GSLV-F10 Failure: ISRO's EOS-03 Satellite Mission

Why in News

Recently, **Indian Space Research Organisation (ISRO)** suffered the loss of an **important earth observation satellite (EOS-03)** during launch when the **GSLV rocket** carrying it malfunctioned about five minutes from the lift-off.

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.

Key Points

- **About the EOS-03:**
  - It was **capable of imaging the entire country four to five times every day.**
  - It was riding on a **GSLV rocket (GSLV-F10),** which has a **new payload carrier** designed to **significantly reduce aerodynamic drag** and thus carry larger payloads.
  - The rocket was supposed to **deposit the satellite in the geostationary transfer orbit,** from where the satellite's onboard propulsion system will **guide it to a geostationary orbit,** 36,000 km from earth's surface.
    - **Geostationary transfer orbit** is a circular orbit positioned approximately 35,900 km above Earth's equator and having a period of the same duration and direction as the rotation of the Earth.
    - An object in this orbit will appear **stationary relative to the rotating Earth.**

- **Significance:**
  - EOS-03, part of the **new generation of earth-observation satellites,** was meant to **provide almost real-time images** of large parts of the country.
    The images could be used for monitoring natural disasters like **floods** and **cyclones**, water bodies, crops, vegetation and forest cover.
  - EOS-03 was being sent **ahead of EOS-02** which has been delayed by the **Covid-19 pandemic.**
    - EOS-02 was supposed to be launched **around March-April this year,** but now has been **rescheduled for September-October.**
    - EOS-02 was supposed to ride on **ISRO's new SSLV (Small Satellite Launch Vehicle) rocket.**
    - SSLVs will broaden **ISRO's current rocket range** that comprises **PSLVs and GSLVs,** and cater to the increasing demand for launching of small commercial satellites.
- **EOS-01:**
  - In November 2020, ISRO had launched EOS-01, the first in the series of new earth observation satellites that bear a new generic naming system.
    It was launched by **Polar Satellite Launch Vehicle (PSLV)**, the third generation launch vehicle of India.
  - It is intended for applications in **agriculture, forestry and disaster management support.**

Geosynchronous Satellite Launch Vehicle (GSLV)

- GSLV is a space launch vehicle designed, developed, and operated by the ISRO to launch satellites and other space objects into **Geosynchronous Transfer Orbits.**
  Geosynchronous satellites are launched into orbit in the same direction the Earth is spinning and can have any inclination.
- 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.

Failure of the GSLV-F10

- **Reasons:**
    - **Liquid fuel strap-on boosters** start the launch of the satellite by providing the extra thrust needed to lift the rocket off the ground.
    - Then, follows a **solid fuel first stage** with **another liquid fuel stage** coming next. These two stages operated as expected.
    - It was the **rocket's crucial third stage,** which uses an **indigenously-made Cryogenic Upper Stage (CUS)** which then **failed to ignite.**
        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".
- **Impacts on the Future Missions:**
    - This was the **second launch ISRO** had lined up for 2021, which had **suffered multiple delays** after being originally scheduled for March 2020.
        Its successful mission was in February, which was **Brazil's earth observation satellite Amazonia-1** and 18 co-passenger satellites.
    - The failure **breaks a series of 16 consecutive successful** launches by ISRO since 2017.
    - Satellites had been planned for **2020-21,** including **OCEANSAT-3, GISAT-2, RISAT-2A,** etc. with these missions set to cost an estimated Rs 701.5 crore.
    - Missions like **Gaganyaan and Chandrayaan-3** will be launched on GSLV Mk-III, a more advanced version of the GSLV rocket that is designed to carry much heavier payloads into space.
    - It is a **big cause of worry for the NISAR mission**, a first-of-its-kind collaboration between NASA and ISRO for a joint earth-observation satellite.
        NISAR, which will use two synthetic aperture radars (SAR) to monitor the entire Earth in a 12-day cycle, is the most important mission as yet involving the GSLV Mk-II rocket.

Source: IE