laser weapons, India intends to integrate these weapons in platforms of three services such as submarines, naval destroyers, and fighters. The DEWs are quintessential with respect to anti-ballistic missile capability and India is working on such technologies. As per LASTEC- Laser Science and Technology Centre, DRDO's dedicated laboratory for development of lasers and other such technologies, laser weapon can fire high energy beam with 25kilowatts potency to obliterate and intercept ballistic missiles even in its terminal phase (Mansoor, 2024). As per officials, India is working on solid-state lasers with 100-kilotwatt potency for destroying ballistic missiles in boost phase.

➤ **Cyber Technologies**

Cyber challenges in the contemporary era are regarded as one of the key intrusive technologies and India is investing heavily in this area. In 2015, India unrolled 'Digital India Program' entailing Spectrum Optical Fibre Project. The investment of India army in the latest cyber technologies includes offensive operations and intelligence. In broader areas, India is enhancing number of skilled cyber experts and concurrently developing potential to harness information technology sector to counter attacks in sensitive areas such as 'ethical hacking; and 'honeypots' and to ensure cyber security defence. Government of India also developed Defence Cyber Agency in August 2021 and divulged that air force, army, and navy had established Cyber Emergency Response Teams.

Moreover, Indian army also revealed in 2021 that it had developed Quantum Lab at MCTE-Military College of Telecommunication Engineering to work on advanced secure communication (Shang-su & Basrur, 2022). Another technological leap is the development of Maya Operating System which is a replacement of Microsoft Windows. This new system aims at fortifying the digital domain of Indian Defence Ministry and

is accompanied with novel endpoint detection-cum-protection system named as “Chakravyuh” that will buttress the OS. Furthermore, this shift from secure alternative of Operating System coupled with end point anti-virus and anti-malware system signifies technological upgradation in digital domain and security breakthrough (CyberPeaceCorps, 2024).

Implications for Regional Security

The strategic milieu in South Asia is presently oscillating between quest for technological modernization and innovation through inclusion of novel strategic weapons on one hand and ensuring deterrence stability on the other. As per the conventional wisdom, India is a nuclear power with restrained nuclear weapons against the nuclear warfighting and follows the No First Use Policy. However, in practical terms, there is less certainty in India's restrained nuclear posture, evident from various official statements and development of array of capabilities favouring the counter force and pre-emption that are contrary to India's professed strategy of minimum deterrence or assured retaliation.

Staunch counter force options are buttressed by these emerging technologies notably by Artificial Intelligence and precise delivery vehicles such as hypersonic missiles that leads to flexibility of command-and-control structure. Such technological innovation may be extremely useful in interception (capabilities) of strategic assets of Pakistan with the aims of neutralizing nuclear capabilities of Pakistan and would break India's strategic paralysis and in turn provide it free end to wage conventional war (limited in nature) in the absence of any fear pertaining to threat of nuclear use by Pakistan.

Furthermore, it can lower the lower threshold and enhance the chances of nuclear brinkmanship (Jalil, 2020). It could not only incentivize India to launch pre-emptive strikes against Pakistan in unconventional as well as conventional terms, but could also cause the military planners of Pakistan to downgrade their restrained approach and resort to nuclear preventive strike. Emerging military technologies could

play a prominent role in stimulating decision-making pace amidst crisis situation. In South Asia strategic milieu, the probability of catastrophic or rapid escalation is already extremely high due to destructiveness and speed of nuclear weapons. This is also described in terms of ‘wormhole’ implying opening up of holes in deterrence’s fabric through which adversarial states (and in this case India) can suddenly and inadvertently enter and traverse between strategic and sub-conventional levels of conflict in non-linear ways (Jaffrey, 2022).

Various advanced military technologies such as hypersonic delivery systems and AI are instrumental in accelerating survivability, lethality, and precision of warfare’s conventional tools in several ways threatening traditional conception of stability and create new ways for transforming conflict escalation into strategic crisis wherein horizontal and vertical escalation consolidate with warm hole impacts. Such risks are further accentuated by the possibility of cyber-attacks owing to development of lethal cyber technologies which are difficult to attribute and anticipate. Cyber-attacks on dual-use Command and Control Systems as well as conventional targets colossally erode deterrence stability. Furthermore, such kind of attacks may be carried out against nuclear systems that in turns undermines already precarious strategic stability in the region.

India’s pursuit of hypersonic weapons (HSWs) has detrimental impact on regional security environment of South Asia. HSWs dual ability to carry nuclear and conventional warhead; besides, it entails military and civilian applications alongside utility as offensive and defensive weapons. Although it is said that such technologies may prove beneficial for strategic stability, the possession of such technologies by India whose rival (Pakistan) is devoid of such defence and novel technologies and is conventionally smaller, HSWs severely undermine the strategic stability in the region. India-Pakistan deterrence equilibrium gets undermined by acquisition of new or disruptive military technology by either state as it endows possessor with substantial strategic advantage in conflictual scenario. In addition, even during the peacetime, this

kind of strategic advantage endows the possessor state to employ coercive tactics to subjugate the rival state.

Emerging military technologies, notably the HSWs, furthers first-strike tendencies providing the state with confidence to carry out first strike against rival state while using HSWs, and then having the ability to use missile defences to nullify Pakistan's retaliatory strike disrupts the equilibrium between them. Moreover, close geographical proximity between Pakistan and India hampers the deterrence equation by decreasing flight times of HSWs. Given the lack of counter measure for such weapons with respect to Pakistan and flight time reduction from 5-10 minutes to few minutes due to hypersonic weapons will jeopardize deterrence between both states. Such unfavourable conditions and technological edge will embolden India to employ belligerent attitude owing to its enhanced counterforce capabilities. Additionally, the conventional-nuclear entanglement also signifies the related scenario in which dual-capable technologies such as HSWs cannot be distinguished upon deployment that whether they are carrying conventional or nuclear payload, therefore causing extreme difficulty for targeted state to find an adequate response to aggressor (Abbasi, 2023).

Such emerging technologies also decrease the probability of conflict resolution, given the substantial edge due to efficacy and precision. The uncertainty surrounding nuclear posture of India and strategic ambiguity associated with emerging military technologies will instigate crisis instability during conflictual scenario in region. With respect to DEWs, India's pursuit in this regard will destabilize the region as it will have a spill over effect in the region and may initiate an arms race in region compelling Pakistan to resort to such technologies to counter India's ever-enhancing military capabilities.

Moreover, DEWs, notably High energy laser weapons with its anti-ballistic missile capability poses another potent challenge to strategic stability and in turn regional security environment. These cutting-edge technological weapons with the ability to destruct and intercept ballistic missiles put Pakistan at a disadvantageous position as it again enhances the counterforce capabilities of India vis-à-vis Pakistan.

Furthermore, it will lead to increasing military asymmetry between India and Pakistan given their enormous potential in provision of considerable operational advantage to Indian military forces. In addition, DEW's inimitable attributes such as precision in targeting objects, speed-of light responsiveness, deep magazines, tailored targeting effects enable the possessor state to get strategic advantage in warfare (Romeo, 2023). The militarization of AI by India would have an impact on regional security in both conventional and nuclear domains.

Owing to India's military integration of AI, India-Pakistan deterrence equation might become unbalanced, thereby disrupting the strategic stability. As per the New START (New Strategic Arms Race Treaty), strategic stability includes arms race stability and crisis stability. Arms race stability includes lack of drive to enhance nuclear force whereas crisis stability implies lack of incentive to carry out first strike. AI integration will endow the Intelligence, Surveillance, and Reconnaissance (ISR) capabilities to India that in turn would enhance its ability to find, track, as well as target the military assets of adversary, notably Pakistan. Furthermore, AI will buttress the pre-emptive strike capability of India that may disrupt the crisis stability between India and Pakistan.

This could boost India's confidence in effectively executing a disarming counterforce strike against Pakistan. The concept of deterrence becomes even more intricate if India employs offensive counterforce capabilities alongside its Ballistic Missile Defence Systems. The integration of AI and autonomous military systems by India introduces new risks of miscalculation and unintended escalation, as rapid data processing might lead to hasty decisions during crises. More broadly, these advancements could spark a high-tech arms race in South Asia, potentially undermining both India and Pakistan's ability to manage and resolve conflicts effectively. This could shorten the window for diplomatic resolution and elevate the risk of nuclear confrontation (Altaf & Javed, 2024).

On the conventional side, AI-backed systems can tremendously enhance efficiency of logistics systems by cutting down costs and wastage, leading to better

functioning of Indian Armed Forces. AI systems would increase India's cyber-war capabilities which includes defensive capabilities — secure communication links and protected military assets, and offensive capabilities—ability to attack military assets of adversary. Moreover, intelligent unmanned systems with the capability to provide ISR can serve dual purpose: on one hand, they can facilitate in identifying potential targets when used for analysing and interpreting data; while on the other hand, they can substantially reduce threat to armed forces personnel when employed for patrolling in conflict zone.

Pakistan's Response

Pakistan's vision prioritizes the advancement of AI to drive economic, educational, and social progress. President Arif Alvi's Presidential Initiative for Artificial Intelligence and Computing (PIAIC) aims to enhance opportunities in national business, research, and education within the fields of block-chain, AI, and cloud computing. In parallel, the Punjab government introduced the National Initiative for Artificial Intelligence and Security (NIAIS) in 2019. This initiative seeks to bridge the skills gap between the labour market and educational institutions while also addressing the implications for national defence capabilities.

In 2020, the Pakistan Air Force's Centre for Artificial Intelligence and Computing (CENTAIC) launched a Cognitive Electronic Warfare (CEW) program aimed at leveraging AI and Machine Learning (ML) for enhanced analytical and tactical decision-making. CENTAIC specializes in areas such as Big Data, ML, Deep Learning, Predictive Analysis, and Natural Language Processing, catering to both military and civilian requirements. In 2022, the Pakistan Army announced the establishment of its Cyber Command, which is believed to consist of two divisions. One of these divisions, the Army Centre of Emerging Technologies, is expected to focus significantly on AI among its key research areas (Ali, 2023).

Pakistan has been developing its domestic drone program. In 2009, the National Engineering and Scientific Commission (NESCOM) collaborated with the Pakistan Air

Force (PAF) to create the indigenous UCAV 'Burraq,' capable of carrying a 50 - kilogram payload over 200 km. Equipped with a Barq air-to-surface laser-guided missile, Burraq was used in counterterrorism against Tehreek-e-Taliban Pakistan (TTP) in North Waziristan. Global Industry Defence Solutions (GIDS) introduced the Shahpar I in 2013 for ISR and disaster management. Following its success, Shahpar II launched in 2021, while Shahpar III debuted in 2023 with enhanced features, including synthetic aperture radar and a 1,650-kilogram payload. Pakistan also has tactical UAVs like UQAB and SATUMA Jasoos II, and it has procured Cai Hong 4 drones from China and Bayraktar Akinci A from Türkiye. (Khan, 2024). Despite these developments, Pakistan's investment in DEWs and other emerging technologies remains either absent or miniscule necessitating incorporation of new military trends commensurate with security needs of the country.

Conclusion

India's quest for emerging military technologies isn't in isolation with other states in the region, notably its arch rival Pakistan. India making significant leaps in such technologies is enhancing military asymmetry with Pakistan as the latter lags behind countering threats from the former in this regard. These technologies' weaponisation has dangerous and far-ranging ramifications that not merely blurs distinction between conventional and nuclear attack, but also runs up escalation ladder. Furthermore, it will generate a new and lethal new arms race between states in the region, primarily between two nuclear rivals. Its overall undermines the stability in South Asian Region. Inclusion and military application of such technologies would have multifaceted repercussions to regional security, notably strategic stability. It would increase temptation of India to harness first strike capabilities owing to enhanced counterforce capabilities. Additionally, such developments will spur new arms race in region and concurrently endows India to initiate conflict and adopt a belligerent posture due to strategic advantage provided by such technologies. Consequently, South Asian

Security Complex becomes more volatile and regional security becomes more threatened.

Disclosure Statement

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References

- Abbasi, A. (2023). Indian Quest for Hypersonic Missiles in South Asia and Disruption of Strategic Stability in Indo-Pak Dyad. *IPRI Journal*, 23(1), 23-52.
doi:10.31945/iprij.230102
- Ali, U. (2023, September 07). *Comparing the AI-Military Integration by India and Pakistan*. Retrieved from Centre for Strategic and Contemporary Research (CSCR): <https://cscr.pk/explore/themes/defense-security/comparing-the-ai-military-integration-by-india-and-pakistan/#:~:text=India's%20assertive%20strides%20in%20AI,%2C%20educational%2C%20and%20social%20development>.
- Ali, U. (2023). *Comparing the AI-Military Integration by India and Pakistan*. Retrieved from CSCR: <https://cscr.pk/explore/themes/defense-security/comparing-the-ai-military-integration-by-india-and-pakistan/>
- Altaf, Z., & Javed, N. (2024, May 02). *The Triad of Technology and Its Implications for Strategic Stability in South Asia*. Retrieved from South Asian Voices: <https://southasianvoices.org/sec-c-pk-r-triad-of-technology-05-02-2024/>
- Arif, S. (2019). Emerging Trends of Artificial Intelligence in South Asia and Implications for Pakistan. *NUST Journal of International Peace and Studies (NJIPS)*, 11(2), 55-66.
- Baruah, S. K. (2023, July 30). *What are India's top-secret Directed Energy Weapons?* Retrieved from The Week: <https://www.theweek.in/theweek/current/2023/07/21/what-are-indias-top-secret-directed-energy-weapons.html>
- Baruah, S. K. (2023, July 23). *What are India's top-secret Directed Energy Weapons?* Retrieved from The Week: <https://www.theweek.in/theweek/current/2023/07/21/what-are-indias-top-secret-directed-energy-weapons.html#:~:text=On%20March%2011%2C%202022%2C%20the,and%20High%20Powered%20Laser%20Devices>.
- Bhan, A. (2022, August 31). *The Hypersonic Potential of India-Russia Military-Technical Cooperation*. Retrieved from ORF: <https://www.orfonline.org/expert-speak/hypersonic-potential-of-india-russia-military-technical-cooperation>
- Buzan, B. (2003). Regional Security Complex Theory in Post-Cold War World. In *Theories of New Regionalism* (pp. 140-159). UK: Palgrave Macmillan.
- CyberPeaceCorps. (2024). *Introduction of New Indian Operating System #MAYA*. Retrieved from <https://www.cyberpeacecorps.in/introduction-of-new-indian-operating-system-maya/>
- Head Quarters Integrated Defense Staff, M. o. (2013, April). *Technology Perspective and Capability Roadmap (TPCR)*. Retrieved from <https://www.mod.gov.in/sites/default/files/TPCR13.pdf>
- Jaffrey, S. A. (2022, January 07). *Non-Linear, Unpredictable, and Dangerous Crisis - Escalation in South Asia*. Retrieved from Next Generation Nuclear Network:

- <https://nuclearnetwork.csis.org/non-linear-unpredictable-and-dangerous-crisis-escalation-in-south-asia/>
- Jalil, G. Y. (2020). *Emerging Technologies and their Impact on Strategic Stability in South Asia*. Institute of Strategic Studies Islamabad. Retrieved from https://issi.org.pk/wp-content/uploads/2020/03/Report_Seminar_Mar_12_2020.pdf
- Khan, U. (2024, May). *Indigenisation of Drones: A Security Imperative for Pakistan*. Retrieved from CASS: <https://casstt.com/indigenisation-of-drones-a-security-imperative-for-pakistan/>
- Levesques, A. (2024, January 18). *Early steps in India's use of AI for defence*. Retrieved from IISS: <https://www.iiss.org/en/online-analysis/online-analysis/2024/01/early-steps-in-indias-use-of-ai-for-defence/#:~:text=India%20launched%20its%20first%20national,a%20Defence%20AI%20Project%20Agency>
- Mansoor, S. (2024, July 15). *High Energy Laser Weapons: A Boon for Pakistan*. Retrieved from Pakistan Politico: <https://pakistanpolitico.com/hel/>
- Mansoor, S. (2024, June 24). *India's AI Militarization: Security Repercussions for Pakistan*. Retrieved from Russian International Affair Council (RIAC): <https://russiancouncil.ru/en/analytics-and-comments/columns/military-and-security/india-s-ai-militarization-security-repercussions-for-pakistan/>
- Masood, M., & Baig, M. A. (2023). Potential Impact of Lethal Autonomous Weapons on Strategic Stability and Nuclear Deterrence in South Asia. *Margalla Papers*, 27-43.
- Mike Yeo, N. P. (2021, March 15). *Hypersonic and directed-energy weapons: Who has them, and who's winning the race in the Asia-Pacific?* Retrieved from Defense News: <https://www.defensenews.com/global/asia-pacific/2021/03/15/hypersonic-and-directed-energy-weapons-who-has-them-and-whos-winning-the-race-in-the-asia-pacific/>
- MoD. (2018). *Technology Perspective and Capability Roadmap*. Retrieved from <https://mod.gov.in/dod/sites/default/files/kelkar.pdf>
- Romeo, J. (2023, May 24). *An upward trajectory for directed-energy weapons*. Retrieved from Military + Aerospace Electronics: <https://www.militaryaerospace.com/power/article/14292443/an-upward-trajectory-for-directed-energy-weapons>
- Saylor, K. M. (2024). *Emerging Military Technologies: Background and Issues for Congress*. CRS Report.
- Shang-su, & Basrur, R. (2022, November 22). *India's military: a tech leap risks nuclear chasm*. Retrieved from The Interpreter: <https://www.lowyinstitute.org/the-interpreter/india-s-military-tech-leap-risks-nuclear-chasm>
- Siddiqui, H. (2023, November 07). *Can DEWs Be a Boon for India's Strategic Border Defence?* Retrieved from Financial Express:

- <https://www.financialexpress.com/business/defence-can-dews-be-a-boon-for-indias-strategic-border-defence-3318633/>
- Simha, R. K. (2024, February 27). *Hypersonic Hiccups: Challenges in BRAHMOS II Development*. Retrieved from Raksha Anurveda: <https://raksha-anirveda.com/hypersonic-hiccups-challenges-in-brahmos-ii-development/>
- Singh, M. (2024, April 18). *India to complete largest defence export deal; BrahMos missiles set to reach Philippines*. Retrieved from THE NEW INDIAN EXPRESS: <https://www.newindianexpress.com/nation/2024/Apr/18/india-to-complete-largest-defence-export-deal-brahmos-missiles-set-to-reach-philippines>
- Standard, B. (2022, July 12). *Rajnath Singh launches 75 newly-developed AI-enabled defence products*. Retrieved from https://www.business-standard.com/article/current-affairs/rajnath-singh-launches-75-newly-developed-ai-enabled-defence-products-122071200094_1.html
- Sudurski, L. (2022). Regional Security Complex Theory: Why is this concept still worth developing. *Polish Political Science Studies*, 75(3), 137-153. doi:DOI: 10.15804/athena.2022.75.08
- Tripathi, P. (2024, May 02). *How hypersonic weapons are redefining warfare*. Retrieved from ORF: <https://www.orfonline.org/expert-speak/how-hypersonic-weapons-are-redefining-warfare>
- Upadhyay, A. (2023, March 01). *Absorption of Emerging Technologies in Armed Forces*. Retrieved from Manohar Pannikar Institute for Defense Studies and Analysis: <https://www.idsa.in/issuebrief/technologies-in-armed-forces-aupadhyay-010322>
- Yeo, M., Pittaway, N., Ansari, U., Raghuvanshi, V., & Martin, C. (2021, March 15). *Hypersonic and directed-energy weapons: Who has them, and who's winning the race in the Asia-Pacific?* Retrieved from Defense News: <https://www.defensenews.com/global/asia-pacific/2021/03/15/hypersonic-and-directed-energy-weapons-who-has-them-and-whos-winning-the-race-in-the-asia-pacific/>