

The HSTDV is an unmanned scramjet demonstration aircraft for hypersonic speed flight. It is being developed as a carrier vehicle for hypersonic and long-range cruise missiles, and will have multiple civilian applications including the launching of small satellites at low cost. The HSTDV program is being run by the Defence Research and Development Organisation.

Hypersonic Technology Demonstrator Vehicle (HSTDV) - Successful Test by DRDO

1. HSTDV was tested at APJ Abdul Kalam testing range (Wheeler Island) in Odisha's Balasore.
2. India is only the fourth country in the world after the US, Russia and China to develop and test the technology that will pave the way for missiles that will travel at six times the speed of sound.
3. The launch was done using Agni missile booster.
4. The Agni solid rocket booster launched the cruise vehicle to an altitude of 30 Km, at this altitude the aerodynamic heat shields were separated at hypersonic speed. In the next step, there was separation of launch vehicle and cruise vehicle.
5. Hypersonic combustion sustained and the cruise vehicle continued on its desired flight path at a velocity of six times the speed of sound (Mach 6), which is nearly 2 km, for more than 20 seconds.
6. Ethylene was the fuel used by the scramjet combustor.

Hypersonic Technology Demonstrator Vehicle (HSTDV) - Monitoring of the Successful test

The successful test of HSTDV was monitored using the following

1. Ship deployed in the Bay of Bengal to monitor the performance during the cruise phase of hypersonic vehicle.
2. Electro-optical systems
3. Multiple tracking radars
4. Electro-optical systems

Hypersonic Technology Demonstrator Vehicle (HSTDV) - Critical Technologies Tested Successfully

India joined an elite club of 3 other nations to have successfully tested HSTDV. The reason is due to the advancements that need to be made in developing critical technologies. The following critical technologies were successfully tested

1. Thermo-structural characterisation of high temperature materials
2. Separation mechanism at hypersonic velocities
3. Sustained combustion at Hypersonic flow
4. Use of scramjet propulsion for ignition
5. Aerodynamic configuration for hypersonic manoeuvres
6. Importantly, the air-intake of the HSTDV opened as planned once it left the launch vehicle.

Hypersonic Technology Demonstrator Vehicle (HSTDV) - Advantages of successful test by DRDO

1. With this successful test of HSTDV mission, the Defence Research and Development Organisation (DRDO), said it has demonstrated capabilities for highly complex technology that will serve as the building block for NextGen Hypersonic vehicles and cruise missiles.
2. It can be used for launching satellites at low cost.
3. This test augurs well for the development of air-breathing in technologies in India.

Scramjet Engines

1. A scramjet (supersonic-combustion ramjet) is a ramjet engine in which the airflow through the engine remains supersonic, or greater than the speed of sound. Scramjet powered vehicles are envisioned to operate at speeds up to at least Mach 15.
2. Scramjet (supersonic combustion ramjet) is a variant of a ramjet airbreathing jet engine
3. Scramjet relies on high vehicle speed to compress the incoming air forcefully before combustion.
4. The scramjet is composed of three basic components: a converging inlet, where incoming air is compressed; a combustor, where gaseous fuel is burned with atmospheric oxygen to produce heat; and a diverging nozzle, where the heated air is accelerated to produce thrust. Unlike a typical jet engine, such as a turbojet or turbofan engine, a scramjet does not use rotating, fan-like components to compress the air; rather, the achievable speed of the aircraft moving through the atmosphere causes the air to compress within the inlet. As such, no moving parts are needed in a scramjet

Ramjet Engines

1. A ramjet, is a form of airbreathing jet engine that uses the engine's forward motion to compress incoming air without an axial compressor or a centrifugal compressor.
2. A ramjet-powered vehicle, requires an assisted take-off like a rocket assist to accelerate it to a speed where it begins to produce thrust.
3. Ramjets work most efficiently at supersonic speeds around Mach 3 (2,300 mph; 3,700 km/h). This type of engine can operate up to speeds of Mach 6 (4,600 mph; 7,400 km/h).

Speed - Different Classification

While referring to missile technology or space technology, one would often come across different types of speed namely subsonic speed, supersonic speed and hypersonic speed.

The below table gives simple difference between the above 3 mentioned speeds in terms of mach number and kilometer/hour (Km/hr)

Speed Classification	Mach Number	Km/hr
Subsonic speed	< 0.8	< 980
Supersonic speed	1.2 – 5.0	1,470 – 6,126
Hypersonic speed	5.0 – 10.0	6,126 – 12,251

Relevant Links

Defense Research and Development Organisation (DRDO)	Missiles Of India - List Of Types Of Missiles In India
Surface to Air Missile	Indian Space Research Organisation
Reusable Launch Vehicle - Technology Demonstrator (RLV - TD)	Aditya L1 - India's First Solar Mission