Semi Cryogenic Engine

Source: ISRO

Indian Space Research Organisation (ISRO) successfully conducted a **short-duration hot test** of its **semi cryogenic engine** at the **ISRO Propulsion Complex (IPRC), Mahendragiri.**

- A short-duration hot test involves briefly firing the engine using actual fuel to **verify its ignition and performance under real operating conditions.** This test marks the 2nd milestone, following the first successful hot test conducted in March 2025.
- **Semi Cryogenic Engine:** It is a li**quid rocket engine** that uses **liquid oxygen (LOX)** as an oxidizer and **refined kerosene (RP-1)** as fuel.
    - Designed to power the booster stages of future heavy-lift launch vehicles, semi-cryogenic engine's LOX-kerosene combination offers higher density impulse than cryogenic systems, enhancing **propulsion performance.**
    - Additionally, **kerosene is cheaper and easier to handle** than liquid hydrogen, reducing costs and simplifying operations.
    - The successful development of this semi-cryogenic engine will boost ISRO's payload capacity and support future launch vehicles like the **Next Generation Launch Vehicle (NGLV).**
- **NGLV :** It is a cost-efficient, reusable heavy-lift rocket being developed by ISRO, designed to carry up to **30 tonnes to Low Earth Orbit,** with a reusable first stage.
    - It features a **3-stage design** with **LOX engines for the first two stages and a cryogenic upper stage.**
    - NGLV aims to support **communication satellite launches**, **deep space missions**, and **future human spaceflight** and cargo missions.

Cryogenic vs Semi-Cryogenic Engines: Key Differences

Feature	Cryogenic Engine	Semi-Cryogenic Engine
Fuel	Liquid Hydrogen (LH_2) + Liquid Oxygen (LOX)	Refined Kerosene (RP-1) + Liquid Oxygen (LOX)
Fuel Temperature	LH_2 at −253°C, LOX −183°C	−183°C, Kerosene stored at ambient temperature
Complexity	High (due to handling ultra-cold LH_2, insulation challgengs)	Lower (kerosene is stable at room temperature)
Cost	Expensive (LH_2 production/storage costs, complex infrast-	Cheaper (kerosene is cost-effective, simpler logistics)
Thrust	Lower thrust but higher specific impulse (efficiency in vacuum)	Higher thrust (ideal for heavy-lift boosters)
Advantages	- High efficiency (specific impulse -450 sec) - Clean exhaust (water vapor)	- Higher thrust-to-weight ratio- Higher density impulse (more fuel storage) -Cost-effective

Read More: 3D Printed Cryogenic Engine and Space Sector Privatisation, NISAR Satellite.