Indian Direct Ascent Anti-satellite Testing

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Summary

Over the last decade, India has shifted from a purely civil space program to one that includes military capabilities. In March 2019, India tested a direct ascent anti-satellite (DA-ASAT) system by destroying one of its own satellites after a failed attempt a month earlier. While India continues to insist that this was merely a demonstration and it is against the weaponization of space, it is possible that India is moving toward an offensive counterspace posture.

Direct Ascent ASAT Programs

DA-ASATs use a ground, air, or sea-launched rocket to place a kinetic kill vehicle (KKV) on a ballistic trajectory up into space. After separation from the rocket, the KKV uses onboard guidance, navigation, and control systems to identify and track a targeted space object and fine-tune its trajectory to create a hypervelocity collision. DA-ASATs are very similar to midcourse missile defense interceptors, with the difference being the missile defense targets are also on ballistic trajectories. Unlike a co-orbital ASAT, the DA-ASAT KKV itself does not have enough velocity to achieve orbit and any resulting fragments are likewise unlikely to remain in orbit unless they were part of an orbital object that was struck. While India has had dedicated programs for ballistic missiles and missile defense, it is only recently that those capabilities have been translated into DA-ASAT capabilities.

Indian DA-ASAT Development

Following the Chinese 2007 anti-satellite weapon test, many Indian officials worried about what it meant for the militarization of space. This, combined with other contextual disputes and concerns about China's role in the Asia-Pacific, led many leaders to begin considering whether India should have its own ASAT capabilities.[1] Dr K. Kasturirangan, former head of the Indian Space Research Organisation (ISRO), said in September 2009 that "India has spent a huge sum to develop its capabilities and place assets in space. Hence, it becomes necessary to protect them from adversaries. There is a need to look at means of securing these."[2] Over the ensuing decade, Indian officials adjusted their take on developing and testing ASAT technology from simply ground simulation to needing to have "all the building blocks… in place" as V.K. Saraswat, who was then the head of India's Defence Research and Development Organisation (DRDO), stated.[3] At the time, he said they had "no plans for offensive space capabilities."[4]

In 2017, India began a series of interceptor tests against suborbital targets with the Prithvi Air Defense (PAD) system (later to be replaced by the Prithvi Defense Vehicle, or PDV) and the Advanced Area Defense (AAD) system.

PDV-Mk II leaving Abdul Kalam Island launch site. Image credit: Indian Government

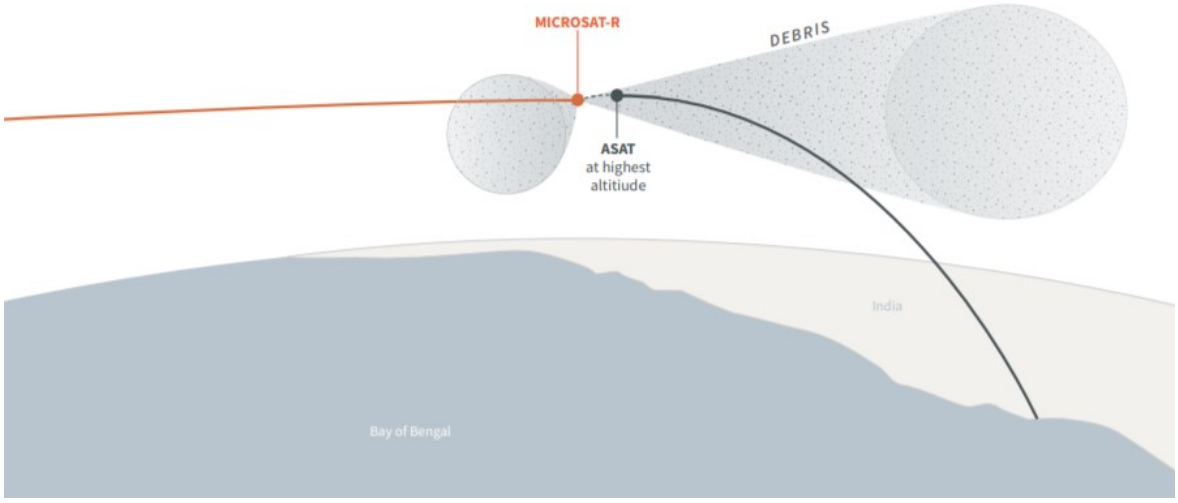

Diagram of the 2019 Indian KE ASAT Test. Image credit: Aerospace Security Project / Emily Tiemeyer

The PDV was successfully test-fired suborbital at 97 km in February 2017 and intended to provide exo-atmospheric intercepts.[5] It was tested again in September 2018 and was able to "successfully engage" its target.[6] The AAD was launched in March 2017 to make a successful intercept at an altitude of 15-25 km[7] and was later tested in August 2018, successfully destroying its target, which was surrounded by decoys.[8] The AD-1 missile was successfully flown for the first time in a November 2022 test and was designed to be able to provide both endo-and exoatmospheric intercepts.

On February 12, 2019, India attempted to launch and test their first ASAT weapon against Microsat-R, one of India's military imaging satellites launched previously that year.[9] The solid-fueled PDV failed thirty seconds into flight. At the time, India gave a vague announcement that they would be conducting a missile test; yet, it was unclear whether it would be of ASAT capabilities. It was not until the successful test later in March that the outside observers noted the same trajectory and target satellite passing overhead for the both the failed and successful tests.

On March 27, 2019, the Indian Prime Minister announced that they had successfully conducted Mission Shakti, where a PDV MK-II interceptor successfully destroyed Microsat-R at an altitude of about 300 km. In a fact sheet released about the ASAT test, the Indian government explained, "The test was done to verify that India has the capability to safeguard our space assets. It is the Government of India's responsibility to defend the country's interests in outer space," but went on to say, "We are against the weaponisation of Outer Space and support international efforts to reinforce the safety and security of space-based assets."[10] After the test, DRDO chair G. Sateesh Reddy stated, "We don't need any more tests in this orbit now," but did not rule out tests at higher orbits.[11]

Indian officials downplayed concerns about large amounts of debris being created by this test, stating that the intercept was at a low enough altitude that most of the debris would reenter in a few days, with the entirety of it coming back down within 45 days at most.[12] However, the intercept created 130 pieces of trackable debris with some pieces thrown to an altitude of more than 1000 km due to collision dynamics.[13] As of February 2023, no trackable debris remained on orbit. While there was some international outcry over the further weaponization of space and the creation of debris in highly trafficked orbits such as that of the ISS, due to the overall smaller amount of debris than previous destructive tests many countries remained silent.[14]

A prime motivation for the test was likely to ensure India would be grandfathered into any future ban on DA-ASAT testing. Successfully demonstrating their own DA-ASAT capability might have been a political prerequisite for India to support discussions on a future ban and showcase their strength as a new spacefaring superpower. While it is possible that Indian officials would decide to test another ASAT, this capability is more likely to be useful as a bargaining chip or a way to demonstrate that India is keeping pace with China.

Summary of Known or Suspected Indian ASAT Tests in Space

Date	Interceptor	Launch Site	Target	Altitude Reached	Debris Created [14]	Comment
Feb. 12, 2019	PDV-MK II	Abdul Kalam Island	Microsat-R	suborbital	0	Booster failed within 30 seconds, no intercept
March 27, 2019	PDV-MK II	Abdul Kalam Island	Microsat-R	300 km	130	Successfully intercepted orbital target

Endnotes

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