Cryogenic Technology

Published On: 29-10-2022

Why is in news? ISRO tests engine for Gaganyaan successfully

Indian Space Research Organisation's **Propulsion Research Complex** (IPRC) **at Mahendragiri in Tamil Nadu's** Tirunelveli district has successfully conducted the '**Pressure Chamber Test' of the cryogenic engine** to be used in the Gaganyaan programme.

Sources in the IPRC said the pressure chamber test of C20 E11 MK III was conducted for about 30 seconds at Mahendragiri on Friday.

The test was conducted to check the efficacy of the engine to be used in **ISRO's prestigious Gaganyaan, which is designed for India's human spaceflight programme.**

The engine was fired for 30 seconds and the performance of the engine met the test objectives, the sources said.

Cryogenic Engine:

Cryogenics is the science that addresses the **production and effects of very low temperatures**.

A cryogenic rocket engine is a **rocket engine** that **uses a cryogenic fuel or oxidizer**.

That is, its fuel or oxidizer (or both) are **gases liquefied and stored at very low temperatures**.

Notably, Cryogenic engines were a crucial part of National Aeronautics and Space Administration **(NASA)'s Apollo missions** to the moon, and were also used by the **GSLV for the Chandrayaan-2 mission**.

Amongst all rocket fuels, **hydrogen** is known to provide the **maximum thrust**.

But hydrogen, in its **natural gaseous form**, is difficult to handle, and, therefore, not used in normal engines in rockets like PSLV. However, hydrogen can be used in liquid form.

The problem is hydrogen liquefies at very low temperature, nearly 250 degrees Celsius below zero.

To burn this fuel, oxygen also needs to be in liquid form, and that happens at about 90 degrees Celsius below zero.

Creating such a low-temperature atmosphere in the rocket is a difficult proposition, because it creates problems for other material used in the rocket. That's why cryogenic upper stage engines are used.

Only six countries have developed their own cryogenic engines: **the US, France/European Space Agency, Russia, China, Japan, and India**.

Why is Cryogenic Technology important for India?

Crucial for the advancement of the Space Programme – Cryogenic Engine is used by ISRO for its GSLV Programme.

Lighter weight - High energy per unit mass is released which makes it Economical.

Missile Programme for the Defence- Cryogenic technology is useful for the development of futuristic rocket engines.

Clean technology - Cryogenic technology uses Hydrogen and oxygen as fuel and releases water as a by-product. This is one of its greatest achievements as no pollution is caused by its use.

Edge over other countries - Earlier India was refused to be helped with technology by other countries. Only the US, Japan, France, Russia & China had this technology. Now, India stands neck to neck with them.