Mission Gaganyaan

Last Updated: August 2022

For Prelims: Gaganyaan Mission, Launch Vehicles

For Mains: Space Technology, Significance and Associated concerns with Gaganyaan Mission

Why in News?

Indian Space Research Organisation (ISRO) will conduct **two unmanned 'Abort Mission' in 2022 to ensure crew safety during the Gaganyaan mission.**

- This is a part of **ISRO's roadmap for the country's first manned flight to space.**
- The first test vehicle for this purpose was **launched in September 2021.**

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.

What are the 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.
- **XpoSat:** Space observatory, XpoSat, designed to study cosmic x-rays.
- **Aditya L1 mission:** It will see an Indian spacecraft going 1.5 million kms away to the L1 or Lagrangian point between the Sun and Earth.
    - There are five Lagrangian points between any two celestial bodies where the gravitational pull of both the bodies on the satellite is equal to the force required to keep the satellite in orbit without expending fuel, meaning a parking spot in space.

What are the Launch Vehicles used by ISRO?

Launch Vehicle	Significance
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.
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
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.
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 del 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.

What is the Significance of Gaganyaan Mission?

- **Enhancement of Science and Technology:**
    - 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 development of technology for social benefits.
- **Improvement of Industrial Growth:**
    - It will help in the improvement of industrial growth and also create employment opportunities in the private industry.
    - Recently, the Government has announced a new organisation, IN-SPACe, part of reforms to increase **private participation in the space sector.**
- **International Collaboration:**
    - 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.

What are the Associated Challenges?

- India does not even have the facilities to train astronauts.
- India is yet to perfect fool-proof launch vehicle technology, the basic requirement for a manned space mission.
- ISRO has not been able to put in place India's own Global Positioning System in spite of completing the **Navigation with Indian Constellation (NavIC)** due to dysfunctional atomic clocks in the satellites, rendering the fleet a dud.
- While the launch vehicle, crew module, re-entry technology, crew escape system are in place, monitoring and tracking systems, **Environmental Control & Life Support System (ELCSS)**, space suit and crew support systems are still in the developmental phase.

What can be the Way Forward?

- In terms of space technology, a manned space programme is the obvious next step for India.
- India cannot afford not to develop the technological capacity for manned space flight because that will represent a major drawback in Indian space capabilities.
- Even if the direct benefits of such advancement may not be as great in the short-term, this is a necessary longer-term investment.

UPSC CSE, Previous Year's Questions (PYQs)

Prelims

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

1. PSLVs launch 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)