EVALUATING THE ROLE AND EFFECTIVENESS OF CROSS-DOMAIN DETERRENCE IN INDIA AND PAKISTAN CONTEXT

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April 2025

ABSTRACT

Cross-domain deterrence (CDD), rooted in the historical evolution of strategic thinking, represents a contemporary approach to dissuading adversaries from hostile actions. It aims to influence adversaries' decision-making by projecting overwhelming costs through retaliatory threats in one sphere to prevent hostile acts in another. This research paper investigates the conceptual evolution, role, and dynamics of CDD. It also looks at India and Pakistan's approaches to deterrence within this strategic framework. Additionally, the paper evaluates capabilities, strategies, and deterrence postures in conventional, nuclear, airpower and cyber domains, highlighting sustained vertical and horizontal capability enhancements by both states for cross-domain operations during conflicts. The paper also offers actionable recommendations for Pakistan to further integrate the concept of CDD as a viable policy against an assertive adversary across different domains with effective response options.

Keywords: Cross-Domain Deterrence (CDD), India, Pakistan, Nuclear, Missiles, Airpower, Space, Cyber

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1. INTRODUCTION

War, as famously stated by Prussian general Carl von Clausewitz, has perpetually been an act of compelling opponents to fulfil one's will through violence on an extensive scale.[1] Throughout history, the means to achieve such aims have morphed, primarily due to technological evolution. Encapsulating these changes within analytical frameworks has been challenging due to the intricate mix of technology and geopolitics, making future warfare considerably more complex. Furthermore, operational ambiguity across various global conflicts has challenged military planners, especially in the evolving character of war. Conflict in Afghanistan, Syria, and Yemen and the recent tension between Russia, and Ukraine have blurred the lines between conventional and unconventional conflicts. Likewise the Gaza-Israel conflict has challenged the traditional notion of war. In addition, the development of emerging technologies, cyber warfare, and space weaponisation indicates a paradigm shift in warfare. As Artificial Intelligence (AI), quantum computing, cyber, space, and biotechnology continue to advance; future battlefields are likely to witness unprecedented changes, posing immense challenges for militaries, policymakers, and strategists.[2] Due to the complexity of today's conflicts and responses, countries are focusing on adopting all-encompassing approaches to counter them. On this basis, the idea of Cross Domain Deterrence (CDD) has systematised the diverse response measures that are now necessary for states to be able to counter threats which have cross-domain impacts.

In South Asia, historical grievances, ideological differences and territorial conflicts have formed an arc of instability between India and Pakistan. The complex

[1] Carl von Clausewitz, *On War* (Kegan Paul, Trench, Trübner & Company, 1908), 63.

[2] 'Assessing the Dangers: Emerging Military Technologies and Nuclear (In)Stability | Arms Control Association', 32, https://www.armscontrol.org/reports/2023/assessing-dangers-emerging-military-technologies-nuclear-instability.

relationship has fostered a strategic continuum, deeply ingrained in the strategic cultures of both states. Additionally, their geostrategic location has prompted the development of CDD as an important response to dissuade aggression by leveraging capabilities across conventional, nuclear, cyber, and space domains. Given that India and Pakistan are nuclear powers, both have made substantial investments to strengthen their deterrent positions in several areas. Introduction of disruptive technologies, however, adds another layer of complication into the deterrence equation with the potential to further complicate the regional stability in the coming decade. The question which arises here is whether the concept of CDD is affected by the induction of these new disruptive technologies and to what extent. Additionally, to what an extent does this concept apply to the Pakistan-India context. Accordingly, this study takes a close look at the concept of CDD and discusses its effectiveness in cyber, air, space, and nuclear domains in light of the induction of newer technologies by both Pakistan and India. It also accesses the effectiveness of CDD in this context and offers recommendations for Pakistan to leverage its strengths in this multi-domain context.

2. WHAT IS CROSS DOMAIN DETERRENCE?

CDD, building on historical strategies, represents a modern approach to dissuading adversaries from aggressive actions across a variety of domains.[3] By offering the possibility of outweighing costs, it attempts to influence decision-making calculus regarding prospective threats by utilising the well-established notion of deterrence. This tactic involves launching counter-attacks in one domain to stop hostile actions in another, with a focus on using deterrence by denial techniques to

[3] Jon R. Lindsay and Erik Gartzke, 'Introduction: Cross-Domain Deterrence, from Practice to Theory', in *Cross-Domain Deterrence: Strategy in an Era of Complexity*, ed. Eric Gartzke and Jon R. Lindsay (Oxford University Press, 2019), 45, https://doi.org/10.1093/oso/9780190908645.003.0001.

disrupt unwanted operations.[4] The interconnection of threats and responses is stressed in the context of CDD underscoring the necessity to handle difficulties across multiple fields such as conventional military, cyber, and unconventional sectors.[5] For CDD to be effective, it is important to integrate denial strategies extending beyond mere threats to include proactive measures aimed at hindering adversarial actions and making deterrence more effective.

The concept of traditional deterrence evolved in multiple waves, each representing a different stage in its evolution.[6] The initial wave of deterrence was centred on state security along with large-scale deterrence, arising in the aftermath of World War II with the development of the nuclear bomb, which eventually gave rise to nuclear deterrence.[7] A subsequent wave introduced the aspect of rationality in deterrence. This era relied on deductive reasoning and focused on addressing high-intensity aggression, including conventional invasions through rationality. The third wave, which emerged a decade later, saw a shift in analytical methodologies and addressed perception and misperception concerns besides stressing the significance of nuclear signalling. A fourth wave emerged with the breakup of the Soviet Union in the 1990s. This wave is persistent till today and focuses on the application of deterrence to threats which are generally beyond the confines of nuclear and strategic to include emerging and disruptive technologies. The continuity in this evolution becomes evident when considering the developments over the past decade.

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[4] Jon R. Lindsay and Erik Gartzke, 'Introduction: Cross-Domain Deterrence, from Practice to Theory', in Cross-Domain Deterrence: Strategy in an Era of Complexity, ed. Eric Gartzke and Jon R. Lindsay (Oxford University Press, 2019), 46, https://doi.org/10.1093/oso/9780190908645.003.0001.

[5] Edited by Erik Gartzke and Jon R. Lindsay, eds., *Cross-Domain Deterrence: Strategy in an Era of Complexity* (Oxford, New York: Oxford University Press, 2019), 79.

[6] Frans Osinga and Tim Sweijs, eds., *NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice*, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 129, https://doi.org/10.1007/978-94-6265-419-8.

[7] Frans Osinga and Tim Sweijs, eds., NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 130, https://doi.org/10.1007/978-94-6265-419-8.

The current trends in deterrence are more cross-domain in nature and have led to the conceptualisation of the CDD concept. This trend, which started in the 21st century, has been fuelled by two key aspects. Firstly, there is now greater integration between military assets spanning land, air, sea and cyberspace as a means of enhancing cross-domain operation.[8] This push for integration has, however, shortened the timeframes for making decisions, creating friction between the operational and tactical reality as well as the strategic goals. New cross-domain concepts aim to mitigate this through tighter horizontal and vertical integration.[9]

Second, "hybrid" or "grey zone" strategies have become more salient, featuring the simultaneous use of military and non-military instruments, typically below the conventional threshold, to exploit adversaries' vulnerabilities while evading attribution.[10] The high costs associated with traditional interstate wars have made major powers hesitant to engage in open conflicts. This reluctance is now leading to the exploration of alternative methods for achieving political goals, often resorting to coercive measures.[11] Additionally, technological advancements have opened up new opportunities for adversaries, especially in heavily interconnected societies.

Consequently, academics and strategists have started to scrutinise the effectiveness of CDD, with many broadly concurring that it entails using threats in one domain to discourage actions in other domains. While some define it exclusively within military domains—land, sea, air, cyber, and space—at varying levels, others perceive its essence as retaliation across all possible domains of warfare be it kinetic

[8] King Mallory, 'New Challenges in Cross-Domain Deterrence' (RAND Corporation, 12 April 2018), 78, https://www.rand.org/pubs/perspectives/PE259.html.

[9] King Mallory, 'New Challenges in Cross-Domain Deterrence', 79.

[10] King Mallory, 'New Challenges in Cross-Domain Deterrence' 79.

[11] Patrick M. Morgan, 'The Concept of Deterrence and Deterrence Theory', in *Oxford Research Encyclopedia of Politics*, 2017, 78, https://oxfordre.com/politics/display/10.1093/acrefore/9780190228637.001.0001/acrefore-9780190228637-e-572.

or non-kinetic. [12] This perspective emphasises punishment over denial as the primary focus. Manzo Vince includes threats on land, at sea, in the air, space, and cyberspace, through economic sanctions and other non-violent means.[14] In general, CDD refers to methods of deterring adversaries by using capabilities in different areas such as land, sea, air, space, cyberspace, etc.[15]

3. CDD: ESCALATION PATH OF INDIA AND PAKISTAN

The complex interconnectedness, as exemplified by CDD, between military, cyber, space, information, and unconventional warfare domains is mirrored in India and Pakistan's strained deterrence roles. India's significant military advantage, driven by its alliance with US, higher defence budget and a proactive approach towards the use of advanced technology underscores its edge in the region. Additionally, India’s acquisitions of Rafale fighter aircraft, K15-Submarine Launched Ballistic Missiles (SSBNs), and the S400 air defence system complements India's nuclear doctrine, which emphasises massive retaliation and improves second-strike capability.

Pakistan, on the other hand, has a robust conventional force; however it has considerable asymmetry vis-à-vis India’s conventional might. Unable to match India weapon to weapon because of the incredible costs associated with development of conventional forces, Pakistan had to go the route of developing nuclear weapons to maintain a credible minimum deterrence (CMD) posture against India. The dynamics

[12] Frans Osinga and Tim Sweijs, eds., NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 130, https://doi.org/10.1007/978-94-6265-419-8.

[14] Frans Osinga and Tim Sweijs, eds., NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 133, https://doi.org/10.1007/978-94-6265-419-8.

[15] Frans Osinga and Tim Sweijs, eds., NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 135, https://doi.org/10.1007/978-94-6265-419-8.

of the India-Pakistan conflict in the conventional and nuclear sphere is further highlighted below, where CDD becomes a crucial framework of analysis.

Pakistan also remains concerned about Indian support for unconventional warfare, including terrorism inside Pakistan, exemplified by India's support of the Balochistan Liberation Army (BLA). More recently there have also been reports of India investing in the merger of Tehrik-e-Taliban Pakistan (TTP) and the BLA.[16] This exemplifies how India has been undertaking operations in one domain to try and gain a strategic advantage over Pakistan in another. This is a classic case of CDD being employed by India.

Amidst these interlinked operations, the interdependence of military capabilities creates strategic vulnerabilities, wherein disruptions in one sphere impacts effectiveness in another. This interplay is not limited to attacks alone; it also shapes complex deterrence considerations in other non-conventional areas. For example, it has many times led to intertwining critical resources with military planning, where India has threatened Pakistan with disruption of the flow of water during flood or drought seasons, despite the river system being under the Indus Water Treaty (IWT).[20] This highlights the multifaceted and potentially unstable nature of the India-Pakistan deterrence relationship.

3.1 CDD in Nuclear and Missile Capabilities

CDD between India and Pakistan has been significantly influenced by the nuclear capabilities of both nations and as such it cannot be understood in its complete context without first understanding the concept of nuclear deterrence as it stands today. Throughout history, each country's strategic decisions and actions

[16] India 'investor' of TTP, BLA nexus in Pakistan: Balochistan home minister, *Dawn*, 26 Jun 2024, accessed on 4 Oct 2024, https://www.dawn.com/news/1842082/india-investor-of-ttp-bla-nexus-in-pakistan-balochistan-home-minister

[20] Ijaz Hussain, *Political and Legal Dimensions Indus Waters Treaty* (Oxford University Press, 2017).

have been shaped by the projected and actual capabilities of the other. This deterrence extends beyond the prevention of nuclear warfare and into gaining strategic advantages in other domains.[21] Pakistan's nuclear programme was initiated as a response to India's development of nuclear weapons as well as its considerable conventional might. Pakistan, as a resource constrained nation unable to match India weapon to weapon in the conventional domain, opted to go the nuclear route thus establishing its own version of CDD in the South Asian context.

One of the most compelling arguments for deterrence at work is that there have not been any massive conventional conflicts between Pakistan and India since both sides developed nuclear weapons. Additionally, having nuclear weapons presents a country with better negotiating leverage in bilateral relations. For example, both nations were on the same grounds in the 1999 Lahore Declaration, possibly because of their shared nuclear capability.[22] However, this dynamic has become complicated.

In the current context, Pakistan's proposal for a Strategic Restraint Regime (SRR) aims to maintain strategic balance with India, based on the principle of parity in deterrence theory.[23] By minimising assertive military capabilities, it aims to maintain regional stability, aligning with the stability-instability paradox. [24] It also aims to reduce the extreme costs associated with war preparations, which may have a big impact on both nations' economies. [25] However, India has never responded in the positive to this proposal by Pakistan, as it would undermine its tendency to assert its

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[21] Keith B. Payne, *Understanding Deterrence* (Routledge, 2014), 34.

[22] Rizwana Abbasi and Zafar Khan, *Nuclear Deterrence in South Asia: New Technologies and Challenges to Sustainable Peace* (Taylor & Francis Limited, 2019), 79.

[23] Zafar Nawaz Jaspal, 'Comparative Analysis of India-Pakistan Proliferation Contours', *Journal of Security & Strategic Analyses* 4, no. 1 (2018): 12.

[24] Sander Ruben Aarten, '(In)Stability Between India and Pakistan', in *NL ARMS Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice*, ed. Frans Osinga and Tim Sweijs, NL ARMS (The Hague: T.M.C. Asser Press, 2021), 215–30, https://doi.org/10.1007/978-94-6265-419-8_12.

[25] Zafar Nawaz Jaspal, 'Comparative Analysis of India-Pakistan Proliferation Contours', Journal of Security & Strategic Analyses 4, no. 1 (2018): 13.

dominance across multiple domains. In addition, India has been using its ballooning defence budget to augment its bid for dominance within the regional context. In fact, the Indian defence budget has steadily grown for the past decade and currently stands at $74 billion for the FY 2024-25.[26] Given this policy direction, India is unlikely to agree to any potential Pakistani proposals in the future.

Furthermore, India's pursuit of advanced military capabilities to counter the perceived threat from China increases insecurity for Pakistan. Due to the perceived danger from China, India has multiple squadrons along China's border which include aircraft like the Mirage 2000H, SU-30 (capable of carrying Brahmos missiles) and Jaguar IS/IB.[27] Along with these aircraft, India has also purchased Rafael jets from France, which are equipped to perform a wide range of tasks, including sea and land strikes.[29]

In addition, Prithvi-II, Agni-I, Agni-II, and Agni-III are among the several short-, medium-, and intermediate-range ballistic missiles that are part of India's existing land-based delivery systems. These missile systems, along with the aircraft squadrons, form a comprehensive nuclear deterrence strategy. Moreover, India's nuclear capabilities, as estimated by the World Nuclear Force, include around 172 warheads.[30] The country is further expanding its arsenal, pursuing thermonuclear weapons, enhancing missile technology, advancing sea-based deterrence, while also exploring hypersonic missiles. The development of long-range Intercontinental Ballistic Missiles (ICBMs) further broadens India's conventional and nuclear strike

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[26] Indian Defence Budget FY 2024-25 – Operational Preparedness And Defence Modernization: Implications For Pakistan, *Policy Paper ISSI*, https://issi.org.pk/wp-content/uploads/2024/08/IB_Maheen_Aug_21_2024.pdf.

[27] Hans M. Kristensen and Matt Korda, 'Indian Nuclear Weapons, 2022', *Bulletin of the Atomic Scientists* 78, no. 4 (4 July 2022): 224–36, https://doi.org/10.1080/00963402.2022.2087385.

[29] 'Rafale: India Gets New Jets amid Border Tension with China', *BBC News*, 29 July 2020, sec. India, https://www.bbc.com/news/world-asia-india-53573878.

[30] "Role of nuclear weapons grows as geopolitical relations deteriorate—new SIPRI Yearbook out now," *SIPRI Yearbook*, June 2024, https://www.sipri.org/media/press-release/2024/role-nuclear-weapons-grows-geopolitical-relations-deteriorate-new-sipri-yearbook-out-now

options, enhancing its flexibility in response options.[31] The development of a robust nuclear triad across land, air, and sea platforms is another key priority for India. [32] This expansion signifies India's strategic intent to bolster its posture across multiple domains however; these developments also contribute to the arms race and potentially undermine strategic stability in South Asia.[33]

In addition, Indian advancements in Ballistic Missile Defence (BMD), aided by the acquisition of Russian S-400 systems and improvements in indigenous capabilities, could foster confidence in moving away from its stated No-First-Use (NFU) policy, a potential change in the nuclear posture which has also been echoed by their top leadership.[34] This surge in India's nuclear and conventional military capabilities, coupled with the lack of global concern, has heightened instability risks in South Asia.[36] For instance, the US has granted India waivers under the Countering America's Adversaries through Sanctions Act (CAATSA) legislation, allowing it to procure advanced S-400 systems from Russia.[37]

Moreover, the US has also negotiated a civil nuclear deal with India as well as military agreements like Logistics Exchange Memorandum of Agreement (LEMOA), Basic Exchange and Cooperation Agreement (BECA), Communications Compatibility and Security Agreement (COMCASA), etc. aimed at strengthening

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[31] Kumar Sundaram and M. V. Ramana, 'India and the Policy of No First Use of Nuclear Weapons', *Journal for Peace and Nuclear Disarmament* 1, no. 1 (2 January 2018): 160, https://doi.org/10.1080/25751654.2018.1438737.

[32] Noreen Naseer, Muhammad Fahim Khan, and Aamer Raza, 'A Comparative View of India and Pakistan's Defence Capabilities: Historical Evolution and Future Trends', *Asian Journal of Comparative Politics* 8, no. 1 (1 March 2023): 216, https://doi.org/10.1177/20578911221124384.

[33] Vivek Raghuvanshi, 'India Orders Astra Weapon in Move to Break Dependence on Foreign Missiles', *Defense News*, 2 June 2022, sec. Asia Pacific, https://www.defensenews.com/global/asia-pacific/2022/06/02/india-orders-astra-weapon-in-move-to-break-dependence-on-foreign-missiles/.

[34] Hans M. Kristensen and Matt Korda, 'Nuclear Notebook: How Many Nuclear Weapons Does India Have in 2022?', *Bulletin of the Atomic Scientists*, 11 June 2022, https://thebulletin.org/premium/2022-07/nuclear-notebook-how-many-nuclear-weapons-does-india-have-in-2022/.

[36] Kristensen and Korda, 'Indian Nuclear Weapons, 2022'.

[37] Iee Chet, 'A CAATSA Waiver for India: What's Really at Stake', accessed 30 November 2023, https://thediplomat.com/2022/07/a-caatsa-waiver-for-india-whats-really-at-stake/.

India's strategic capabilities, despite its history of diverting "peaceful" nuclear technology for weapons.[38]

Additionally, India has four reprocessing plants outside the International Atomic Energy Agency (IAEA) safeguards which are capable of producing a substantial amount of weapon-grade plutonium.[39] India could generate a significant number of warheads given these plants' potential which, in reality, would be greater than Western assessments. The disparity between the actual and estimated nuclear weapons development capacity is alarming. Moreover, it is estimated that India has separated 5.67-7.839 tons of weapons-grade plutonium, enough for over a hundred warheads.[40] There are also reports of India building a top-secret nuclear city at Challakere, Karnataka, which could be South Asia's largest military-run complex of nuclear centrifuges, and atomic-research laboratories.[41]

In comparison to the Indian nuclear build-up, Pakistan's nuclear and missile capabilities serve as a defensive response to potential aggression and advancements from India. Pakistan's nuclear programme is primarily aimed at deterring a conventionally superior, nuclear-armed India.[42] This makes Pakistan's nuclear deterrence its own form of CDD. Pakistan's nuclear policy is intended to protect its sovereignty and relies on a full spectrum of response options to ensure

[38] Muhammad Ali Baig, 'Issue Brief on "LEMOA, COMCASA, and BECA in India's Foreign Calculus" | Institute of Stategic Studies Islamabad', 22 July 2022, https://issi.org.pk/issue-brief-on-lemoa-comcasa-and-beca-in-indias-foreign-calculus/.

[39] 'Nuclear Notebook'.

[40] Adeel Azam, Ahmed Khan, and Sameer Khan, *Indian Unsafeguarded Nuclear Program : An Assessment* (Pakistan: Institute of Strategic Studies, 2016), 45, https://catalog.princeton.edu/catalog/99101437213506421.

[41] Adrian Levy, 'India Is Building a Top-Secret Nuclear City to Produce Thermonuclear Weapons, Experts Say', *Foreign Policy* (blog), 27 November 2023, https://foreignpolicy.com/2015/12/16/india_nuclear_city_top_secret_china_pakistan_barc/.

[42] Paul K Kerr and Mary Beth Nikitin, 'Pakistan's Nuclear Weapons', n.d., 3.

Full Spectrum Deterrence (FSD) within the confines of Credible Minimum Deterrence (CMD). [44]

In terms of capability development, Pakistan has nuclear-capable cruise missiles such as the Babur and Ra'ad, as well as short- and medium-range ballistic missiles such as the Abdali, Ghaznavi, Shaheen-I, Shaheen-II, and Shaheen-III. Fighter jets like the JF-17 Thunder, Mirage and F-16s, as well as land-based launchers, are capable of delivering these missiles.[45] Pakistan is also developing longer-range missiles, such as the Shaheen-III, which has a range of 2750 km covering the entirety of continental India. [47] In addition to all these strategic developments, Pakistan maintains a deliberate strategic ambiguity with regards to its nuclear thresholds and has not declared an NFU pledge so as to maintain a semblance of balance with its conventionally superior adversary, India.

This full-spectrum of response options affords Pakistan the ability to respond to any Indian conventional and nuclear misadventure with a befitting response. Pakistan's nuclear deterrence is unique in the sense that it developed its nuclear options as a counter to the Indian conventional might so that it would not need to match India weapons for weapon in the conventional domain. Thus, Pakistan augments it deterrence, through cross-domain options, in both conventional and nuclear domains.

However, effectively maintaining crisis stability through CDD requires a delicate balance between signalling and capability. This challenge is becoming more

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[44] Ashfaq Ahmed, 'Pakistan Nuclear Doctrine from Minimum Deterrence to Full Spectrum Credible Minimum Deterrence (FSCMD)', *Pakistan Social Sciences Review* 3, no. II (31 December 2019): 228, https://doi.org/10.35484/pssr.2019(3-II)07.

[45] Hans M. Kristensen, Matt Korda, and Eliana Johns, 'Pakistan Nuclear Weapons, 2023', *Bulletin of the Atomic Scientists* 79, no. 5 (3 September 2023): 330, https://doi.org/10.1080/00963402.2023.2245260.

[47] Hans M. Kristensen, Matt Korda, and Eliana Johns, 'Pakistan Nuclear Weapons, 2023', Bulletin of the Atomic Scientists 79, no. 5 (3 September 2023): 332, https://doi.org/10.1080/00963402.2023.2245260.

difficult for Pakistan with respect to India's continued military modernisation. Both nations have diversified their delivery systems, transitioning from strike planes to ballistic and cruise missiles, and now extending to naval platforms.

For example, in 2022, the testing of the AD-1 interceptor marked the initiation of Phase 2 trials for India's BMD system, with a specific focus on extending interception ranges.[50] Concurrently, the establishment of additional BMD radar sites emphasises India's determination to construct a robust defence shield. Building on these achievements, India reached a notable milestone in April 2023 by conducting its inaugural test of a ship-based BMD system, thereby joining the exclusive group of nations possessing naval BMD capabilities. [51]

On the other hand, Pakistan has developed a sea-based deterrent through its Ababeel medium-range ballistic missile which is capable of carrying multiple independently targetable re-entry vehicles (MIRVs), as a counter to India's BMD.[52] This capability allows a single ballistic missile to transport multiple warheads, each with the potential to target different locations. This makes it challenging for BMD systems to intercept all incoming warheads, consequently boosting the effectiveness of Pakistan's nuclear deterrent. Another effective measure for countering the conventional threat from India is that of UAVs which offer a more cost-effective solution to the plethora of threats facing Pakistan. In this regard, Pakistan already has the Chinese Wing Loong, Turkish Akinci and Bayraktar TB-2 along with the

[50] Vijainder K. Thakur, 'India's DRDO Notches "Big Success"; Tests Interceptor To Thwart Pakistan & China's Beyond 2000 Km Range Missiles', *Latest Asian, Middle-East, EurAsian, Indian News* (blog), 3 November 2022, https://www.eurasiantimes.com/india-notches-big-success-interceptor-missile-that-aims-to-thwart/.

[51] 'DRDO & Indian Navy Conduct Successful Trial of BMD Interceptor from Naval Platform', accessed 28 December 2023, https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=1918799.

[52] 'Why Did Pakistan Test Its MIRV-Capable Ababeel Missile?', https://thediplomat.com/2023/11/why-did-pakistan-test-its-mirv-capable-ababeel-missile/.

indigenously developed Shahpar drones, the third iteration of which has recently been unveiled at the International Defence Exhibition and Seminar (IDEAS) 2024.[53]

While nuclear deterrence has been at play between Pakistan and India for decades, as evidenced from the above, however, in recent years this strategic competition has become complicated owing to the integration of other domains of warfare with that of nuclear and conventional deterrence especially from the Indian side. The next few sections details how this relationship has been complicated by the concept of CDD.

3.2 Role and Effectiveness of CDD in Air Domain: India and Pakistan

In the framework of CDD, participating in warfare below the nuclear threshold creates obstacles for Air Defence operations. In such a case, the deployment of a credible Air Defence system might deter opponents from launching pre-emptive attacks or participating in aggressive operations for fear of incurring unacceptable damage. However, if deterrence fails to work, the chance of a nuclear war increases considerably.[54] Three important areas of technological improvement in air have had a notable impact on deterrence; active missile defence, overhead surveillance, and the possibility of communication breakdowns within command and control systems.[55] Additionally, within this geographical context, the proximity and rapid pace of delivery systems escalate the threats faced by both nations.

Comparing the air force capabilities of both countries is crucial to understand why CDD becomes an important aspect of Pakistan's strategy. India has a clear quantitative advantage over Pakistan, with 632 combat aircraft versus 453 for

[53] Pakistan unveils indigenous powerful drone Shahpar III at IDEAS 2024, *Pakistan Observer*, 19 Nov 2024, https://pakobserver.net/pakistan-unveils-indigenous-powerful-drone-shahpar-iii-at-ideas-2024/

[54] King Mallory, *New Challenges in Cross-Domain Deterrence* (RAND Corporation, 2018), 5.

[55] King Mallory, New Challenges in Cross-Domain Deterrence (RAND Corporation, 2018), 5.

Pakistan.[56] However, Pakistan maintains robust CDD in the air, largely attributed to the capabilities of the JF-17 Thunder.[57] The JF-17 significantly enhances Pakistan's air capabilities. The Thunder can carry electro-optical/infrared sensors and self-defence jammers.[58] The Thunder's capabilities establish it as a cost-effective and potent asset in potential conflicts between Pakistani and Indian aviation.

Furthermore, Pakistan has always held an edge in network-centricity particularly in air defence. Pakistan’s acquisition of the J-10 from China further augments its air power and provides a counterbalance to India’s Rafale fleet. The combination of J-10 and existing JF-17s strengthens Pakistan’s combat capabilities.[59]

PAF is working in tandem with the newly acquired JF 17 Block III through which it can target an enemy High Tech Surface-to-Air (SAM) using the almost hypersonic CM-400 missiles. These aircraft can work with PAF’s Airborne Early Warning and Control (AEW&C) aircraft in a Suppression/Destruction of Enemy Air Defence (SEAD/DEAD) operation against the Indian S-400.[60] Despite India's approximately 1.6:1 advantage in total combat aircraft, PAF relies on its self-sufficiency in maintaining and integrating new technologies, as well as adopting cost-effective solutions, as a strategy for CDD.[61]

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[56] ‘Pakistan Air Force (2023)’, accessed 2 January 2024, https://www.wdmma.org/pakistan-air-force.php.

[57] ‘JF-17 Thunder / FC-1 Xiaolong Multirole Combat Aircraft’, 1, accessed 1 January 2024, https://www.airforce-technology.com/projects/fc1xiaolongjf17thund/.

[58] David Axe, ‘China’s JF-17 Is the Ultimate MiG-21 Fighter (And Has One Advantage Over the F-35)’, Text, The National Interest (The Center for the National Interest, 20 April 2020), https://nationalinterest.org/blog/buzz/chinas-jf-17-ultimate-mig-21-fighter-and-has-one-advantage-over-f-35-146052.

[59] Quwa Team, ‘J-10CE: The Story of Pakistan’s Newest Fighter Acquisition’, *Quwa* (blog), 18 April 2022, https://quwa.org/2022/04/18/j-10ce-the-story-of-pakistans-newest-fighter-acquisition-2/.

[60] Parth Satam, ‘Pakistan Uses JF-17, J-10C Fighters & CM-400 To Counter India’s S-400 System In New Warfare Drills’, *Latest Asian, Middle-East, EurAsian, Indian News* (blog), 24 October 2023, https://www.eurasiantimes.com/uses-jf-17-j-10c-cm-400-to-counter-indias-s-400-systems/.

[61] ‘Comparison of India and Pakistan Military Strengths (2023)’, accessed 2 January 2024, https://www.globalfirepower.com/countries-comparison-detail.php?country1=india&country2=pakistan.

The complexity of deterrence and retribution between the two nuclear-armed neighbours was highlighted by India's offensive operation in Balakot and Pakistan's following Operation Swift Retort. Following the Indian offensive on 26 Feb 2019, which India alleged to be successful in destroying their intended target, Pakistan gave a befitting response the next day when it downed an IAF aircraft which crossed into Pakistani territory.[62] For this particular operation, Pakistan employed a counter-offensive move meant not to escalate the situation but to act as a deterrent against further action. This is a clear example of CDD at play whereby action in one domain led to deterrence in another. Managing escalation was a key aspect, with Pakistan ensuring proportionate responses and maintaining precision strike capability.

In comparison to its Indian counterparts, Pakistan's comprehensive reaction to the Balakot event demonstrates its superiority. Pakistan's successful downing of the Indian aircraft revealed the efficiency of its powerful jamming system, emphasising the significance of electronic warfare capabilities in the context of CDD.[70] While India has Astra Mk-1, an advanced BVR missile, Pakistan is prepared to employ the P-12 and PL 15, which are aligned with longer ranges to effectively challenge India's BVR capabilities.[71] The combination of a well-executed radar strategy and BVR missile emphasises the need for a solid radar system.[72] Crucially, the PAF has a first-shot capability edge and this advantage is expected to be maintained through continued upgrade programmes.

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[62] Dawn.com, '2 Indian Aircraft Violating Pakistani Airspace Shot down; Pilot Captured', *DAWN.COM*, 11:11:47+05:00, https://www.dawn.com/news/1466347.

[70] Naveed Siddiqui, 'PAF Response to Indian Aggression Will Be Remembered as Operation Swift Retort: Air Chief', DAWN.COM, 14:34:37+05:00, https://www.dawn.com/news/1479602.

[71] 'Pakistan's PL-15 Missile Equipped JF-17 Block 3 Is a Serious Game Changer - How India Can Respond To', Pakistan Defence, 18 April 2020, 15, https://pdf.defence.pk/threads/pakistans-pl-15-missile-equipped-jf-17-block-3-is-a-serious-game-changer-how-india-can-respond-to.661968/.

[72] 'Pakistan's PL-15 Missile Equipped JF-17 Block 3 Is a Serious Game Changer - How India Can Respond To', Pakistan Defence, 18 April 2020, 15, https://pdf.defence.pk/threads/pakistans-pl-15-missile-equipped-jf-17-block-3-is-a-serious-game-changer-how-india-can-respond-to.661968/.

3.3 Role and Effectiveness of CDD Cyberspace: India and Pakistan

While new technologies can strengthen the stability features of nuclear deterrence by improving the physical means and perceived readiness, they also can undermine them by interfering with the means to effectively exercise command and control over deterrence forces.[78] One of the technologies which can undermine the deterrence equation between Pakistan and India is that of cyberspace.

Challenges pertaining to predictability and monitoring are different in cyberspace as compared to a conventional or nuclear spheres. It is difficult to assess behaviour or determine the extent of damage in this domain. Similarly, understanding and measuring the effects of attack are unpredictable owing to interconnectivity. Therefore, maintaining equilibrium in cyberspace is of vital importance. With modest investment in offensive capabilities, states can cause disproportionate danger to each other.[79] However, this scenario results in intensifying the potential and proclivity for pre-emptive attacks.

Additionally, the ability to link cyber-attacks to a specific attacker is critical for maintaining accountability, however this remains the most elusive aspect. Instability can be compounded further by ambiguous attribution, which is commonly cloaked in plausible deniability. In this perspective, the development of offensive cyber capabilities is significant not only for its potential cost-effectiveness, but also for its

[78] Tom McKane, 'New Technologies and Nuclear Deterrence', in *Arms Control and Europe: New Challenges and Prospects for Strategic Stability*, ed. Polina Sinovets and William Alberque, Contributions to International Relations (Cham: Springer International Publishing, 2022), 49, https://doi.org/10.1007/978-3-031-03891-4_6.

[79] Vincent A. Manzo, *Deterrence and Escalation in Cross-Domain Operations: Where Do Space and Cyberspace Fit?* (Institute for National Strategic Studies, National Defense University, 2011).

role in tackling the complicated difficulties connected with strategic stability in the ever-changing cyber battlefield. [80]

The objective of cyber deterrence is to dissuade threatening actions in cyberspace through punitive measures, defence denial, entanglement, and normative taboos. Scholars contend that deterring adversaries through the threat of retaliation is the most effective method, but the challenges of attributing cyber-attacks make retaliation difficult.[92] Deterrence through denial becomes crucial in the cyber domain, where a state's superior defence capabilities can dissuade adversaries from taking offensive actions. [93]

India has continuously used cyberspace to operate against Pakistan. The malware attack known as "Pegasus," which India acquired from an Israeli company known as the NSO Group, aptly demonstrates how India is using cyber tools to obtain private GPS information in preparation for possible kinetic attacks.[94] India and Israel's growing cyber security cooperation further augment this risk for Pakistan. Israel has offered India the Talpiot program for training in the cyber domain.[95] India has also made progress in the military domain by developing a vision for cyber defence and security. Additionally, India is incorporating emerging technologies with the utilisation of Space-Ground Integrated Information Networks (SGIIN) for networked warfare and deploying autonomous weapons.[97] India is also in the process of transforming its Intelligence, Surveillance and Reconnaissance (ISR) structure which consists of information-gathering satellites, airborne platforms and

[80] Max Smeets, 'The Strategic Promise of Offensive Cyber Operations', *Strategic Studies Quarterly* 12 (22 September 2018): 5, https://cisac.fsi.stanford.edu/publication/strategic-promise-offensive-cyber-operations.

[92] Payne, *Understanding Deterrence*.

[93] Michael J. Mazarr, *Understanding Deterrence* (RAND, 2018).

[94] 'The Cyber Threat Facing Pakistan', accessed 28 December 2023, https://thediplomat.com/2020/06/the-cyber-threat-facing-pakistan/.

[95] Manjit Kishore, 'India, Israel Deepen Collaboration in Innovation, Startups, Tech', YourStory.com, 5 May 2023, https://yourstory.com/2023/05/india-israel-mou-csir-collaborate-innovation-technology-startups.

[97] 'Indian Vision-2047 for Cyber Defence Security'.

ground-based sensors that facilitate cyber operations. India has integrated these systems and technologies with the cyber command under the Indian Defence Cyber Agency.

As India fortifies its cyber capabilities, it could potentially disrupt Pakistan's integrated air defence systems, which heavily rely on network-centric operations. According to western analysts like Greg Austin, the head of the IISS' cyber program, India's cyber-intelligence and offensive cyber capabilities are regionally focused, primarily on Pakistan.[98] Pakistan, recognising India rapidly advancing military and civilian cyber sector capacities, has taken necessary measures to counter this threat. The National Centre for Cyber Security (NCCS) has been commissioned by the government in joint collaboration with the Higher Education Commission and the Planning Commission of Pakistan.[99] Under this initiative, labs have been set up in reputed universities of Pakistan for carrying out R&D on specialised aspects of cyber security. In addition, Pakistan's National Aerospace Science & Technology Park (NASTP) has also taken a number of initiatives aimed at augmenting the country's cyber security landscape. NASTP Alpha hosts the Siber Koza, Pakistan first ever Cyber and IT incubation centre.[100] It is a joint venture between NASTP and a Turkish company called CryptTech. In addition, Air University's National Centre for Cyber Security, which focuses on providing innovative solutions for cyber threats, is also hosted at NASTP Alpha.[101]

[98] 'Focused on Pakistan Rather than China, India in Tier 3 as Cyberpower: Report | India News - The Indian Express', https://indianexpress.com/article/india/focused-on-pakistan-rather-than-china-india-in-tier-3-as-cyberpower-report-7378610/.

[99] 'National Center for Cyber Security | Pakistan', accessed 1 January 2024, https://nccs.pk/.

[100] Regional center and HQs for Punjab province, *NASTP*, https://nastp.gov.pk/alpha.

[101] Regional center and HQs for Punjab province, *NASTP*, https://nastp.gov.pk/alpha.

Pakistan has also enacted laws like the Prevention of Electronic Crimes Act which penalises cyber offences.[102] The Pakistani military is also securing its ISR assets further with electronic countermeasures and boosting its ability to detect advanced aerial threats through cyber means.

The success of a cross-domain strategy is determined by how much both armed forces rely on susceptible assets of which cyber is a major one. By interpreting India's weaknesses and operationally using its advantages in certain areas, Pakistan may be able to neutralise India in the cyber domain. CDD is unique because it matches strength against enemies' vulnerabilities in predefined situations as closely as feasible.

For Pakistan, CDD is a vital response option in light of Indian developments in all the above identified domains. India has been modernising its military and expanding its arsenals in conventional, nuclear, cyber and air domains thereby enhancing its offensive capabilities. This evolution necessitates a strategic response from Pakistan to ensure its national security and to maintain regional strategic stability.

4. RECOMMENDATIONS

CDD has been a cornerstone of Pakistan’s nuclear as well as conventional deterrence since the country became an overt nuclear power, however, given the expanding ambit of Indian offensive capabilities, there is a need to expand it in other domains. Some of the response options developed by Pakistan in recent years already cater to deterrence across different domains, however there are areas where this deterrence can be augmented. Employing CDD would not only reinforce Pakistan’s defensive posture but also fosters a sense of strategic stability in the

[102] ‘Prevention of Electronic Crimes Act https://www.pakistanpressfoundation.org/prevention-of-electronic-crimes-act/.

region, making clear that any aggression will be met with a comprehensive response, regardless of which domain is being used by the adversary. Ultimately, CDD is essential for Pakistan to safeguard its sovereignty, protect its interests, and maintain a balance of power in South Asia.

Keeping the above in mind, the recommendations in this section offer actionable options for Pakistan to take advantage of its already existing capabilities to leverage their potential across different domains.

4.1 **Adoption of Multifaceted Strategy**

To strengthen Pakistan’s defence capabilities and ensure a comprehensive approach to CDD, a multifaceted strategy is recommended, specially keeping the increasing importance of UAVs in modern warfare in mind. UAVs equipped with cutting-edge technologies like Electronic Warfare (EW) and High-Power Microwave (HPM) systems offer a cost-effective solution to the problems facing Pakistan cross different domains. Pakistan also needs to invest in other cutting edge technologies like electromagnetic pulse (EMP), which is recognised as a crucial component of a full-spectrum CDD strategy. It has the potential to aid the military by disrupting adversaries' electronics across different domains.

4.2 Advance Offensive Cyber Capabilities as Asymmetric Deterrents

Cyber security improvements are necessary for critical air defence systems such as radars, command and control centres, Ground-Based Air Defence Systems (GBADS), and communication nodes. Cyber-security drill repetitions will improve preparedness as well. Pakistan must also look into R&D for the development of systems capable of non-kinetically upsetting adversary satellites and infrastructure used for command and control in times of emergency. This can be done through

cyberspace capabilities. NASTP and Air University are already undertaking initiatives aimed at enhancing cyber security through the NCCS based at NASTP Alpha. The already established eco-system can be further utilised to advance non-kinetic offensive cyber capabilities as well.

4.3 Develop Intelligent Autonomous Drones and Loitering Munitions

By giving priority to the development and integration of intelligent autonomous drones and lingering bombs, Pakistan is already enhancing its deterrence capabilities across several domains. To augment its capabilities even further, Pakistan can draw from example of the successful use of drone swarm technology during the Nagorno-Karabakh conflict. Pakistan must look into implementing the same technology for significant tactical advantages. Moreover, the integration of autonomous/semi-autonomous UAVs/UCAVs would be a cost-effective and beneficial addition to manned fighter aircraft, considering the evolving dynamics in air power. The 'Loyal Wingman' idea, offers embedded duties with combat aircraft as a viable employment strategy.

4.4 Establish a Dedicated Joint Command and Control Branch for both Offensive and Defensive Operations

While Pakistan has already taken steps towards network-centric warfare by integrating its air, land and naval forces through improved ISR capabilities, however the country can augment this further through a formalised joint command and control initiative. The PAF has already taken the initiative by formulating command forces across different domains including EW, UAV, Space and Cyber which are working in a multi-domain manner. Taking a cue from this successful model, the other forces

may also look into the development and implementation of a Joint All-Domain Command and Control. This is an advanced net-centric warfare concept, to bolster defensive capabilities across several domains. With the integration of land, air, sea, nuclear and cyberspace, the envisioned command would function as a single, cohesive force.

5. CONCLUSION

The intricate dynamics of CDD between India and Pakistan highlight the complexities of modern warfare, where technologies interlink spheres once considered distinct. Conceptual basis of CDD and its role in the India-Pakistan context across the nuclear, aerial, space and cyber realms remains an important facet of discussion. The analysis reveals that both countries are actively enhancing deterrence postures, but effectiveness remains questionable due to challenges around signalling, attribution and escalation control.

India's expanding capabilities and aggressive nuclear posturing aimed at great power ambitions have fuelled arms race dynamics. in addition, classical deterrence is hampered in the cyber arena owing to the attribution issue, which is why denial capabilities are essential. Both countries possess cyber capabilities, but when they are used in military operations, their dynamics remain uncertain. Given the constraints of stand-alone cyber deterrence, integrating cyber threats into broader cross-domain frameworks may facilitate communication about thresholds and proportionality.

Ultimately, while India pursues cross-domain superiority to back its hegemonic vision, Pakistan stresses deterrence for sovereignty and self-defence. However, the disparity in capabilities and actions between both countries at all levels

poses a danger to regional security calculus. To avoid unintentional escalation, new equilibrium techniques that prioritise parity, predictability, and escalation management across all domains are the need of the hour.

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