

Scramjet : how it works, why it matters

SUSHANT KULKARNI

PUNE SEPTEMBER 7

THE DEFENCE Research and Development (DRDO said on Monday that Hypersonic Technology Demonstrator Vehicle (HSTDV), which is an unmanned scramjet vehicle that can travel at six times the speed of Sound.

What is a Scramjet?

Scramjets are a variant of a category of jet engines called air-breathing engines. When an engine can handle airflows of speeds in multiples of speed of sound, the vehicle can operate at those speeds. Hypersonic speeds are five times the speed of sound, or more. The unit tested by the DRDO can achieve up to six times the speed of sound or Mach 6 (over 7,000) km per hour or around 2 km per second.

For the test on Monday, the hypersonic combustion sustained and the cruise vehicle continued on its desired flight path at velocity of Mach 6 for a period of 20 seconds. "The critical events like fuel injection auto ignition of scramjet demonstrated technological maturity. The scramjet engine performed in a textbook manner," DRDO said. While technology helps achieve hypersonic speeds, it comes with disadvantages, including very high cost and high thrust-to weight ratio.



DRDO's hypersonic vehicle, powered by scramjet engine. *PIB*

How did the test go?

It took place at 11:03 am at Dr. A.P.J. Abdul Kalam Launch complex at Wheeler Island, off the coast of Odisha. A solid rocket motor of the Agni missile was used to

take it to an altitude of 30 km where the cruise vehicle separated from the launch vehicle, and the air intake opened planned. The parameters of the test were monitored by multiple systems, and a ship was deployed in the Bay of Bengal to monitor performance during the cruise phase of the hypersonic vehicle. All parameters have indicated a resounding success, officials said.

A senior DRDO scientist said although the system was tested for a very short duration, it has given scientists a large set of a data points to work on for further development. Scientist believe that while the test in a major milestone, many more tests will have to be done to achieve the same level of technology as the US, Russia or China. " This is certainly a milestone, but developers will have to look at it as a stepping stone," a DRDO scientist said.

How was the technology developed?

It was developed indigenously, which will also boost future development of systems built with hypersonic vehicles at their core, including hypersonic cruise missile systems and also in the space sector. Defense Minister Rajnath Singh tweeted, " The DRDO has today successfully flight tested the Hypersonic Technology Demonstrator Vehicle using the indigenously developed scramjet propulsion system. With this success, all critical technologies are now established to progress to the next phase."

The DRDO started development of the engine in early 2010s. ISRO too had successfully tested such a system in 2016, DRDO conducted a test of this system in June 2019.

The DRDO special project consisted of contributions from its multiple facilities including the Pune-headquarterd Armament and Combat Engineering Cluster." At hypersonic speeds, the system has to handle temperatures to the range of 2500⁰ C as well as the air speed, and thus development of the material is one of the main challenges," said a DRDO scientist.