

GSLV Mk III

November 23, 2018

Manifest Pedagogy

UPSC concentrates on some big events of ISRO. The questions on those events would appear subsequently. Eg: MoM on 2014, Peace Prize to ISRO in 2015, IRNSS in 2017 etc. Hence, GSLV Mk-III, payloads of it in the past like GSAT-19 and GSAT-29, and the future payloads like Chandrayaan-2 and Gaganyaan become focal areas.

In news

GSAT-29 launch successful: ISRO takes another step closer to country's first manned mission

In syllabus

1. Science and Technology- developments and their applications and effects in everyday life.
2. Achievements of Indians in science & technology.
3. Indigenization of technology and developing new technology.
4. Awareness in the fields of Space

Static dimensions

1. GSLV and GSLV Mk-III
2. GSAT 29
3. Cryogenic engine

Current dimensions

1. India's space capabilities
2. Indigenization of technologies
3. Gaganyaan

Content

❌ **GSLV Mk-III Specifications:**

- It is a three-stage heavy lift launch vehicle.
- It has 3 stages:
 - With Two solid **strap-ons (S200)**
 - With a core **liquid booster (2 Vikas L110 engines)**
 - A **cryogenic upper stage (C25)** – powered by CE-20, India's largest cryogenic engine.
- It is designed to carry 4 ton class of satellites into Geosynchronous Transfer Orbit (GTO) or about 10 tons to Low Earth Orbit (LEO), which is about twice the capability of GSLV Mk II.

Payload GSAT-29:

- GSAT-29 is a multi-beam, multiband **communication satellite** of India.
- This is the **heaviest satellite** launched from India.
- It carries **Ka/Ku-band** high throughput communication transponders.
- It will bridge the digital divide of users including those in **Jammu & Kashmir and North Eastern** regions of India.
- It also carries **Geo-stationary High Resolution Camera**.
- **For the first time an optical communication payload** is being used for data transmission.

GSLV Mk III Launches till Date

SN	Title	Launch Date	Payload
3	GSLV Mk III-D2 / GSAT-29 Mission	Nov 14, 2018	GSAT-29
2	GSLV Mk III-D1 / GSAT-19 Mission	Jun 05, 2017	GSAT-19

SN	Title	Launch Date	Payload
1	LVM-3 / CARE Mission	Dec 18, 2014	Crew module Atmospheric Re- entry Experiment (CARE)

Launches in the future:

Date	Payload	Orbit
3 January 2019	Chandrayaan-2	GEO
TBD	GSAT-22	GEO
December 2021	Gaganyaan crewed orbiter(Indian Human Spaceflight Programme)	LEO

Cryogenic engine

A Cryogenic rocket stage is more efficient and provides more thrust for every kilogram of propellant it burns compared to solid and earth-storable liquid propellant rocket stages. Specific impulse (a measure of the efficiency) achievable with cryogenic propellants (liquid Hydrogen and liquid Oxygen) is much higher compared to earth storable liquid and solid propellants, giving it a substantial payload advantage.

However, cryogenic stage is technically a very complex system compared to solid or earth-storable liquid propellant stages due to its use of propellants at extremely low temperatures and the associated thermal and structural problems.

Liquid Oxygen (LOX) and Liquid Hydrogen (LH2) from the respective tanks are fed by individual booster pumps to the main turbo pump to ensure a high flow rate of propellants into the combustion chamber.

Oxygen liquefies at $-183\text{ }^{\circ}\text{C}$ and Hydrogen at $-253\text{ }^{\circ}\text{C}$. The

propellants, at these low temperatures are to be pumped using turbo pumps running at around 40,000 rpm.

ISRO's Cryogenic Upper Stage Project (CUSP) envisaged the design and development of the indigenous Cryogenic Upper Stage to replace the stage procured from Russia and used in GSLV flights.

Gaganyaan

- Gaganyaan is a fully autonomous spacecraft designed to carry a 3-member crew to orbit and safely return to the Earth after a mission duration of few orbits and up to seven days.
- The capsule is similar to the Soyuz-shaped re-entry spacecraft. The space capsule will have life support and environmental control systems.
- It will be equipped with emergency mission abort and emergency escape that can be done at the first stage or second stage of the rocket burn.

Test yourself: Mould your thoughts

GSLV Mk-III with indigenized upper stage cryogenic engine is a remarkable achievement of ISRO. Comment. Will this lead India to unexplored space endeavours?