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DRDO's hypersonic glide missile debuts at Republic Day parade: Its features, strategic significance

The DRDO is displaying LR-AShM along with its launcher. The missile system is designed to meet the coastal battery requirements of the Indian Navy. Here's how it will boost the Navy's firepower.

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The ballistic missiles are a category of missiles that utilise projectile motion to deliver warheads. (YouTube/IndianExpress)

At the 77th Republic Day Parade on Kartavya Path, the highlight of the Defence Research and Development Organisation (DRDO) display is the Long Range Anti-Ship Hypersonic Missile

(LR-AShM), which it is showcasing for the first time. We explain the features and capabilities of this hypersonic glide missile, and also what other hypersonic missiles India is developing.

LR-AShM: the hypersonic glide missile

The DRDO is displaying LR-AShM along with its launcher. The missile system is designed to meet the coastal battery requirements of the Indian Navy. The LR-AShM is capable of engaging static and moving targets and is designed to carry various payloads to a range of around 1,500 kilometers.

This missile follows a quasi-ballistic trajectory with hypersonic speeds starting at Mach 10 (multiples of speed of sound) and maintaining average Mach 5 with multiple skips. Ballistic missiles are boost-powered initially and then travel unpowered on a high, arched trajectory. Quasi-ballistic missiles begin ballistically but fly lower and manoeuvre in flight to change course and evade interception.

As this missile flies at low altitudes with high speed and manoeuvrability, enemy ground and ship-based radars cannot detect it. The LR-AShM is configured with a two-stage solid propulsion rocket motor system. These propulsion systems boost the missile to the required hypersonic velocities. Stage-1 of the vehicle is separated after it is spent. After Stage-II burnout, the vehicle performs an unpowered glide with required manoeuvres in the atmosphere before engaging the target, the DRDO has said.

"It has high aerodynamic efficiency which means that it moves through the air with minimal drag while generating effective lift and control, allowing it to fly farther, faster, or more accurately using the same amount of energy," a DRDO scientist said.

Strategic significance and road ahead

The obvious advantages of the hypersonic speed is it makes it difficult for missiles to be detected. It can cover its range around 1,500 kilometers in 15 minutes. Versions with higher ranges upto 3,500 kilometers are currently at various stages of development.

A senior DRDO scientist said, "All classes of warships can be neutralised with the missile. This variant and the upcoming ranges will be a key asset for sea denial operations, which prevent an adversary from using a maritime area for military or commercial purposes. This capability will be crucial for the strategically significant Indian Ocean region. Army and Air Force versions of these missile and ship-fired versions for the Navy are also said to be either under

consideration or under development. With its versatility, it could well place India in the hypersonic arms domain."

One of the known successful tests of the missile was done by DRDO on November 16, 2024 from the Dr APJ Abdul Kalam Island off the coast of Odisha. As part of the further development cycle, the missile warhead and sensor mechanisms will be integrated soon, before its induction into the Navy in two to three years. This missile takes some key components from the submarine-launched ballistic missile Sagarika or K-15, which is from the K missile family and also from the Brahmos supersonic cruise missile.

Other hypersonic cruise missiles

Amidst cutthroat global competition in hypersonic weapons, DRDO is working on two key hypersonic technologies. One is hypersonic glide and another is hypersonic cruise. LR-AShM is a hypersonic glide vehicle and includes in itself major achievements in indigenous technologies like materials and control systems needed for sustained hypersonic flight.

Hypersonic cruise missiles fly within the atmosphere at hypersonic speeds using scramjet engines for sustained powered flight and manoeuvrability.

Ramjets are air-breathing engines that compress incoming air using forward motion, with fuel igniting in a combustion chamber; they require an assisted take-off and work best around Mach 3, losing efficiency at hypersonic speeds. Scramjets improve on ramjets by keeping airflow supersonic in the combustion chamber, enabling efficient operation above Mach 5, but are far more complex to design and operate.

In a path-breaking milestone achieved earlier this month, DRDO conducted ground tests of its Actively Cooled Scramjet Full Scale Combustor, achieving a run time of over 12 minutes. This significant achievement had built upon the earlier subscale test conducted on April 25 last year for more than 1000 seconds.

Earlier in September 2020, DRDO successfully demonstrated the hypersonic air-breathing scramjet technology with the flight test of Hypersonic Technology Demonstration Vehicle from Dr APJ Abdul Kalam Launch Complex.