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# Decoding India's Strategic Weapons Capabilities

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## Summary

*India's recent Anti-Satellite weapons (ASAT) test has extended its strategic deterrent into outer space. Built upon India's Ballistic Missile Defence (BMD) program, an ASAT capability allows India to bridge the gap with China in the weaponisation of outer space but also makes New Delhi a major stakeholder in any future negotiations over arms control in outer space. This paper outlines India's ASAT capabilities, underlines the similarities and differences between its BMD and ASAT program and highlights the changes in India's approach to strategic weapons systems and what it means for India's emergence as a great power.*

## Introduction

Almost 20 years after India acquired a nuclear deterrent by conducting five nuclear tests in May 1998, it has now extended its deterrent capability into outer space. On 27 March 2019, India conducted an Anti-Satellite weapons (ASAT) test.[1] Codenamed Mission Shakti, as were the nuclear tests of 1998, India's Defence Research and Development Organisation (DRDO), targeted a small military intelligence satellite called MICROSAT-R in the Lower Earth Orbit (LEO) at the height of 283 kilometres.[2] Along with the US, Russia and China, India is the fourth such nation to have an ASAT capability. Announcing the success of the mission, Prime Minister Narendra Modi called the test a "highly complex" technological exercise and declared that it was "an important step towards securing India's safety, economic growth and technological development."

Since India began a Ballistic Missile Defence (BMD) program in the early 2000s, the ASAT weapons have been on New Delhi's radar.[3] In the last 15 years, India's maturing BMD capability along with the significant progress it made in its missile program gave Indian scientists enough confidence to undertake an ASAT test. After the launch of India's first intercontinental ballistic missile (ICBM) in April 2012, DRDO Chief VK Saraswat publicly stated that "India has all the building blocks of an anti-satellite system in place."[4] India's interest in ASAT is primarily motivated by the need to bridge the deterrent gap with China in outer

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1 Press Trust of India, "India demonstrates anti-satellite missile capability, stands tall as space power: PM," 27 March 2019, http://www.ptinews.com/news/10470066_India-demonstrates-anti-satellite-missile-capability--stands-tall-as-space-power--PM.

2 Rahul Bedi, "India's DRDO Reveals additional details of recent ASAT Test," 10 April 2019, https://www.drdo.gov.in/drdo/pub/npc/2019/April/din-10april2019.pdf.

3 Manoj Joshi, "India's ASAT Capability has been around for some time now," *The Wire*, 27 March 2019, https://thewire.in/space/asat-test-india-narendra-modi.

4 Sandeep Unnithan, "'India has all the building blocks of an anti-satellite system in place': Interview with VK Saraswat," India Today, 27 April 2012, https://www.indiatoday.in/india/story/agni-v-drdo-chief-dr-vijay-kumar-saraswat-interview-100405-2012-04-27.

space; Beijing conducted its first ASAT test almost a decade ago.[5] The emerging arms control regime for outer space also fuelled concerns in New Delhi.[6] India obviously wants to avoid a situation where the lack of a demonstrated capability may lead to its exclusion from arms control negotiations on outer space.

## Putting India's ASAT Capability in Perspective

The process culminating in the 27 March 2019 ASAT began in 2016 when Modi had tasked the DRDO to work on "challenging technologies."[7] Soon after, the Prime Minister's Office ordered the DRDO to demonstrate India's offensive capability in outer space. In January 2019, Indian Space Research Organisation (ISRO) launched a small satellite weighing 740 kg called MICROSAT-R in the Low Earth Orbit (LEO) as the target for the forthcoming ASAT. DRDO first attempted to target the satellite in February 2019. However, the mission failed as the interceptor missile fizzled after a few seconds in flight.[8] Notwithstanding this initial disappointment, the recent success of the ASAT is significant because it confirms three major developments in India's strategic capabilities.[9]

First, successfully intercepting an orbital object moving at speeds close to 10 kilometres per second requires tracking capabilities of extreme accuracy. According to the DRDO, even when satellites at LEO are at much closer range compared to satellites orbiting in Mid Earth or High Earth Orbits, the challenge is the relatively high speeds at which such an interception is made.[10] The ASAT made use of several subsystems involved in India's BMD program. The Long Range Tracking Radar (LATR) India has developed with the help of Israel was employed to track the precise location of the targeted satellite.[11] The LATR is reported to have the capability to track objects of tiny sizes at a range of 1,000 kilometres. The LATR was used in conjunction with several ground-based data links and communication networks "distributed around a wide geographical expanse."[12]

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5 Rajeshwari Pillai Rajagopalan, "India's Changing Policy on Space Militarization: The Impact of China's ASAT Test," India Review, Vol. 10, No. 4 (2011), pp. 354-378.

6 Brian Weeden and Victoria Samson, "India's ASAT test a wake-up call for norms of behavior in space," Space News, 8 April 2019, https://spacenews.com/op-ed-indias-asat-test-is-wake-up-call-for-norms-of-behavior-in-space/

7 Ajit Dubey, "A-SAT missile project began two years ago, went into 'mission mode' in last six months, says DRDO Chairman," Asia News International, 28 March 2019, https://www.aninews.in/news/national/general-news/a-sat-missile-project-began-two-years-ago-went-into-mission-mode-in-last-six-months-says-drdo-chairman20190328085439/.

8 Ankit Panda, "Exclusive: India Conducted a Failed Anti-Satellite Test in February 2019," *The Diplomat*, 30 March 2019, https://thediplomat.com/2019/04/exclusive-india-conducted-a-failed-anti-satellite-test-in-february-2019/.

9 Indranil Roy, "All you need to know about the PDV MK-II: India's Satellite Killer," Delhi Defence Review, 3 April 2019, http://delhidefencereview.com/2019/04/03/all-you-need-to-know-about-the-pdv-mk-ii-indias-satellite-killer/.

10 Rahul Bedi, "India's DRDO Reveals additional details of recent ASAT Test," 10 April 2019, https://www.drdo.gov.in/drdo/pub/npc/2019/April/din-10april2019.pdf.

11 The Economic Times, "Mission Shakti: DRDO Video Reveals how ASAT works," 27 March 2019, https://www.youtube.com/watch?v=KwTfaiFZTWI.

12 Ibid.

Second, launching a Kinetic Kill Vehicle (KKV) to requisite distances requires significant missile booster capability. A recent report suggests that the DRDO used a combination of missile boosters from its missile and the BMD program to launch the KKV used in the ASAT test.[13] The three-stage missile interceptor used boosters from India's Sea Launched Ballistic Missile K-4 for the first two stages. The last stage was based on an interceptor missile developed for its exo-atmospheric BMD called the PDV. The PDV was first tested in February 2017 with a capability to intercept objects at the height of more than 120 kilometres. It represented an upgrade on the earlier Prithvi Air Defence (PAD) system which could intercept objects at the height of 60-80 kilometres. The use of K-4 boosters for the first two stages allowed the KKV to intercept the satellite at a distance of 283 kilometres, much beyond the range of the PDV interceptor.

Lastly, the ASAT test demonstrated the accuracy with which India could target objects in space. At the LEO orbit, satellite speeds are at their maximum, close to 10 kilometres per second. For the DRDO, this posed a "serious challenge."[14] Precise targeting of objects at such high speeds requires immense manoeuvrability. A sophisticated ring laser gyroscope-based inertial navigation system guided the KKV during much of its flight. However, in the final stages, an Imaging Infrared (IIR) homing sensor was used to zero in on the targeted satellite.[15] The IIR helps in homing on to the target object in its last moments with an accuracy of up to 10 centimetres.

India's ASAT capability has been built on the foundations of its missile and BMD program. Notwithstanding the success of Mission Shakti, however, India has a long way to go before it can be assured of the reliability of its ASAT weaponry. First of all, even when the DRDO has claimed that it has the capability to intercept satellites at a distance of a 1,000 kilometres and the intercept was made in the LEO to keep the debris at a minimum, India still has a long way to go before it can target satellites at a longer range especially in Middle Earth Orbits (2,000-36,000 kilometres) and High Earth Orbits (beyond 36,000 kilometres). If the logic of the test was to establish deterrence, then India cannot remain content with shooting down a satellite in LEO as most military reconnaissance satellites operate at HEO.[16] However, long-range interception would require enormous work on missile boosters. With India's ICBM program on a solid track, this should not be very difficult. However, the Agni-V ICBM will take time to mature. Second, missile interceptors are only one of the many methods used for disabling satellites.[17] If the intent is to stop transmission of information by the adversary's space assets, then India must move beyond direct ascent kill vehicles. It should also make an effort in developing other offensive counter-space capabilities such as directed energy weapons, electronic warfare and cyber operations against an adversary's space assets.

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13 Indranil Roy, "All you need to know about the PDV MK-II: India's Satellite Killer," Delhi Defence Review, 3 April 2019, http://delhidefencereview.com/2019/04/03/all-you-need-to-know-about-the-pdv-mk-ii-indias-satellite-killer/.

14 The Economic Times, "Mission Shakti: DRDO Video Reveals how ASAT works," 27 March 2019, https://www.youtube.com/watch?v=KwTfaiFZTWI.

15 Ibid.

16 Lt. Gen. PR Shankar, "A Quick Supplement for Understanding the Role and Context of Anti-Satellite Weapons," Delhi Defence Review, 5 April 2019, http://delhidefencereview.com/2019/04/05/a-quick-supplement-for-understanding-the-role-and-context-of-anti-satellite-weapons/.

17 Brian Weeden and Victoria Sampson, "Global Counterspace Capabilities: An Open Source Assessment," Secure World Foundation, April 2018.

Mission Shakti has proved that India's BMD program has now matured significantly. ASAT and BMD weapons have distinct military missions even when they share some essential technical characteristics. As former US Secretary of Defense Ashton Carter explains, whereas dedicated ASAT systems have "marginal BMD capability," all BMD capabilities have a "substantial ASAT capability."[18] India's ASAT signifies the technological advances India has made in its BMD program. However, it would be premature to conclude that India's BMD is now fully operational.

## Similar Technology, Differing Missions

At a very general level, both the ASAT and BMD involve intercepting objects at high altitudes and great speeds. This technological similarity, however, conceals many differences between these two weapons systems. The BMD and ASAT systems are deployed towards two distinct military missions and operate in very different strategic environments.[19]

Most BMD systems are designed to intercept objects at either terminal or mid-course trajectories. Even with significant advances made in the BMD technology, it is still tough to target missiles in their boost phase. First, intercepting a missile in the boost phase requires extensive surveillance capabilities such as locating the point of their origin and timing of launch with high accuracy. Second, since BMD being a defensive system is employed in a reactionary mode, it is almost impossible to reach and intercept a missile in its boost phase. When the BMD is used as a direct ascent ASAT weapon, it can carry interceptions only in lower earth or sub-orbital levels. A BMD system is incapable of intercepting satellites at very high ranges. Second, unlike the trajectory of a satellite which follows a highly predictable path along a fixed orbit, coordinates of a missile vary both vertically and horizontally. Random flight pattern renders the tracking of missiles a hazardous enterprise. Unlike satellites which provide a fixed target, use of decoys further complicates the tracking and interception of missiles.[20]

The BMD and ASAT systems also operate under very different strategic environments.[21] First is the issue of the military initiative. In the ASAT weapons, the initiative always rests with the offensive. In conducting the ASAT targeting, a state can choose its own time and place. The BMD systems, however, fall in the domain of defense; missile defence works only after the adversary has launched its missiles. Second, in the ASAT systems, the targets are fixed; only a given number of satellites would be hit at any given time. The BMD has to engage with multiple incoming targets simultaneously. Surveillance capabilities required for the BMD far exceed those for conducting the ASAT. Lastly, the BMD has to operate under most hostile conditions: when a state is facing an incoming missile barrage. Since the BMD is employed

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18 Ashton B. Carter, "The Relationship of ASAT and BMD Systems," Daedalus, Vol. 114, No. 2 (Spring 1985), pp. 171-189.

19 Ibid.

20 Ankit Panda, "India can blow up satellites now. And a New Arms Race could be starting," The Washington Post, 1 April 2019, https://www.washingtonpost.com/outlook/2019/04/01/india-can-blow-up-satellites-now-new-space-arms-race-could-be-starting/?utm_term=.90e3a5132432.

21 Ashton B. Carter, "The Relationship of ASAT and BMD Systems," *Daedalus*, Vol. 114, No. 2 (Spring 1985), pp. 171-189.

under conditions of deterrence breakdown, it is a weapon of high threshold and of the ultimate resort. The ASAT, on the other hand, can be deployed to gain an offensive advantage over an adversary during the beginning of a crisis or in the middle of a conventional conflict. ASAT weapons, therefore, have a low threshold of use.

Differing military missions and strategic environments suggests that even when the BMD technology may provide specific ASAT capability, they are not the same. India's BMD program has laid the foundation for its ASAT program. However, as India moves towards operationalisation of its BMD and ASAT capabilities, these differences would become more pronounced. New Delhi is yet to establish an integrated space command for its armed forces; it also does not have a space doctrine in place.[22] To make the most of this technological feat, India must follow by laying down the organisational and doctrinal framework of their deployment and use, both in periods of peace and crisis. However, as academic Gaurav Kampani has shown in his work on the weaponisation of India's nuclear capability, translating technological capacity into a usable weapon system is indeed a herculean task.[23]

These differences also create problems for arms control regimes targeting missile defenses or ASAT weapons. Any arms control regime aimed at curbing direct ascent ASAT weapons would have to take into account that BMD systems share certain technological features which can be easily replicated for targeting space assets at LEO and beyond. Even when states may agree to curb ASAT weapons, they may not be willing to put any limits to their BMD capabilities. The current discussion on arms control around ASAT tests suffers from this interconnection between the two.

## ASAT and India's Strategic Makeover

India's journey from Pokhran to outer space has been a phenomenal one in three significant ways.[24] First, from a reluctant nuclear power for much of its independent history, the last two decades have witnessed a remarkable change in New Delhi's approach to hard material power especially in pursuing all kinds of strategic weapon systems. The introduction of the Agni-V ICBM's and the Arihant-class SSBN's have significantly advanced its strategic capabilities. A votary against missile defenses during the Cold War, New Delhi is today keen on developing and fielding a sophisticated ballistic missile defense to protect itself from its nuclear adversaries. Its ASAT capability is a direct offshoot of its BMD program. Second, if fully embracing the logic of arms race is a significant departure, so has been the pragmatic turn in its policies on arms control and disarmament. India's *moralpolitik* of disarmament has given way to the *realpolitik* of weaponisation. Lastly, India's rapid strides in strategic weapons have also reconfigured the global perceptions around its ambitions to acquire hard power based on high technology. If in the 1990s and early 2000s, India's strategic weapons program evoked fear and sanctions around the globe, today it hardly registers any significant

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[22] Laxman Behera, "Mission Shakti: what next," IDSA, 10 April 2019, https://www.drdo.gov.in/drdo/pub/npc/2019/April/din-10april2019.pdf.

[23] See Gaurav Kampani, "India's Long Nuclear Journey: How Secrecy and Institutional Roadblocks delayed India's Weaponization," *International Security*, Vol. 38. No. 4 (Spring 2014), pp. 79-114.

[24] C. Raja Mohan, "India's Nuclear Exceptionalism," In Sverre Lodgaard and Bremer Maerli (eds.), *Nuclear Proliferation and International Security*, (New Delhi: Routledge, 2007), pp. 152-171.

reactions from other global powers. The recent ASAT is yet another manifestation of the above mentioned changes in Indian policy towards strategic weapon systems

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