



HS200 Solid Rocket Booster for Gaganyaan Mission

Why in News?

Recently, the [Indian Space Research Organization \(ISRO\)](#) has completed the static test of the **human-rated solid rocket booster (HS200)** for Gaganyaan programme.

What is the HS200 Solid Rocket Booster?

- The booster engine is **part of the Geosynchronous Satellite Launch Vehicle MkIII (GSLV Mk III) rocket** that will carry Indian astronauts to space.
 - The GSLV Mk-III rocket which will be used for the Gaganyaan mission will have **two HS200 boosters** which will supply the thrust for lift-off.
 - The HS200 is a 20-metre-long booster with a diameter of 3.2 metres and is the **world's second largest operational booster using solid propellants**.
- The HS200 is the **human-rated version of the S200 rocket booster of satellite launch vehicle [GSLV Mk III](#)**, popularly known as LVM3.
 - Since Gaganyaan is a crewed mission, the GSLV Mk-III will have improvements to increase reliability and safety to meet the requirements of 'human rating.'
- The S200 motor - the first stage of the LVM3 launch vehicle **designed to deliver 4,000 kg satellites to geosynchronous transfer orbit** - was configured as a strap-on rocket booster.
- This full-duration test of the first stage of the launch vehicle marks a major milestone for the Gaganyaan programme.
- Design and development of the HS200 booster was completed at the Vikram Sarabhai Space Centre (VSSC) in Kerala's Thiruvananthapuram, and propellant casting was completed at Sriharikota.
- Out of the three propulsion stages of LVM3, the human-rated versions of the second-stage known as L110-G loaded with liquid propellant and the third stage C25-G with cryogenic propellant are in the final phase of qualification, including tests with static firing.

What is GSLV?

- GSLV is a much more powerful rocket, meant to carry heavier satellites much deeper into space. Till date, GSLV 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 of GSLV Mk II.
- Mk-III versions have made ISRO entirely self-sufficient for launching its satellites.
 - Before this, it used to depend on the European Ariane launch vehicle to take its heavier satellites into space.
 - GSLV-Mk III is a fourth generation, three stage launch vehicle with four liquid strap-ons. The indigenously 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 propellant core stage (L110) and a cryogenic stage (C-25).

What is Gaganyaan Mission?

- **About:**
 - Gaganyaan is a mission by the [Indian Space Research Organisation \(ISRO\)](#).
 - Under the Gaganyaan schedule (to be launched in 2023):
 - Three flights will be sent into orbit.
 - There will be two unmanned flights and one human spaceflight.
 - The Gaganyaan system module, called the Orbital Module will have three Indian astronauts, including a woman.
 - It will circle Earth at a [low-earth-orbit](#) at an altitude of 300-400 km from earth for 5-7 days.
- **Payloads:**
 - **The payload will consist of:**
 - Crew module - spacecraft carrying human beings.
 - Service module - powered by two liquid propellant engines.
 - It will be equipped with emergency escape and emergency mission abort.
- **Launch:**
 - [GSLV Mk III](#), also called the LVM-3 (Launch Vehicle Mark-3,) the three-stage heavy lift launch vehicle, will be used to launch Gaganyaan as it has the necessary payload capability.
- **Training in Russia:**
 - In June 2019, the Human Space Flight Centre of the ISRO and the Russian government-owned Glavkosmos signed a contract for the training, which includes Russian support in the selection of candidates, their medical examination, and space training.
 - The candidates will study in detail the systems of the Soyuz manned spaceship, as well as be trained in short-term weightlessness mode aboard the Il-76MDK aircraft.
 - The Soyuz is a Russian spacecraft. The Soyuz carries people and supplies to and from the space station.
 - The Il-76MDK is a military transport plane specially designed for parabolic flights of trainee astronauts and space tourists.
- **Significance:**
 - It will help **in enhancement of science and technology levels** in the country and help inspire youth.
 - Gaganyaan will involve numerous agencies, laboratories, disciplines, industries and departments.
 - It will help **in the improvement of industrial growth.**
 - Recently, the Government has announced a new organisation, IN-SPACe, part of reforms to increase [private participation in the space sector](#).
 - It will **help in the development of technology** for social benefits.
 - It will help in improving international collaboration.
 - One [International Space Station \(ISS\)](#) put up by multiple countries may not be enough. Regional ecosystems will be needed and Gaganyaan will focus on regional needs: food, water and energy security.
- **India's Other Upcoming Projects:**
 - **Chandrayaan-3 Mission:** India has planned a new moon mission named [Chandrayaan-3](#). It is likely to be launched in 2022.
 - **Shukrayaan Mission:** The ISRO is also planning a mission to Venus, tentatively called Shukrayaan.

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)

- 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.**

Q. What is 'Greased Lightning-10 (GL-10)', recently in the news? (2016)

- (a) Electric plane tested by NASA
- (b) Solar-powered two-seater aircraft designed by Japan
- (c) Space observatory launched by China
- (d) Reusable rocket designed by ISRO

Ans: (a)

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