

Cryogenic Technology

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In news

Hindustan Aeronautics Limited has delivered the biggest cryogenic propellant tank (C32 LH2) made by it to the Indian Space Research Organisation, ISRO.

What is Cryogenic?

- Cryogenic means low temperature.
- The word itself refers to the technology of sub-zero temperatures. Cryogenic engines use liquid oxygen as the oxidizer and liquid hydrogen as the fuel.
- As it is known Oxygen can be kept in the liquid state below – 183 degrees Celsius, while hydrogen requires temperature below – 253 degree Celsius to be in liquid form.
- Since liquid oxygen is extremely reactive and combustible it can be used as a propellant to carry heavy loads.

Fundamentals of Cryogenic

- It is the study of production and behaviour of materials at extremely low temperatures that is below 150 degrees.
- It is useful for lifting things in space, storing medicines and drugs at low temperatures etc.
- It is used in the last stage of speed launch vehicles, SPVs.
- It also states that the cryogenic stage is the liquid propellant stage or solid propellant stage at extremely low temperatures.

ISRO and Cryogenic Technology

- **ISRO crossed an important milestone** in the development

of indigenous cryogenic upper stage for the GSLV when the first cryogenic engine was ignited at the Liquid Propulsion System centre, Mahendragiri.

- The engine made by LPSC was expected to be used as the **upper stage in the third launching of the GSLV.**
- Cryogenic engines are very useful in launching heavy satellite launch vehicles like GSLV.
- **India will become self-reliant** in its space programmer after the development of this technology.
- The realization of the cryogenic technology would also help India to become a partner in space explorations and activities of other countries.
- **Commercialization** of this technology will get India precious foreign currency.

What is the Geosynchronous Satellite Launch Vehicle (GSLV)?

- GSLV is a 49 m tall three stage vehicle with the first stage comprising a solid booster with four liquid strap-on motors, each weighing 40 ton.
- The second stage is a liquid engine and the third stage is the indigenously built Cryogenic Upper Stage (CUS) which uses 15 ton of cryogenic propellants such as Liquid Hydrogen (LH₂) as fuel and Liquid Oxygen (LOX) as Oxidiser.
 - The GSLV is capable of injecting 2500 kg. Class communication satellites into Geo-synchronous circular orbits at an altitude of 3600 km.

ISRO or Indian Space Research Organisation

- - India's space agency **founded in 1969** to help develop an indigenous Indian space program.

- **Headquartered in Bengaluru.**

- It is one of the **6 largest space agencies in the world** today.
- ISRO maintains one of the **biggest fleets of remote sensing (IRS) and communication (INSAT) satellites.**
 - **ISRO functions in the following areas:** broadcasting, weather forecasting, disaster management, geographic information systems, navigation, cartography (maps), telemedicine, distance education satellites, etc.

Major Achievement ISRO

- The **first Indian-made sounding rocket** was the RH-75 (**Rohini-75**). It weighed just 32 kg. Series of Rohini Sounding Rockets were developed **by ISRO for atmospheric and meteorological studies.**
- ISRO built its **first satellite in 1975 and named it Aryabhata.**
- The first Indian-built launch vehicle was SLV-3 and it was used to launch the Rohini satellite in 1980.
 - ISRO launched its **first INSAT satellite in 1982**. It was a communication satellite. The next communication satellite INSAT-1B was launched in 1983.
 - ISRO also launched the **first IRS (remote-sensing satellite) in 1988.**
 - ISRO has developed three types of launch vehicles (or rockets) namely, the **PSLV** (Polar Satellite Launch Vehicle), the **GSLV** (Geosynchronous Satellite Launch Vehicle) and Geosynchronous Satellite Launch Vehicle Mark III (**GSLV Mark III or LVM**).
 - ISRO launched its first lunar mission **Chandrayaan I in 2008.**
- It also launched the **Mars Orbiter Mission (MOM) or the Mangalyaan in 2014.** With this, India became the first country to achieve success in putting a satellite in the Mars orbit in its maiden attempt and the fourth space agency and the first space Asian agency to do so.
 - In 2017, ISRO created another world record by launching 104 satellites in a single rocket. It launched its heaviest rocket yet, the Geosynchronous Satellite Launch Vehicle-Mark III and placed the GSAT 19 in orbit. There are future plans for human spaceflight (**Gaganyaan**), interplanetary probes and a solar mission as well.