



Small Satellite Launch Vehicle (SSLV)

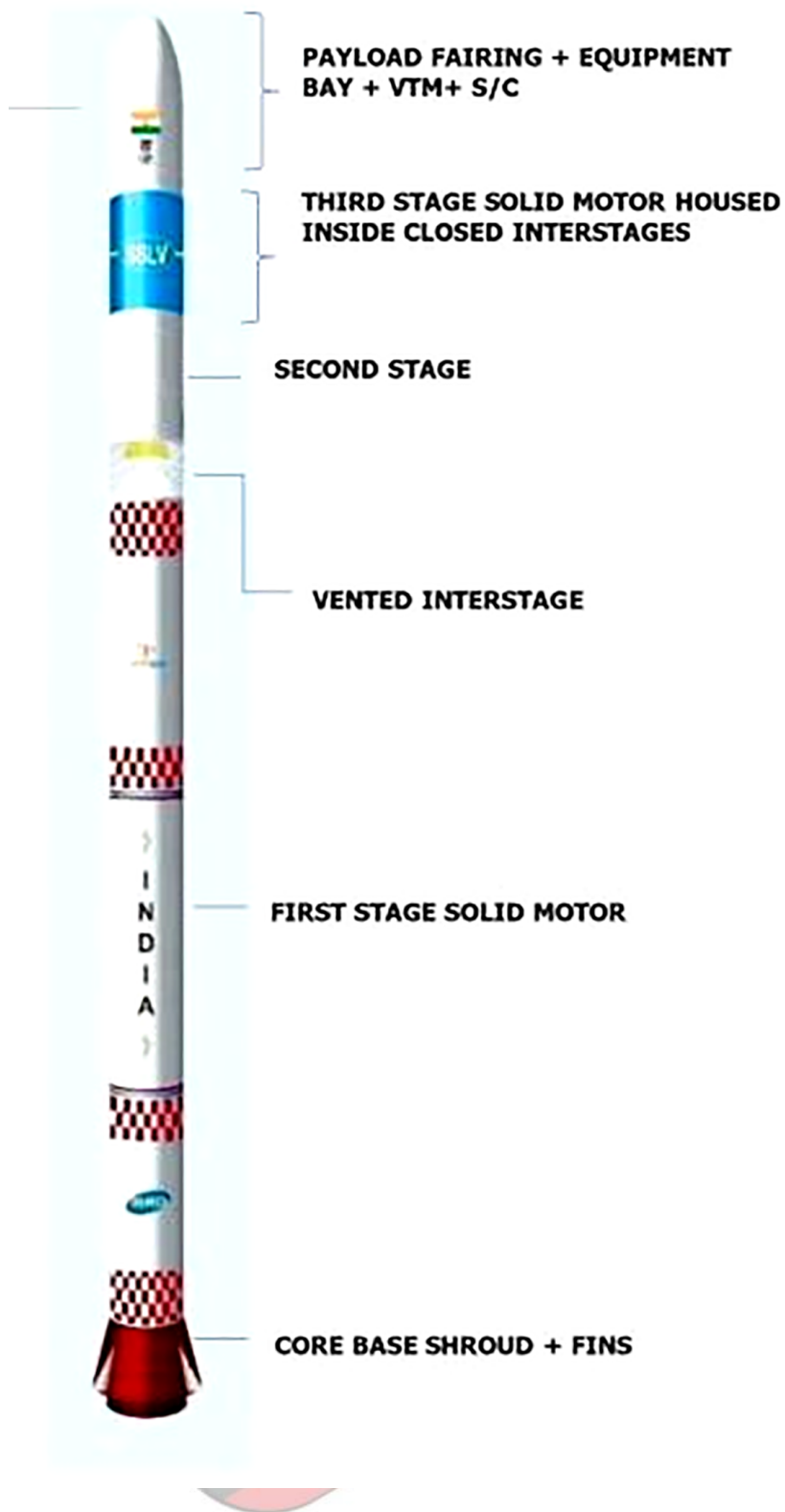
Why in News?

Recently, [Indian Space Research Organisation \(ISRO\)](#) launched the first flight of the [Small Satellite Launch Vehicle \(SSLV\)](#), carrying an [Earth observation satellite EOS-02](#) and co-passenger students' satellite [AzaadiSAT](#).

- However, the mission failed to place the satellites in their required orbits, and the satellites, as they were already detached from the launch vehicle, were lost.

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What is a Small Satellite Launch Vehicle?

- About:
 - **Small Satellite Launch Vehicle (SSLV)** is a **three stage Launch Vehicle** configured with **three Solid Propulsion Stages** and a **liquid propulsion-based Velocity Trimming Module (VTM)** as a terminal stage.
 - SSLV is 2m in diameter and 34m in length with a lift-off weight of around 120 tonnes.
 - SSLV is capable of launching 500kg satellites in 500km planar orbit from Satish Dhawan Space Centre (SDSC).

▪ Key Features:

- Low cost,
- Low turn-around time,
- Flexibility in accommodating multiple satellites,
- Launch demand feasibility,
- Minimal launch infrastructure requirements, etc.

▪ Significance:

◦ The Era of small satellites:

- Earlier, the bigger satellite payloads were given importance, but as the sector grew many players emerged like **Businesses, government agencies, universities, and laboratories began to send satellites.**
 - Mostly all of them fall in the category of small satellites.

◦ The Rise in Demand:

- The demand for the launch of small satellites has increased at a rapid pace in the last eight to ten years, **due to the ever-growing need for space-based data, communication, surveillance, and commerce.**

◦ Saves cost:

- Satellite manufacturers and operators do not have the luxury of waiting months for space on a rocket or paying exorbitant trip charges.
 - Therefore, Organizations are increasingly developing a constellation of satellites in space.
 - **Projects like SpaceX's Starlink and One Web are assembling a constellation of hundreds of satellites.**

◦ Business opportunity:

- With the rise in demand, the rockets could be launched frequently with less cost, this provides a business opportunity for space agencies like ISRO to tap the potential of the sector as most of the demand comes from companies that are launching satellites for commercial purposes.

What is the SSLV-D1/EOS-02 Mission?

- It was aimed at garnering a larger pie in the small launch vehicles market, as it could place the satellites into **Low Earth Orbit.**
- It was carrying the two satellites on board the rocket -
 - **The primary EOS-2 Earth-observing satellite-** EOS-02 is an earth observation satellite designed and realised by ISRO.
 - This microsat series satellite offers advanced optical remote sensing operating in infra-red band with high spatial resolution.
 - **The secondary AzaadiSAT student satellite-** It is an 8U Cubesat weighing around 8 kg.
 - It carries 75 different payloads each weighing around 50 grams and conducts **femto-experiments.**
 - It carried out tiny experiments which would have measured the **ionising radiation in its orbit** and also a transponder which worked in the ham radio frequency to enable amateur operators to access it.
 - **Girl students from rural regions across the country were provided guidance to build these payloads.**
 - The payloads are integrated by the student team of **"Space Kidz India".**

What was the Issue?

- The problem appeared to be the SSLV's terminal stage, called the **velocity trimming module (VTM).**
 - According to the launch profile, the VTM was supposed to have burnt for 20 seconds at 653 seconds after launch.
 - However, it burnt for only 0.1 seconds, denying the rocket the requisite altitude boost.
- The two satellites separated from the vehicle after the VTM burned, there was a malfunctioning of a sensor which resulted in placing the satellites **in an elliptical orbit, rather than a circular orbit.**

- According to **ISRO**, all the stages performed normally, both the satellites were injected. But the orbit achieved was less than expected, which makes it unstable.

What is the Difference between Circular and Elliptical Orbits?

- **Elliptical Orbits:**
 - Mostly objects such as **satellites and spacecrafts are put in elliptical orbits only temporarily.**
 - They are then either pushed up to circular orbits at a greater height or the acceleration is increased until the trajectory changes from an ellipse to a hyperbola and the spacecraft escapes the gravity of the Earth in order to move further into space — for example, to the Moon or Mars or further away.
- **Circular Orbits:**
 - **Satellites that orbit the Earth** are mostly placed **in circular orbits.**
 - One reason is that if the satellite is used for imaging the Earth, it is easier if it has a fixed distance from the Earth.
 - If the distance keeps changing as in an elliptical orbit, keeping the cameras focused can become complicated.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

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)

Exp:

- **PSLV is the third generation launch vehicle of India. It is the first Indian launch vehicle to be equipped with liquid stages.** It is used mainly for delivering various satellites in Low Earth Orbits, particularly the Indian Remote Sensing series of satellites. It can take up to 1,750 kg of payload to Sun-Synchronous Polar Orbits of 600 km altitude.
- GSLV is designed mainly to deliver Indian National Satellite System, or INSAT, which is a series of multipurpose geo-stationary satellites launched by ISRO to fulfil the needs of telecommunications, broadcasting, meteorology, and search and rescue operations. It places satellites to the highly elliptical Geosynchronous Transfer Orbit (GTO). **Hence, statement 1 is correct.**
- The satellites in the geosynchronous orbits appear to remain permanently fixed in the same position in the sky. **Hence, statement 2 is not correct.**
- GSLV-Mk III is a fourth generation, three stage launch vehicle with four liquid strap-ons. The indigenously developed Cryogenic Upper Stage (CUS), which is flight proven, forms the third stage of GSLV Mk III. It is capable to lift 4-5 tonne satellites into Geosynchronous Transfer Orbit (GTO). The rocket has three-stages with two solid motor strap-ons (S200), a liquid propellant core stage

(L110) and a cryogenic stage (C-25). Hence, statement 3 is not correct. **Therefore, option (a) is the correct answer.**

Mains

Q. What is India's plan to have its own space station and how will it benefit our space programme? **(2019)**

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