



# Reusable Launch Vehicle, RHUMI-1

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## Why in News?

India recently launched its **first reusable hybrid rocket, RHUMI-1**, developed by the Tamil Nadu-based **start-up Space Zone India**, to collect data for research purposes on [global warming](#) and [climate change](#).

- The rocket, carrying 3 **Cube Satellites** and 50 **PICO Satellites**, was launched into a suborbital trajectory using a mobile launcher.

### Note:

- **Cube satellites** are nano satellites that weigh between 1 to 10 kg.
- **Pico satellites** are smaller satellites, with weights ranging from 0.1 to 1 kg.

## What are the Key Features of RHUMI-1?

- **Hybrid Propulsion System:** The RHUMI-1 integrates both solid and liquid propellants, enhancing efficiency and lowering operational costs.
- **Adjustable Launch Angle:** The engine allows for **precise trajectory control** with adjustable angles ranging from 0 to 120 degrees.
- **Electrically Triggered Parachute System:** It has **advanced and eco-friendly** descent mechanism that ensures safe recovery of rocket components, offering both cost-effectiveness and environmental benefits.
- **Environmentally Friendly:** It is entirely free of **pyrotechnics (fireworks) and TNT (Trinitrotoluene)**, an odourless yellow solid used in explosives, highlighting its commitment to sustainability.

### Note:

- **Dr. A.P.J Abdul Kalam Students Satellite Launch Mission:** In 2023, this mission involved over 2,500 students from government, tribal, and public schools across India who contributed to designing and constructing a student satellite launch vehicle capable of carrying a payload of 150 Pico Satellites research experiment cubes.

## What are Reusable Launch Vehicles (RLVs)?

- **About:**
  - Reusable Launch Vehicles (RLVs) are spacecraft designed to be **launched, recovered,**

and launched again multiple times.

▪ **Advantages:**

- **Cost Savings:** Up to **65% cheaper** than building a new rocket for every launch.
- **Reduce Space Debris:** By minimising discarded rocket components.
- **Increased Launch Frequency:** Lesser turnaround time enables the rocket to be used more frequently.

▪ **Different from Multi-Stage Rocket:**

- In a typical multi-stage rocket, the **first stage is discarded after its fuel is exhausted** to reduce weight, allowing the remaining stages to continue propelling the payload into orbit.
- However, **RLVs recover and reuse the first stage.** After separating from the upper stages, the first stage descends back to Earth using engines or parachutes for a controlled landing.

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# ISRO LAUNCH VEHICLES

## BACKGROUND

- First rocket developed by ISRO - SLV (Satellite Launch Vehicle)
- Successor of SLV - Augmented Satellite Launch Vehicle (ASLV)

### Polar Satellite Launch Vehicle (PSLV)

**About**

- The Workhorse of ISRO
- 3<sup>rd</sup> gen, 4-Stage launch vehicle (1<sup>st</sup>, 3<sup>rd</sup> stages - solid fuel; 2<sup>nd</sup>, 4<sup>th</sup> stages - liquid fuel)

**Capacity**

- Delivers earth-observation/remote-sensing satellites
- Used to launch satellites of lower mass (~1400 Kg)

**4 Variants:** PSLV-CA, PSLV-DL, PSLV-DL, PSLV-XL

**Launches Satellites in:** Low Inclination LEO, Sub-GTO, GTO

**Important Launches**

- First successful launch - October 1994
- Chandrayaan-1 (2008)
- Mars Orbiter Spacecraft (2013)

PSLV is 1<sup>st</sup> Indian launch vehicle to be equipped with liquid stages

### Geosynchronous Satellite Launch Vehicle (GSLV)

**About**

- 4<sup>th</sup> Gen, 3-staged launch vehicle
- Much more powerful rocket, carries satellites much heavier into space
- Has an indigenous Cryogenic Upper Stage

**Capacity**

- Delivers communication-satellites
- Carries heavier satellites (~2200 kg to GTO)
- Carries 10,000-kg satellites to LEO

**Launches Satellites in**

- Primarily Geosynchronous Transfer Orbit (GTO) (~36000 Km altitude)

**Important Launches:** Chandrayaan-2, Upcoming Gaganyaan

### Launch Vehicle Mark-III

**About**

- Aka GSLV Mk-III
- 3-stage launch vehicle (2 solid propellant and 1 core stage comprising liquid and cryogenic stages)

**Capacity**

- 4,000-kg of satellites into GTO
- 8,000 kg of payloads into LEO

**Launches Satellites in**

- GTO
- Medium Earth orbit (MEO)
- LEO
- Missions to moon, sun

Mk-III versions have made ISRO entirely self-sufficient in launching its satellites

### Small Satellite Launch Vehicle (SSLV)

**About**

- Developed specifically for small and micro-satellites

**Capacity**

- Satellites up to 500 kg

**Launch Limit**

- 500 km planar orbit (LEO) from Satish Dhawan Space Centre

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## UPSC Civil Services Examination, Previous Year Question (PYQ)

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)**

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