BALLISTIC MISSILE DEFENCE IN SOUTHERN ASIA

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INTRODUCTION

In recent times, one of the most significant developments in the nuclear missile programmes of India, China and Pakistan is related to the research, development and procurement of indigenous and external Ballistic Missile Defence (BMD) systems. The development of BMD systems can be traced back to the US abrogation of the Anti-Ballistic Missile (ABM) Treaty (1972) in June 2002. Research related to missile defence technology was initiated by the US and Russia much before their withdrawal from the ABM Treaty. In Southern Asia, BMD was introduced by the procurement of the Russian S-300 BMD system by China in 1993. China cites the offensive US missile defence programme as one of the major factors that encouraged the development of its BMD programme. Against this backdrop, this chapter traces the abrogation of the ABM Treaty and the emergence of missile defence programmes in the US and Russia to analyse the development of BMD in Southern Asia. Further, it analyses the rationale for the development of BMD in China, India and Pakistan. The following sections include the rationale behind the development and procurement of BMD by these countries, the

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existing BMD capability and an assessment of the impact of the missile defence programme in the region.

BALLISTIC MISSILE DEFENCE: AN OVERVIEW

The ballistic missile was first used during World War II in 1944 and within a decade after that, it emerged as one of the most high-profile delivery systems and became central to strategic stability between the superpowers. During the period of *détente*, both the US and USSR were engaged in developing defensive systems against ballistic missiles to gain military advantage and tilt the strategic balance in their favour.

An Anti-Ballistic Missile (ABM) system was recognised as essential for a credible first strike capability since a mere first strike could not be effective enough to destroy the entire missile arsenal of the adversary.[1] The ABM system was expected to provide a defensive shield that could defend against the missiles that could survive a credible first strike.

By early 1957, the US was developing the Nike-Zeus, a system of radar and interceptor missiles for high altitude interception of incoming ballistic missiles, and by 1962, the system had been successfully tested. The Research and Development (R&D) activity led to the development of another new system, the Nike-X, with a low altitude interceptor capability. Accordingly, from 1963 to 1967, developmental work proceeded, and in 1967, a system named the Sentinel was ready for deployment. After substantial modification in the number of missiles and location of deployment, the Sentinel was ready to protect US nuclear forces against a Soviet attack and its second priority was to provide nationwide defence against a supposed Chinese attack.[2] The primary impetus for the US ABM system development came from the desire to counter the large Soviet offensive missile force and the threat of deployment of a massive ABM system by the USSR.

1. Anand Sharma, "Missile Defence: Strategic Issues and Dilemmas", in *Ballistic Missile Defence Frontier of the 21st Century* (New Delhi: KW Publishers Pvt. Ltd., 2010), pp. 129-160.
2. Alexander Flax, "Ballistic Missile Defense: Concepts and History", *Daedalus*, vol. 114, no. 2, 1985, pp. 33-52, http://www.jstor.org/stable/20024977.

Indeed, the Soviets were also pursuing an active defence programme and by 1962, the USSR had declared that effective ABM systems were being developed. In 1966, the USSR deployed an ABM system around Moscow, named the 'Galosh'.[3] The interceptor missile Galosh, known in the US as the ABM-I was believed to be nuclear armed and designed for long-range high-altitude interception.

In the late 1960s, then US President Nixon approved the development of the Safeguard ABM system in response to the Soviet ABM system around Moscow.[4] Despite concerns over the effectiveness of the system, it was approved to strengthen America's negotiating position in the Strategic Arms Limitation Talks (SALT).

Around the same time, however, the technological limitations and operational challenges, along with the high cost of ABM systems that could not provide foolproof defence against a large number of ballistic missiles, had begun to emerge. Both the superpowers were finding it technically impossible to build large defences and were discovering that the ABM systems might actually scale up the arms race.[5] In May 1972, the US and USSR signed the SALT 1 to limit strategic offensive weapons such as land-based Inter-Continental Ballistic Missiles (ICBMs) and their launchers, as well as the ABM Treaty to limit the ballistic missile defence systems.

Primarily, the ABM Treaty prohibited both parties from deploying nationwide missile defence systems. The treaty barred development, testing or deployment of sea-based, air-based, space-based, or mobile land-based ABM systems (Article V). However, it permitted each of them to build two ABM deployment areas with ground-based missiles, one around the national capital area and another around an ICBM launch site containing ICBM silo

3. Ibid.
4. Joseph Cirincione, "Brief History of Ballistic Missile Defense and Current Programs in the United States", Carnegie Endowment for International Peace, February 1, 2000, at https://carnegieendowment.org/2000/02/01/brief-history-of-ballistic-missile-defense-and-current-programs-in-united-states-pub-133#top.
5. For more information on the development of ABM systems and how it led to the ABM Treaty, 1972, refer to Sharma, n. 1.

The ABM Treaty was an effort to limit the nuclear arms race. It was understood that limiting missile defence systems would reduce the need to build more offensive weapons to overcome the defensive systems that the other country might have deployed.

launchers (Article III).[6] Later, in 1974, both sides signed a protocol that further reduced the ABM deployment areas to one site only for each country. Also, R&D was allowed.

The ABM Treaty was an effort to limit the nuclear arms race. It was understood that limiting missile defence systems would reduce the need to build more offensive weapons to overcome the defensive systems that the other country might have deployed. Mutual vulnerability deterred both sides from launching a first strike as it would result in a potential retaliatory strike that would cause significant damage to the adversary.

However, by the 1980s, President Reagan refused to accept the notion that vulnerability to attack ensured better strategic stability. The ABM Treaty did not prohibit the "modernization and replacement of ABM systems or their components" and permitted research and experimental work prior to development.[7] It also permitted fixed land-based testing of any type of missile defence for research purposes. In March 1983, President Ronald Reagan launched a major R&D programme—the Strategic Defence Initiative Organisation (SDIO). The primary aim of the SDI was to pursue research on various technological components leading to a comprehensive BMD programme and National Missile Defence (NMD) deployment.

The Soviet Union also conducted substantial R&D work for its Moscow BMD system to increase its capabilities, and developed a new system, the ABM-X-3, with an improved radar and interceptor missiles. This development alarmed the US and contributed to its move towards SDI, also known as "Star

6. Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty), retrieved from https://media.nti.org/documents/abm_treaty.pdf
7. Ibid., and "The Anti-Ballistic Missile (ABM) Treaty at a Glance", Fact Sheets and Briefs, Arms Control Association, last reviewed December 2020, at https://www.armscontrol.org/factsheets/abmtreaty.

Wars". The idea of SDI was mainly based on developing defensive layers, including air, land, sea and space-based components to track and shoot down incoming ballistic missiles. However, the possible destabilising effects and the enormous cost of SDI became major issues and it remained an R&D effort, although the vision paved the way for further research on missile defence.

In 1997, the Commission to Assess the Ballistic Missile Threat to the United States was established to "assess the nature and magnitude of the existing and emerging ballistic missile threat to the United States".[8] Former Secretary of Defence Donald H. Rumsfeld was appointed as chairperson of the commission. In 1998, the Rumsfeld Commission's report concluded that the worldwide development and proliferation of Weapons of Mass Destruction (WMDs), mainly by China, Iran and North Korea, in addition to Russia, posed a growing threat to the continental US.[9] With the end of the Cold War, it was felt that the ABM Treaty's ban on nationwide missile defences prevented the US from developing and deploying defences against the proliferating threat of ballistic missiles, especially from countries pursuing nuclear weapon capabilities and long-range missiles.

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In July 1999, the US passed the National Missile Defence (NMD) Act to deploy an effective missile defence system. Further, the US effort to amend the ABM Treaty to allow a limited national missile defence was rejected by Russia. In December 2001, the US announced its withdrawal from the ABM Treaty which took effect in June 2002. Then US President George W. Bush argued that the events of September 11 had made it clear that the US had a new kind of emerging threat from rogue states and terrorist groups equipped

8. Executive Summary of the Report of the Commission to Assess the Ballistic Missile Threat to the United States, July 15, 1998, at https://irp.fas.org/threat/bm-threat.htm.
9. Ibid.

with WMDs and long-range missiles, and the ABM Treaty prevented the US from developing defence against possible ballistic missile attacks by rogue forces. With this, he also announced the deployment of the missile defence system at the earliest.

CHINA'S PERCEPTIONS OF US BMD PROGRAMME AND OWN EFFORTS

Since the US abandoned the ABM Treaty, China has perceived US missile defence as a potential threat that could undermine the credibility of its nuclear deterrent. China has consistently opposed the US NMD programme since its inception due to its potential to impact China's deterrence.[10] In March 2001, in a statement made by China's envoy on disarmament issues, Ambassador Sha Zukang, he claimed, "… the US NMD programme will hamper the international arms control and disarmament process and even trigger a new round of arms race."[11]

Accordingly, in a study conducted by Chinese scholars, it was reported that US-China bilateral relations were at an all time low by mid-2018 and the negative trend has only accelerated since then.[12] As diplomatic relations worsened, many factors, including changes in the US nuclear policy and posture that include developments in nuclear and non-nuclear technologies, have also heightened China's threat perception from the US. According to the Chinese perception, US missile defence is increasingly becoming offensive despite the US insistence otherwise. In the 2019 Missile Defence Review (MDR), the US government stated that the intent of US missile defence is to "protect against possible missile attacks on the homeland posed by the long-range missile arsenals of rogue states, defined today as North Korea and Iran…". It further repeatedly stated, "The United States relies on *nuclear*

10. Tong Zhao, "How (and How Seriously) Does U.S. Missile Defense Threaten China?", *Narrowing the US-China Gap on Missile Defense*, June 29, 2020, at https://carnegieendowment.org/2020/06/29/how-and-how-seriously-does-u.s.-missile-defense-threaten-china-pub-82122.
11. M.V. Rappai, "China's Nuclear Arsenal and Missile Defence", *Strategic Analysis*, vol. xxvi, no. 1, January-March 2002, at https://ciaotest.cc.columbia.edu/olj/sa/sa_jan02ram01.html. Accessed on October 6, 2021.
12. Zhao, n. 10.

deterrence to address the large and more sophisticated Russian and Chinese intercontinental ballistic missile capabilities…". And the same document reports that the US perceives China's nuclear missile modernisation, including the purchase of the S-400 missile defence system from Russia as increasingly offensive and an "emerging missile threat to the US homeland".

As a result of its threat perception from the US, Beijing has gradually and consistently modernised its nuclear forces over the past few decades. Reportedly, China presently has approximately 350 nuclear warheads in its arsenal, compared to its biggest rival, the USA, whose active arsenal has reduced to 3,800 warheads since the Cold War era peak. China also has 116 ICBMs and Submarine-Launched Ballistic Missiles (SLBMs) that could strike the US homeland. This number was much less during the 1980s when China had approximately 20 liquid fuelled DF-5 ICBMs and 240 nuclear warheads. This development in the number and more advanced type of missiles and nuclear weapons is the result of decades of modernisation. During this time, China has developed and tested the DF-31 and DF-31A, with a range of 8,000 and 11,000 km respectively. Another new solid fuelled ICBM, the DF-41, is reportedly capable of carrying at least three and up to 10 Multiple Independent Reentry Vehicle (MIRVed) warheads. Another future SLBM, the JL-3, will also be capable of carrying multiple warheads. Apart from missiles, a significant increase in the number of missile launchers can also be observed in the 2021 US Department of Defence (DoD) report. The 2021 *The Military Balance* report has stated that Chinese ICBM launchers have increased from roughly 60 in 2010 to 100 in the recent time.[13] In addition to these, in late June 2021, various largely cited open sources reported the construction of hundreds of missile silos, estimated to be around 250 silos for ICBMs at three sites at least.[14] It is perceived that a large number of silo-based ICBMs that are

13. Office of the Secretary of Defence, "Annual Report to Congress: Military and Security Developments Involving the People's Republic of China", Department of Defence, United States of America, 2021.
14. Matt Korda and Hans M. Kristensen, "China Is Building A Second Nuclear Missile Silo Field", Federation of American Scientists, July 26, 2021, at https://fas.org/blogs/security/2021/07/china-is-building-a-second-nuclear-missile-silo-field/; Shannon Bugos and Julia Masterson, "New Chinese Missile Silo Fields Discovered", Arms Control Association, September

China has developed capabilities to defend against a spectrum of ballistic missile challenges starting from short range ballistic missiles to ICBMs. Over the years, China's missile defence research has benefitted from Russian technology, and it took a significant leap in 1993 with the import of the S-300 system from Russia.

less vulnerable than road-based ICBMs, could survive a surprise attack by the US and will be able to retaliate effectively. By increasing the number of solid fuelled silo-based missiles that are capable of carrying multiple warheads, China is ensuring that a sufficient number of warheads will be able to penetrate the US missile defence.

Besides ICBMs and SLBMs, China has made significant progress in developing ballistic missile defence capabilities as well. BMD systems involve the capability to detect, track and intercept an incoming missile in the boost mid-course phase, before its reentry into the atmosphere or at the terminal phase. China has developed capabilities to defend against a spectrum of ballistic missile challenges starting from short range ballistic missiles to ICBMs. Over the years, China's missile defence research has benefitted from Russian technology, and it took a significant leap in 1993 with the import of the S-300 system from Russia. The North Atlantic Treaty Organisation (NATO) designation of the missile system is SA-10 Grumble. Initially, China acquired around 100 S-300 missile systems and, by 1995, it obtained clearance to manufacture its own S-300 systems named the Hongqi-10 (HQ-10). While at the initial stage, China imported the parts from Russia to manufacture the missile system, over the years, the reliance on Russia has decreased as China now manufactures its own parts and has developed an upgraded version, the S-300PMU-1, also known as the Hongqi-15 (HQ-15), with a range up to 200 km. The missile system is ground-based, road mobile, with a stated capability to target cruise missiles and aircraft in a conflict situation. The HQ-15 is deployed around Beijing and Shanghai to protect GDP military assets and

2021, at https://www.armscontrol.org/act/2021-09/news/new-chinese-missile-silo-fields-discovered.

near the eastern coastal zone that produces a large part of China's Gross Domestic Product (GDP), as well as near the Taiwan Strait.[15] In 2010, China bought around 15 batteries of the S-300 air defence system from Russia. An S-300 battery consists of four truck mounted installations with each having four missiles held in launch tubes.[16]

In the Russian military, a regiment of S-400 consists of two battalions and two batteries make up a battalion. A S-400 battery consists of four large Transporter Erector Launchers (TELs) or 16 smaller TELs or a combination of both.

Another strategic air defence system of Russia, the S-400 Triumf has also been acquired by China. The S-400 is a three-tier air defence system equipped with the Surface-to-Air Missile (SAM) system. The system is claimed to have the capability to intercept cruise and ballistic missiles, aircraft and Unmanned Aerial Vehicles (UAVs) of a range up to 3,500 km and speed of up to 4.8 km per second at the terminal phase.[17] The delivery of two regiments of the missile system took place in May 2018 and February 2020. In November 2018, the first long range interceptor test of a ballistic target at the missile defence system's maximum 250 km range was conducted and, accordingly, in December 2018, the PLA Air Force (PLAAF) completed the user trial of the first S-400 regiment.[18] In the Russian military, a regiment of S-400 consists of two battalions and two batteries make up a battalion. A S-400 battery consists of four large Transporter Erector Launchers (TELs) or 16 smaller TELs or a combination of both and each TEL can carry four long range or up to 16 medium and short-range missiles. However, the Chinese configuration of the missile system is not known yet. Reportedly, the S-400

15. HQ-15, Missile Defense Advocacy Alliance, at https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china/china-anti-access-area-denial/hq-15/, June 20, 2018.
16. Dmitry Solovyov, "China Buys Air Defense Systems from Russia", Reuters, April 2, 2010, at https://www.reuters.com/article/us-russia-china-arms-idUSTRE6310WG20100402.
17. Sharma, n. 1.
18. Franz-Stefan Gady, "Russia Completes Delivery of Second S-400 Regiment to China", *The Diplomat*, February 3, 2020, at https://thediplomat.com/2020/02/russia-completes-delivery-of-second-s-400-regiment-to-china/.

can be equipped with various kinds of advanced missiles, including the SAM interceptor, the 40N6E, in addition to the 48N6E3, as well as the 9M96E and 9M96E2" .[19] The 40N6E is Russia's most advanced interceptor for the system.

China has also developed and tested the HQ-19 with reported ballistic missile defence capability. The HQ-19 is designed to intercept medium range ballistic missiles (1,000 to 3,000 km range) at the mid-course phase of their trajectory. The missile defence system is a counterpart of the US Terminal High Altitude Area Defence (THAAD). THAAD is presently deployed in South Korea, and China perceives that its advanced radar system could be used to monitor China's military activities.

A number of missile defence tests have been conducted by China after its January 2007 Anti-Satellite (ASAT) test. In January 2010, China's Foreign Ministry announced a successful exo-atmospheric test flight of a ground-based, mid-course missile interceptor. The test was conducted against the backdrop of the US sale of weapons to Taiwan, including the PAC-3 air defence system. In the absence of any substantial information, experts estimate that the test was for the air defence missile, HQ-9 or HQ-12.[20] Similar air defence missile tests were carried out in 2013, 2014, 2018 and 2021.

The July 2014 test by China was claimed as an anti-satellite weapon test by the US while China denied the claim and stated that it was a land-based missile interceptor test. China's Ministry of National Defence said the successful test was "defensive in nature and does not target any country".

The latest such test was conducted in February 2021 and China announced that it was able to successfully use missile defence technology against a ballistic missile during its mid-course phase.[21] Reportedly, it was the fifth

19. Ibid.
20. Jeffrey G. Lewis, "Chinese Missile Defense Test", *Arms Control Wonk*, at https://www.armscontrolwonk.com/archive/202588/chinese-missile-defense-test/, January 12, 2010.
21. Wang Xinjuan, "China Conducts Land-Based Mid-Course Missile Interception Test", Ministry of National Defence, http://eng.mod.gov.cn/news/2021-02/05/content_4878595.htm, February 5, 2021.

land-based missile interceptor flight test and the fourth land-based, mid-course missile defence test that China has officially announced.[22]

Although, it is apparent that China's BMD programme is US-centric, owing to its ambiguity and rapid development in the field of strategic missiles, technologies and missile defence capabilities, China's rapid advances do impact India's security concerns negatively.

INDIA'S PERCEPTIONS OF CHINA'S BMD PROGRAMME AND OWN EFFORTS

Given the profound impact of BMD, it is imperative for India to accord adequate thought and attention to the issue. BMD has the potential to "break the stability of mutual vulnerability" by providing one side the advantage of defence of its arsenal against an adversary's nuclear arsenal.[23] This vulnerability tends to upset the deterrence relationship in a region.[24] Therefore, the development of BMD by China has implications for India and, in the same way, Pakistan has expressed concern about BMD deployment by India.[25] However, India's BMD programme aims to strengthen its No First Use (NFU) posture. As India has a declared NFU doctrine, the BMD capabilities aim to ensure the survivability of the critical components of the nuclear arsenal. Hence, India's BMD programme, enhances deterrence since the NFU posture reduces the possibility of preemption, which is a primary concern for nations with a first use doctrine.[26] A BMD system aimed at intercepting a nuclear strike against India could also enhance the "credibility of an Indian threat to respond to a low-level attack while upholding the NFU posture".[27] Hence, the development of BMD capability

22. Liu Xuanzun, "China Conducts Mid-Course Antiballistic Missile Test, System 'Becomes More Mature, Reliable'", *Global Times*, February 5, 2021.
23. Yogesh Joshi and Alankrita Sinha, "India and Ballistic Missile Interception: From Theory To Practice", *Nuclear Notes*, Centre for Strategic and International Studies (CSIS), June 2012, at https://csis-website-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/120529_Spies_NuclearNotes2_Web.pdf
24. Manpreet Sethi, "Lure of the Shield: BMD in India's Nuclear Strategy", in *Nuclear Strategy: India's March Towards Credible Deterrence* (New Delhi: KW Publishers, 2009).
25. Ibid.
26. Ibid.
27. Ibid., p. 23.

by India will, in fact, bolster the survivability and credibility of its nuclear arsenal.

Similarly, China's BMD capabilities concern India. While China's BMD programme primarily aims to deter US missiles, factors like China being a nuclear neighbour of India that shares a close strategic partnership with Pakistan, its BMD development programme and the counter-measure technologies by China all become a source of insecurity for India. Especially given the fact that China already claims a large portion of Indian territory. Border disputes between the two countries are only becoming more prominent in recent times, and India's security concern has obviously intensified. Reportedly, amidst the ongoing standoff at the Sino-India border, China has deployed SAMs and is strengthening its combined air defence formations, including deployment of S-400 systems at Hotan air base in Xinjiang and Nyingchi air base in Tibet, across Ladakh and Arunachal Pradesh respectively, close to the Line of Actual Control (LAC).[28]

At the same time, China has been developing and modernising its conventional and strategic weapons programmes for the past few decades and the pace of modernisation has been rapid in the last decade. In this time period, China's strategic capability has grown in both numbers and quality. Not only BMD, but, in the last decade, China has worked significantly on the counter-BMD programme to effectively defeat missile defence shields. These counter-BMD technologies of China range from the development of hypersonic missiles to MIRVed missiles. While there are debates surrounding the effectiveness of these technologies and their cost, it is certain that these technologies are increasingly becoming a prominent security threat. Although China claims that the primary purpose of its BMD programme is the threat perception from the US, the recent mobilisation of BMD systems near the Sino-India border indicates that in case of a conflict China might utilise these systems to blunt the adversaries' air strike potential to have a position of advantage. Another factor that China has consistently

28. Shishir Gupta, "Chinese S-400 Systems Across LAC, Forces India to Rethink Air Defence", *Hindustan Times*, June 23, 2021, at https://www.hindustantimes.com/analysis/chinese-s-400-systems-across-lac-forces-india-to-rethink-air-defence-101624417959950.html.

worked on is its strategic missile capability to defeat technologically superior US strategic missiles and missile defence systems, and, invariably, India's missile defence systems and strategic missiles will be rudimentary compared to China's. While China maintains ambiguity regarding the effectiveness of these technologies, open-source research indicates this fact.

Similarly, another pertinent threat perception of India comes from the China-Pakistan nuclear nexus. While Pakistan's growing strategic missile inventory and nuclear warheads controlled by the Pakistan Army already pose a security threat to India, its nexus with its all-weather ally, China, further complicates India's security calculus. China's long, continuous assistance to Pakistan's strategic weaponry programme and nuclear technologies is evident from most of the Pakistani strategic missile designs—Pakistan's access to these technologies might prove detrimental for India's security environment in a conflict situation. Also, the development of new technologies by China as part of its Anti-Access/Area-Denial (A2/AD) strategy in the western Pacific has the potential to impact targets in the mainland and Indian waters, and a robust BMD capability might prove effective against this capability. Although China is relatively less concerned about India's missile defence systems as long as its nuclear deterrence is credible vis-à-vis India, it is imperative for India to develop a functional missile defence shield, according to its threat perceptions, essentially to defend the strategically important installations such as command and control centres, nuclear forces, national capital area and vital economic zones of the country.

Having examined India's rationale for missile defence, the following section explores the existing BMD systems of India. Considering India's threat perception mainly from its nuclear neighbour, India's BMD systems are required to have the potential to primarily defend against medium and short-range missiles. At the same time, BMD cannot defend against cruise missiles, and both countries have large inventories of nuclear capable cruise missiles. Given these factors, such as cost benefit and effectiveness of BMD against limited categories of missiles, India needs to carefully consider its BMD options. This will ensure a functional BMD that provides adequate protection without requiring an unreasonably large expenditure. Also, the development of BMD provides a technological gain that has a secondary application in conventional and sub-conventional conflicts.[29]

In order to gain a reliable retaliatory capability, a major effort was made by India in the early 2000s at acquiring and developing the technology of BMD. In 2001, two Israeli Elta green Pine multi-functional radars were purchased that were part of the Arrow-2 BMD system.[30] Also, India has begun to explore the feasibility of cooperation with other countries in this area; for example, since 2001, India has regularly discussed these issues within the framework of the US-India Defence Policy Group.[31]

Presently, India has a two-tier ballistic missile defence system. The Defence Research and Development Organisation (DRDO) is developing the BMD system that provides multi-layer protection. The two-stage development of BMD began in 1998 by DRDO. The first layer of the BMD system consists of the Prithvi Air Defence (PAD)/Pradyumna and Prithvi Defence Vehicle (PDV) interceptors that can intercept a missile at an exo-atmospheric altitude of 50-180 km. The second layer consists of a single-stage solid rocket-propelled Advanced Air Defence (AAD)/Ashin interceptor missile that destroys an incoming missile at the endo-atmospheric altitude of 15-40 km. Reportedly, this BMD system can intercept medium range missiles. PAD and PDV are designed for mid-course interception of ballistic missiles and AAD is designed to intercept missiles at the terminal phase, after entry into the earth's atmosphere. The Akash SAM is part of AAD. Apart from this, the system also consists of the Swordfish Long Range Tracking Radar (LRTR) capable of tracking missile launches 600-800 km

29. Balraj Nagal, "India and Ballistic Missile Defense: Furthering a Defensive Deterrent", Carnegie Endowment for International Peace, June 30, 2016, at https://carnegieendowment.org/2016/06/30/india-and-ballistic-missile-defense-furthering-defensive-deterrent-pub-63966. Accessed on April 16, 2023.
30. Petr Topychkanov, "India's Prospects in the Area of Ballistic Missile Defense: A Regional Security Perspective", Working Paper No. 3, Carnegie Moscow Centre, 2012, July 26, 2012, at https://www.files.ethz.ch/isn/152118/WP3_2012_Topychkanov_en.pdf.
31. Ibid.

from its site, and Swordfish-2 LRTR, that has a range of approximately 1,500 km.[32]

The first test of the PAD was conducted in November 2006. During the test, the Prithvi-II missile was successfully intercepted by the PAD at the endo-atmospheric altitude of 48 km. The AAD was first tested in 2007 and intercepted a simulated electronic missile at an altitude of 15 km. Another test was successfully conducted in March 2009. The fourth test was conducted in July 2010 and the DRDO test-fired an AAD missile from the Integrated Test Range (ITR). In another test in May 2016, the AAD missile intercepted and destroyed a Prithvi missile that was fired from a ship. On February 2017, another test was conducted and the target missile was successfully intercepted by an exo-atmospheric interceptor missile at an altitude of above 50 km. This test was followed by another test of an AAD missile in March 2017 that intercepted the target at an endo-atmospheric altitude.[33]

In an advancement of indigenous BMD technology, India conducted the first test of its Anti-Satellite (ASAT) missile in March 2019. Named Mission Shakti, the test put India in an elite group of countries that have the ASAT capability—the US, Russia and China. As part of the test, an anti-satellite missile, the PDV Mark II (a modified exo-atmospheric interceptor missile) successfully destroyed a Microsat-R satellite in the Lower Earth Orbit (LEO) at 300 km in a "hit to kill mode".[34] Although the test created a mixed reaction from experts across the world regarding the timing, debris generation and space security, this capability enables India to shoot down an enemy satellite, thereby disrupting critical surveillance capability.

32. "India's Ballistic Missile Defence Phase-I Deployment Starts in 2022-23", Indian Defence Research Wing, at https://idrw.org/indias-ballistic-missile-defence-phase-i-deployment-starts-in-2022-23/, October 4, 2020.
33. "India's Indigenous Supersonic Interceptor Missile Successfully Test-Fired", *Hindustan Times,* March 1, 2017, at https://www.hindustantimes.com/india-news/india-again-successfully-test-fires-indigenous-supersonic-interceptor-missile/story-koKVtYI5wUKCqP2dHtjDZM.html.
34. Dinakar Peri, "Successful Anti-Satellite Missile Test Puts India in Elite Club", *The Hindu*, at https://www.thehindu.com/news/national/successful-anti-satellite-missile-test-puts-india-in-elite-club/article26657024.ece, March 27, 2019.

In its second phase of development, DRDO plans to develop two new kinds of mobile interceptor missiles named AD-1 and AD-2 against short and intermediate range ballistic missiles.

Reportedly, in January 2020, the indigenous BMD system was completed and government approval for activation of the system near New Delhi was being sought. It was further reported that after the approval, it will take three to four years to install the BMD system.[35] DRDO or the Indian Air Force (IAF) have not officially confirmed the report.

In its second phase of development, DRDO plans to develop two new kinds of mobile interceptor missiles named AD-1 and AD-2 against short and intermediate range ballistic missiles.

It is noteworthy that India is also moving towards foreign collaboration to leverage and further strengthen its BMD shield. In this respect, in the 2019 Missile Defence Review, the US stated, "There are now a number of states in South Asia that are developing an advanced and diverse range of ballistic and cruise missile capabilities. Within this context, the United States has discussed potential missile defence cooperation with India. This is a natural outgrowth of India's status as a major defence partner and a key element of our Indo-Pacific strategy." Reportedly, the US defence contractor Lockheed Martin had shown its willingness to cooperate with India on BMD in 2008. Though the US has strong bilateral relations with Japan and South Korea in the region, India will be a valuable addition to this. In addition to these, in October 2018, India signed a deal with Moscow to buy five units of the most advanced long-range surface-to-air missile defence system, the S-400, despite the Trump Administration's warning that the deal with Russia may invite US sanctions. The first squadron of the S-400 missile system reached India in December 2021 and is reportedly being deployed in the western state of Punjab.[36]

35. Snehesh Alex Philip, "India's Ballistic Missile Shield Ready, IAF & DRDO to Seek Govt Nod to Protect Delhi", *The Print*, at https://theprint.in/defence/indias-ballistic-missile-shield-ready-iaf-drdo-to-seek-govt-nod-to-protect-delhi/345853/, January 8, 2020.
36. Amit Chaturvedi, "First Squadron of S-400 Deployed in Punjab Sector: Report", *Hindustan Times,* December 21, 2021, at https://www.hindustantimes.com/india-news/first-squadron-of-s-400-deployed-in-punjab-sector-report-101640055551309.html.

Evidently, India's BMD architecture is limited in nature and it does not seek a nationwide missile defence system. By this architecture, India attempts for "point defence through interception at the terminal phase".[37] Once activated, this limited BMD architecture will strengthen India's deterrence by providing an effective shield to important strategic centres in a scenario of first strike by an adversary state, and will retain the effectiveness of a second strike by reducing the impact of the strike on strategic assets of the country. Thus, the presence of a functional BMD will prevent the adversary from launching a ballistic missile attack for possible retaliation. This also reinforces India's NFU posture and makes it more credible by reducing the chance of a first strike, as the incentives it offers would be low. Also, as rapid advancement in space technology has become a reality, knowledge of BMD technology will be an added benefit.

Pakistan perceives India's BMD programme as destabilising and argues that it is pushing the region into an arms race as it weakens the credibility of Pakistan's nuclear deterrence.

PAKISTAN'S PERCEPTIONS OF INDIA'S BMD AND OWN EFFORTS

Pakistan's security interests are primarily India-centric and any development in India's military posture invariably evokes Pakistan's response. Pakistan perceives India's BMD programme as destabilising and argues that it is pushing the region into an arms race as it weakens the credibility of Pakistan's nuclear deterrence by creating doubts regarding the deterrent value of its existing nuclear arsenal and intensifies Islamabad's security dilemma.[38] One Pakistani analyst argues that India's BMD capability would significantly erode Pakistan's air force penetration, strike capability and ground-based ballistic missile systems. Further, Pakistan decries that BMD would cause a 'false sense of security' among the Indian leadership and in a

37. Sethi, n. 24.
38. Anjum Ibrahim, "Implications of Indian Ballistic Missile Defence (BMD) on Strategic Stability", *Policy Perspectives, Pluto Journals,* vol. 13, no. 1, 2016, pp. 97-114, at https://www.jstor.org/stable/10.13169/polipers.13.1.0097.

crisis situation, India's actions would leave Pakistan vulnerable.[39] On India's ASAT technology development, Pakistan perceives that such emerging technologies would increase India's capability to destroy hostile satellites and enhance terrain analysis which would decrease Pakistan's element of strategic surprise.[40] While Pakistan argues against Indian BMD and claims to have developed counter-BMD technologies, it does not consider the development of BMD capability for Pakistan as a vital policy.

Undoubtedly, the induction of BMD is a security concern for Pakistan. In order to take the necessary steps to penetrate the defensive shield, Pakistan is enhancing its nuclear arsenal and delivery systems and also developing MIRVed missiles. In terms of Pakistan's response to this development of India, Pakistani nuclear expert and adviser to the National Command Authority (NCA) Lieutenant General (Retd) Khalid Kidwai has claimed that Pakistan has cost effective solutions to India's BMD technology. He further added that adequate response in the form of MIRV capabilities, miniaturisation of nuclear warheads for its short-range delivery systems and four types of cruise missiles are available with Pakistan.[41]

One of the available options for states not in possession of BMD capability is to develop cruise missile technology as a more accurate delivery system, and a controlled flight path can prove to be effective to deceive the BMD system. As of 2021, Pakistan has four types of cruise missiles, i.e., the Babur and Babur-2 ground launched cruise missiles with ranges of 700 km and 750 km, respectively, and the Ra'ad and Ra'ad-2 air launched cruise missiles with ranges of 350 km and 600 km respectively. Reportedly, Pakistan's solid fuelled ballistic missile, the Ababeel, is a MIRVed missile and the basic design of the missile resembles that of China's CSS – 7/DF-11 missile. The missile was first tested in January 2017 and the official statement noted that the "missile

39. Lora Saalman and Petr Topychkanov, "South Asia's Nuclear Challenges", *SIPRI,* at https://www.sipri.org/sites/default/files/2021-03/2104_south_asias_nuclear_challenges_0.pdf. April 2021.
40. Ibid.
41. "Pakistan to Maintain Strategic Balance with India, says NCA Adviser", *Dawn,* November 7, 2018, at https://www.dawn.com/news/1444087.

is capable of delivering multiple warheads, using MIRV technology… Development of the Ababeel weapon system is aimed at ensuring the survivability of Pakistan's ballistic missiles in the growing regional Ballistic Missile Defence (BMD) environment."[42] Pakistan's claim of MIRV technology has not been verified and remains a point of debate. It is also not certain if the technology was used during the test launch. MIRV technology requires a broad degree of technical sophistication and Pakistan may have taken external assistance from China to develop the technology. Analysts note that Pakistan would have had to overcome a number of technical challenges before being able to develop successful MIRV technology. Since its introduction in 2017, no other test of the Ababeel missile is known to have taken place (till October 2021) which also indicates that the missile system is at the nascent stage of development and requires more testing before its successful deployment.

MIRV capability provides the attacking state disarming counter-force strike capability and with greater accuracy; land-based MIRV systems indicate essentially first strike capability rather than retaliatory capability. If Pakistan successfully develops MIRV capability with China's assistance, the mutual threat perception is likely to grow further. It is noteworthy that India's BMD system is defensive in nature and essentially developed to defend from the growing threat of rapidly increasing Chinese and Pakistani nuclear warheads, delivery systems and ballistic missile inventory. In addition, Pakistan has a declared nuclear first use policy. In this scenario, it is only prudent for India to develop a defensive missile shield. Whereas, MIRV is essentially an offensive capability that India's nascent BMD system will not be advanced enough to keep up with, as no BMD assures complete interception and destruction of all incoming missiles. With the increased tendency for crises, these developments could have a negative impact on regional deterrence stability.

42. ISPR Report No PR-34/2017-ISPR, January 24, 2017, at https://www.ispr.gov.pk/press-release-detail.php?id=3705

IMPLICATIONS FOR REGIONAL STABILITY

Regional missile defence in the South Asian region has evoked debates regarding the effectiveness of these systems. While some analysts believe that BMD would promote stability in the region, others argue that it could upset the strategic balance, coupled with its exorbitantly high cost and apparent inability to provide a foolproof defensive shield against hostile missiles. While cost is a factor, accessing the value of BMD entirely based on cost is incorrect as the development of BMD and technological advancement by the neighbouring nuclear powers cannot go unnoticed as it has direct implications.

In the case of India, China and Pakistan dynamics, the development of BMD by any one of these states will have a cascading effect on the others. In this case, if all three states develop ballistic missile technology, it may have a negative effect on the region's deterrence stability as the offence-defence balance could get disturbed. BMD "threatens to break the stability by providing one side with an advantage of defence against an adversary's nuclear weapons".[43] A state's BMD architecture decreases the threat posed by other states' nuclear arsenals and undermines the adversary's deterrent value. Consequently, the adversary tends to move towards an offensive posture. Also, a state that has BMD technology, can also undertake a conventional strike in an adversary's territory as the possibility of a nuclear response reduces. Hence, the capability build-up might shift the balance from defence to offence.[44]

Besides, the presence of a significant number of sophisticated ballistic missiles in China's missile inventory, some of which are ICBMs, along with a robust modernisation programme, creates a security concern that leads to arms build-up and advancement of technologies that will be beneficial to counter these developments. China's fast growing nuclear missile inventory

43. Yogesh Joshi and Alankrita Sinha, eds, "India and Ballistic Missile Interception: From Theory to Practice", *Nuclear Notes*, vol. 2, issue 1, Centre for Strategic and international Studies (CSIS), 2012, at https://csis-website-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/120529_Spies_NuclearNotes2_Web.pdf.
44. Ibid.

which includes 240 operational land-based and 48 sea-based ballistic missiles impacts the strategic balance in South Asia. Also, in the last decade, China has focussed on the steady expansion of its nuclear missiles and platforms, BMD, MIRV, hypersonic and ASAT capabilities. Pakistan also possesses a number of nuclear capable ballistic and cruise missiles, along with its tactical nuclear missiles. China has enabled Pakistan's nuclear programme for decades and notably, China's assistance to Pakistan to develop miniaturised warhead and MIRV capability has serious implications for India as these capabilities and the China-Pakistan nexus undermine India's nuclear deterrence. In this scenario, India's decision to develop a missile defence shield comes from its preference for defence over retaliatory offence. And the main purpose of BMD is to "ensure a survivable command and control" and a credible second-strike capability.[45]

Pakistan fears that the Indian BMD will erode the credibility of its nuclear deterrence, and it seeks to pursue qualitative and quantitative enhancement of its nuclear force which is noticeable from the fact that it has one of the fastest growing nuclear arsenals in the world. Whereas, the Indian BMD ensures that India will survive a potential nuclear first strike in the event of a crisis which is essential to maintain the NFU policy. Nuclear stability in the region is already disturbed by Pakistan's nuclear first use posture. In this scenario, India cannot afford to keep its vital strategic assets and key command centres vulnerable to attack by two hostile nuclear neighbours. Hence, India's BMD has a positive effect in maintenance of regional stability by allowing India to sustain its NFU posture.

In terms of India-China dynamics, the general perception is that India's BMD system is not likely to be perceived by China as a potential threat because of the capability gap between the two countries, the fact that India's BMD might not be able to intercept China's long-range missiles, and its stated NFU policy. But this situation might alter considering China's concern over India's missile programme, particularly the development of the Agni-V

45. Nagal, n. 29.

ICBMs.[46] Even so, China is not likely to consider India's missile defence as a major factor in the near term. For China, more than India, it is the US that has a direct impact on its strategic decision-making. Nonetheless, BMD development in the South Asian region will have both positive and negative impacts. While Pakistan's insecurity due to BMD will likely lead to a larger arms build-up, on the other hand, it will ensure greater reliance on NFU and, hence, will stabilise the nuclear dynamics in the region. However, it needs to be ensured that the quest for BMD technology by an increasing number of countries does not lead to illegal technology transfer or technological proliferation. Limited use of the technology may be ensured by undertaking measures like treaties to restrain the big powers from incessantly investing in the technology and indirectly providing incentives to other countries to use counter-BMD technologies, hence, leading to a never-ending arms expansion.

46. Ananth Krishnan, "China Questions India's Missiles Project", *The Hindu,* September 16, 2021, at https://www.thehindu.com/news/international/china-questions-indias-missiles-project/article36502832.ece.