CENTRE FOR AIR POWER STUDIES

In Focus

New Delhi

CAPS InFocus: 21/2024

26 November 2024

Advent of India's Hypersonic Atmnirbharta

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Source: Source: pib.gov.in

Keywords: Hypersonic Missile, HGC, HCM, HSTDV, DRDO, Atmanirbharta

The successful flight test of India's first long-range hypersonic missile is a great success for India. The trial was conducted by the Defence Research and Development Organisation (DRDO) on Dr APJ Abdul Kalam Island, off the coast of Odisha, in the late evening of November 16, 2024. This hypersonic missile is designed to carry various cargoes for the Armed Forces at a distance greater than 1,500 km.[1] This flight trial of India's first long-range hypersonic missile by the DRDO is a major milestone for India's strategic vision. This achievement places India in a select group of nations possessing such advanced military technology.[2]

Significance

Cruise hypersonic missiles travel at speeds over five times the speed of sound in the stratosphere, about 6200 km per hour. This is comparable to an intercontinental ballistic missile. The arrangement of a hypersonic glide vehicle allows it to manoeuvre during flight, either towards the target or to avoid a defence shield. Such missile manoeuvres make them challenging to the adversary's detection and interception capabilities.

In recent years, there has been a growing emphasis on development of the hypersonic missiles. Major powers such as the United States, China and Russia are pursuing the development of advanced hypersonic missile systems designed to effectively penetrate the opponent's heavily fortified targets. The recent deployment and use of hypersonic missiles by Russia in the Russia-Ukraine conflict has sparked interest in this new technology. At the same time, there are concerns about the effectiveness of such missiles after Ukraine said it had shot down several of Russia's Kinzhal missiles.[3]

Indian Impetus to Hypersonic Technology

Hypersonic technology refers to projectiles that travel at speeds in excess of five Mach. Its launch system consists of "Hypersonic Glide Vehicles (HGV)" and "Hypersonic Cruise Missiles (HCM)" systems. An HGV is a glide vehicle, initially propelled by a rocket to reach the upper atmosphere. Once it re-enters Earth's atmosphere, it glides the rest of the way towards its destination.[4]

India has been working on the development of hypersonic missiles for the past few years. Defence Minister Rajnath Singh, in a DRDO-organised seminar in mid-December 2021, had asked scientists to work towards developing hypersonic missile technology. The DRDO has made tireless and sincere efforts to develop hypersonic technology, beginning with the Hypersonic Technology

Demonstration Vehicle (HSTDV) project. This project deals with hypersonic air-breathing scramjet technology.[5]

With the flight test of the HSTDV conducted at 1103 hours on September 7, 2020, from the Dr APJ Abdul Kalam Launch Complex at Wheeler Island, off the coast of Odisha, the DRDO was able to successfully demonstrate the hypersonic air-breathing scramjet technology.[6]

A tried and tested solid rocket engine was used to launch the hypersonic cruise vehicle. This motor was able to propel the vehicle to an elevation of 30 kilometres, where the aerodynamic heat shields were split at a hypersonic speed. There was a planned separation between the launch vehicle and the cruise vehicle, and the air intake was opened as expected.

For about 20 seconds, hypersonic combustion was sustained and the cruise vehicle proceeded along its designated flight path at a velocity six times that of sound, or two Kilometers per second. Specific events, such as the fuel injection and auto-ignition of the scramjet, were critical demonstrations of the maturity of the technological system. The scramjet engine operated in accordance with established protocols.[7]

Implications on India's Strategic Vision

Technological Advancement: India is deeply interested in developing and maturing indigenous hypersonic technology, which has given impetus to hypersonic capabilities.

The development of hypersonic missile technology demonstrates India's technological prowess and its ability to innovate in cutting-edge fields.[8]

Enhanced Military Capability: Hypersonic missiles are extremely difficult to intercept due to their high speed and manoeuvrability. In a major boost to its military prowess, India has successfully flight-tested a long-range hypersonic missile off the coast of Odisha, an achievement that has put the country in a select group of nations having the weapon that can strike with extreme speed and evade most air defence systems.

Defence Minister Rajnath Singh described the missile test on Saturday under the country's first long-range hypersonic mission as a "stupendous" achievement and a "historic moment". This significantly enhances India's military capabilities, making it a formidable force in the region.[9]

Strategic Deterrence: The possession of hypersonic missiles gives India a powerful tool for strategic deterrence, as potential adversaries would need to consider the devastating consequences of such a weapon.

Strengthening India's Position: This achievement solidifies India's position to enhance its military strength and carve out a strategic place in South Asia and globally.

Balancing Regional Power Dynamics: This achievement reasserts India's position as a regional and global military power. India can now exert its power more confidently and meet future contingencies with more confidence.

Promoting India's "Make in India" Initiative: The hypersonic missile test thus indicates India's upward trajectory in its military-industrial complex. The indigenous development of this missile reinforces India's commitment to self-reliance in defence technology, reducing its dependence on foreign suppliers. It encourages the growth of investment in indigenous research and development under the 'Make in India' programme, which creates optimism about aspiring India's future defence system.

Enhancing International Partnerships: The recent advancements made by India in hypersonic missile technology could lead the country to cooperate with other countries in the area of military technology and thus introduce greater safety for the world.

Escalation of New Arms Race

Presently, all the major powers, including France, Germany, Australia, Japan, Iran and Israel, are also involved in the race for the development of hypersonic missile systems. Number of states are developing hypersonic missiles, which have become a threat that brings along an arms race. The deployment of these missiles potentially changes the balance of power and affects the strategic balance. For instance, these missiles reach their stipulated targets in very short time to surprise the enemy. Therefore, an effort to promote the non-proliferation of hypersonic missiles merits consideration by the world. Though the defence technology and production know-how of hypersonic missiles today are limited to a few selected states only, it will be challenging to limit its control.

Conclusion

The successful flight trial of the long-range hypersonic missile marks a significant step forward in India's strategic objectives. It enhances India's military capabilities, strengthens its deterrence

posture, and positions India as a global leader in advanced technology. Nevertheless, dedicated R&D efforts are required to advance the missile systems by enhancing their capabilities as well as addressing their vulnerabilities.

Notes:

[1] "DRDO carries out successful flight-trial of India's first long-range hypersonic missile off the Odisha coast", *PIB*, November 17, 2024, https://pib.gov.in/PressReleasePage.aspx?PRID=2073994#:~: text=This%20missile%20has%20been%20indigenously,various%20other%20DRDO%20laboratories%20and. Accessed on November 17, 2024.

[2] "DRDO Conducts Historic Flight Trial of long range Hypersonic Missile", *The Times of India*, November 17, 2024, https://timesofindia.indiatimes.com/india/drdo-conducts-historic-flight-trial-of-long- range-hypersonic-missile/articleshow/115376058.cms#:~:text=This%20is%20a%20historic%20moment,of%20such%20critical%20and%20advanced. Accessed on November 17, 2024.

[3] Ahmed Ali, "Global Arms Race for Hypersonic Missiles must be halted", Strategic Vision Institute (SVI), October 4, 2023, https://thesvi.org/as-russia-china-and-the-us-pursue-hypersonic-missiles-a-global-non-proliferation-treaty-is-needed/. Accessed on November 17, 2024.

[4] Mahnoor Saghir, "India's Hypersonic Ambitions and it's Ratifications for Regional Strategic Stability", The Global Defense Insight, May 19, 2024, https://defensetalks.com/indias-hypersonic-ambitions-and-its-ratifications-for-regional-strategic-stability/. Accessed on November 20, 2024.

[5] Dr DK Pandey, "Hypersonic Missiles With Heat-Seeking Technology", Chankya Forum, April 5, 2023, https://chanakyaforum.com/hypersonic-missiles-with-heat-seeking-technology/. Accessed on November 19, 2024.

[6] "DRDO successfully flight tests Hypersonic Technology Demonstrator Vehicle", *PIB*, September 7, 2020, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1651956. Accessed on November 17, 2024.

[7] Ibid.

[8] Dipti Ravi Sharma, "Tracking the Advancement of India's Hypersonic Ambitions", CLAWS, July 16, 2024,

https://www.claws.in/tracking-the-advancement-of-indias-hypersonic-ambitions/#:~:text=The%20achievement%20demonstrates%20that%20India,in%2Ddepth%20knowledge%20of%20precision. Accessed on November 17, 2024.

[9] "India successfully tests long-range hypersonic missile in historic trial", *The Business Standard*, November 17 2024, https://www.business-standard.com/external-affairs-defence-security/news/india-successfully-tests-long-range-hypersonic-missile-in-historic-trial-124111700079_1.html. Accessed on November 17, 2024.