



Air Breathing Engines

Why in News?

Recently, the [Indian Space Research Organisation \(ISRO\)](#) has successfully conducted the hot test of **Scramjet Engine**, a type of [Air Breathing Engine](#).

- India is the fourth country to demonstrate the flight testing of a Scramjet Engine.

What are Air Breathing Engines?

▪ About:

- An air-breathing engine is an **engine that takes in air from its surroundings in order to burn fuel**.
- All practical air breathing engines are **internal combustion engines that directly heat the air by burning fuel**, with the **resultant hot gases used for propulsion** via a propulsive nozzle.
- A continuous stream of air flows through the air-breathing engine. The air is compressed, mixed with fuel, ignited and expelled as the exhaust gas.
- **Thrust produced** by a typical air-breathing engine is about **eight times greater than its weight**.
 - The thrust **results from the expulsion of the working gases from the exhaust nozzle**.

▪ Types:

- **Ramjet:** A ramjet is a form of air-breathing jet engine that **uses the vehicle's forward motion to compress incoming air for combustion** without a rotating compressor.
 - Ramjets work **most efficiently at supersonic speeds** but they are not **efficient at hypersonic speeds**.
- **Scramjet:** A scramjet engine is an **improvement over the ramjet engine as it efficiently operates at hypersonic speeds** and allows **supersonic combustion**.
- **Dual Mode Ramjet (DMRJ):** A dual mode ramjet (DMRJ) is a type of jet engine where a **ramjet transforms into a scramjet over Mach 4-8 range**, which means it can **efficiently operate both in subsonic and supersonic combustion modes**.

Speed Range	Mach Number	Velocity in m/s
Subsonic	< 0.8	< 274
Transonic	0.8-1.2	274-412
Supersonic	1.2-5	412-1715
Hypersonic	5-10	1715-3430
High-hypersonic	10-25	3430-8507

▪ Significance:

- Air Breathing Engine provides a technological key for **low-cost space transportation system**.
- The technology is an important step towards developing reusable launch vehicles.
- Basically, of the total launch vehicle mass, 86% is propellant mass in the launch vehicle. Out of that propellant, 70% is oxidiser.
 - These engines can **reduce nearly 70% of the propellant** carried in the vehicles

as these systems use atmospheric oxygen, which is available up to a height of 50km from the earth's surface.

[Source: TH](#)

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