ISRO brings down the Megha Tropiques satellite

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In news– The Indian Space Research Organisation brought down a satellite in a controlled manner after its end of life, for the first time recently.

About Megha Tropoiques satellite-

- **The weather satellite Megha Tropiques-1, which was developed as a joint mission by Indian and French space agencies,** entered the atmosphere after the final two manoeuvres recently and burnt up over the Pacific Ocean.
- It **was launched aboard a PSLV by the space agency in 2011**. And, although the **planned mission life of the satellite was only three years**, it continued providing data on water cycle and energy exchanges in the tropics for nearly a decade.
- With the progress made by GEWEX (Global Energy and Water Cycle Experiment), Megha-Tropiques was designed to understand tropical meteorological and climatic processes, by obtaining reliable statistics on the water and energy budget of the tropical atmosphere.
- It complemented other data in regional monsoon projects such as MAHASRI and the completed GAME project.
- It also sought to describe the evolution of major tropical weather systems. The focus was the repetitive measurement of the tropics.

Controlled re-entry-

- With over 120kgs of fuel remaining in the satellite even after being decommissioned, the space agency determined that there was enough to attempt a controlled re-entry, where a series of 20 manoeuvres over eight months lowered the orbit of the satellite such that it re-

entered the dense atmosphere in march 2023 and burned up.

- **This was the first time that the space agency attempted such a manoeuvre to clear out space debris** despite the satellite not being built to do so.
- **The re-entry was not really planned as part of the mission**; there was fuel left so Isro attempted it. Usually, satellites are left in their orbit and because of the gravitational pull of the earth, they come down to the atmosphere over years and years.

- **When the satellites re-enter the atmosphere, the friction causes it to heat up to extreme high temperatures of thousands of degrees Celsius.**
- Without a heat shield, 99% of a satellite gets burnt up whether in a controlled re-entry or an uncontrolled one.
- **A controlled re-entry like the one attempted by Isro recently** is **possible only for satellites in the low-earth orbit** – at **about 1,000 kms over the surface of the earth.** These manoeuvres, however, are not usually attempted because fuel reserves have to be maintained in the satellite after mission life is over.
- And, **this is impossible for satellites placed in geo-stationary or geosynchronous orbit – where time taken by the satellite to orbit the earth matches Earth's rotation** – because they are at altitudes of nearly 36,000 kms.

Why did Isro attempt a controlled re-entry?

- Other than extra fuel conveniently remaining in the satellite after the mission life ended, **Isro attempted the control re-entry to demonstrate and understand the process of doing so.**
- With several space fairing nations and private entities launching satellites, mostly in low earth orbits, it has become imperative **to keep the space clean**. There are thousands of objects flying around in these orbits; not

just old satellites and their parts but also last stages of the rockets that take them there. Moving at extremely high speeds, even the smallest debris can destroy active satellites.

- Scarier still is **Kessler syndrome – a scenario where the amount of space debris reaches a point where they just create more with one collision triggering others.**
- **This is the reason the space debris are monitored and sometimes satellites have to be moved from their way. Isro carried out 21 such collision course manoeuvres in 2022**.
- In fact, **the space agency set up a department in 2022 to monitor the space debris and mitigate the risks** posed.
- The space **agency was also following the guidelines of UN and the Inter-Agency Space Debris Coordination Committee** (IADC) that say satellites should be deorbited after mission life – either through controlled entry over a safe impact zone as was attempted by Isro with Megh Tropiques-1, or by bringing it down to reduce the orbital lifetime (the time it would take for a satellite to drop from a particular orbit by itself) to less than 25 years.
- It is also recommended that in such cases stored fuel be removed from the spacecraft to ensure that there are no accidents that break up the satellite in space and create more debris.
- In the case of Megha Tropiques-1, the orbit of 867 km with 20 degree inclination meant an orbital lifetime of over 100 years. And, there was over 120 kg of fuel left over in the spacecraft.