GSLV-F10

For Prelims: Geosynchronous Satellite GSLV-F10/EOS-03 mission , Geosynchronous Satellite Launch Vehicle (GSLV), Types of launch vehicles.

For Mains: Space Technology, Types of launch vehicles and Related Issues.

Why in News?

In 2021, a high-level panel was established to examine the **failed Geosynchronous Satellite GSLV-F10/Earth Observation Satellites (EOS)-03 mission** and recommended measures for making the Cryogenic **Upper Stage (CUS)** more robust.

- The **Geosynchronous Satellite Launch Vehicle (GSLV)** with improvements added to its CUS is expected to be ready in the second half of this year.

What is a Geosynchronous Satellite Launch Vehicle (GSLV)?

- GSLV is a **space launch vehicle designed, developed, and operated by the** Indian Space Research Organisation (ISRO) to launch satellites and other space objects into **Geosynchronous Transfer Orbits.**
  - GSLV has been designed for **launching communication satellites.**
- Geosynchronous satellites are launched into orbit in the **same direction the Earth is spinning and can have any inclination.**
  - The satellites in the geosynchronous orbits appear to **remain permanently fixed in the same position in the sky.**
- GSLV has the capability to put a heavier payload in orbit than the **Polar Satellite Launch Vehicle (PSLV).**
- It is a **three-stage launcher with strap-on motors.**

What is Cryogenic Upper Stage?

- GSLV follows a **solid fuel first stage** with another **liquid fuel stage coming next. The second stage is followed by a third stage** known as **CUS.**
  - It was the rocket's **crucial third stage**, which then failed to ignite and led to the **failure of the GSLV-F10.**
- The 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.**

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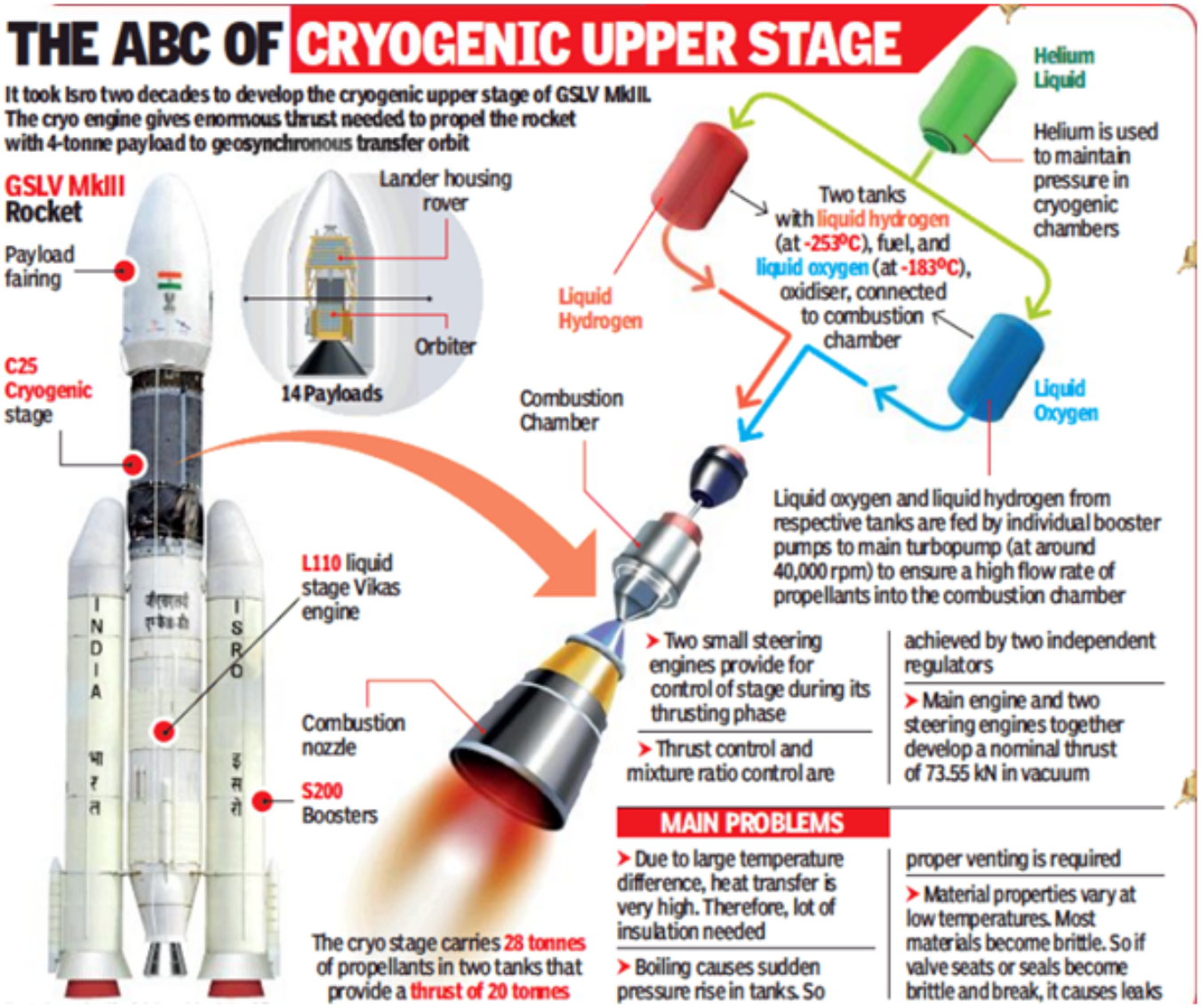

What are Earth Observation Satellites?

- **Earth observation satellites** are the satellites equipped with **remote sensing technology.**
  - Earth observation is the gathering of information about Earth's physical, chemical and biological systems.
- Many earth observation satellites have been employed on sun-synchronous orbit.
- Other earth observation satellites launched by ISRO include **RESOURCESAT- 2, 2A, CARTOSAT-1, 2, 2A, 2B, RISAT-1 and 2, OCEANSAT-2, Megha-Tropiques, SARAL and SCATSAT-1, INSAT-3DR, 3D, etc.**

	Launch vehicles used by ISRO
Satellite Launch Vehicle (SLV):	▪ The first rocket developed by ISRO was simply called **SLV, or Satellite Launch Veh** ▪ It was followed by the **Augmented Satellite Launch Vehicle or ASLV.**
Augmented Satellite Launch Vehicle (ASLV):	▪ SLV and ASLV both could carry small satellites, **weighing up to 150 kg**, to lower ea ▪ ASLV operated till the early **1990s before PSLV** came on the scene.
Polar Satellite Launch Vehicle (PSLV):	▪ PSLV's first launch was in 1994, and it has been ISRO's main rocket ever since. Today **and several times more powerful than the ones** used in the 1990s. ◦ It is the first Indian launch vehicle to be equipped with liquid stages. ▪ PSLV is the **most reliable rocket used by ISRO till date**, with 52 of its 54 flights b ◦ It successfully launched two spacecraft – **Chandrayaan-1** in 2008 and **Mars**

	later traveled to Moon and Mars respectively. ◦ ISRO **currently uses two launch vehicles – PSLV and GSLV** (Geosynchron there are lots of different variants of these.
Small Satellite Launch Vehicle (SSLV):	▪ SSLV is targeted at rising global demand for the launch of small and micro-satellites. ▪ SSLV is meant to offer **cost-effective launch services for satellites up to 500 kg** ▪ It is supposed to carry an indigenous earth observation satellite EOS-03 into space.
Geosynchronous Satellite Launch Vehicle (GSLV):	▪ GSLV is a much **more powerful rocket**, meant to carry **heavier satellites much d** rockets have carried out 18 missions, of which **four ended in failure.** ▪ It **can take 10,000-kg satellites** to lower earth orbits. ▪ The indigenously developed **Cryogenic Upper Stage (CUS),** forms the third stage o ▪ Mk-III versions have made ISRO entirely **self-sufficient for launching its satellites** ◦ Before this, it used to depend on the European Arianne launch vehicle to take ◦ GSLV-Mk III is **a fourth generation, three stage launch vehicle** with four developed CUS, which is flight proven, forms the third stage of GSLV Mk III. ◦ The rocket has three-stages with two solid motor strap-ons (S200), a liquid pr cryogenic stage (C-25).
Reusable Rockets/ Future Rockets:	▪ The future rockets are meant to be reusable. Only a small part of the rocket would be ▪ The bulk of it would **re-enter the earth's atmosphere and land very much like a** missions. ▪ Reusable rockets would **cut down on costs and energy,** and also reduce space deb problem because of the large number of launches. ▪ **Fully-reusable rockets are still to be developed,** but partially-reusable launch ve ▪ ISRO has **also developed a reusable rocket, called RLV-TD (Reusable Launch** which has had a successful test flight in 2016.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. With reference to India's satellite launch vehicles, consider the following statements: (2018)

1. PSLVs launch the satellites useful for Earth resources monitoring whereas GSLVs are designed mainly to launch communication satellites.
2. Satellites launched by PSLV appear to remain permanently fixed in the same position in the sky, as viewed from a particular location on Earth.
3. GSLV Mk III is a four-staged launch vehicle with the first and third stages using solid rocket motors, and the second and fourth stages using liquid rocket engines.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 and 3
(c) 1 and 2
(d) 3 only

Ans: (a)

Source: TH