

Need for space sustainability

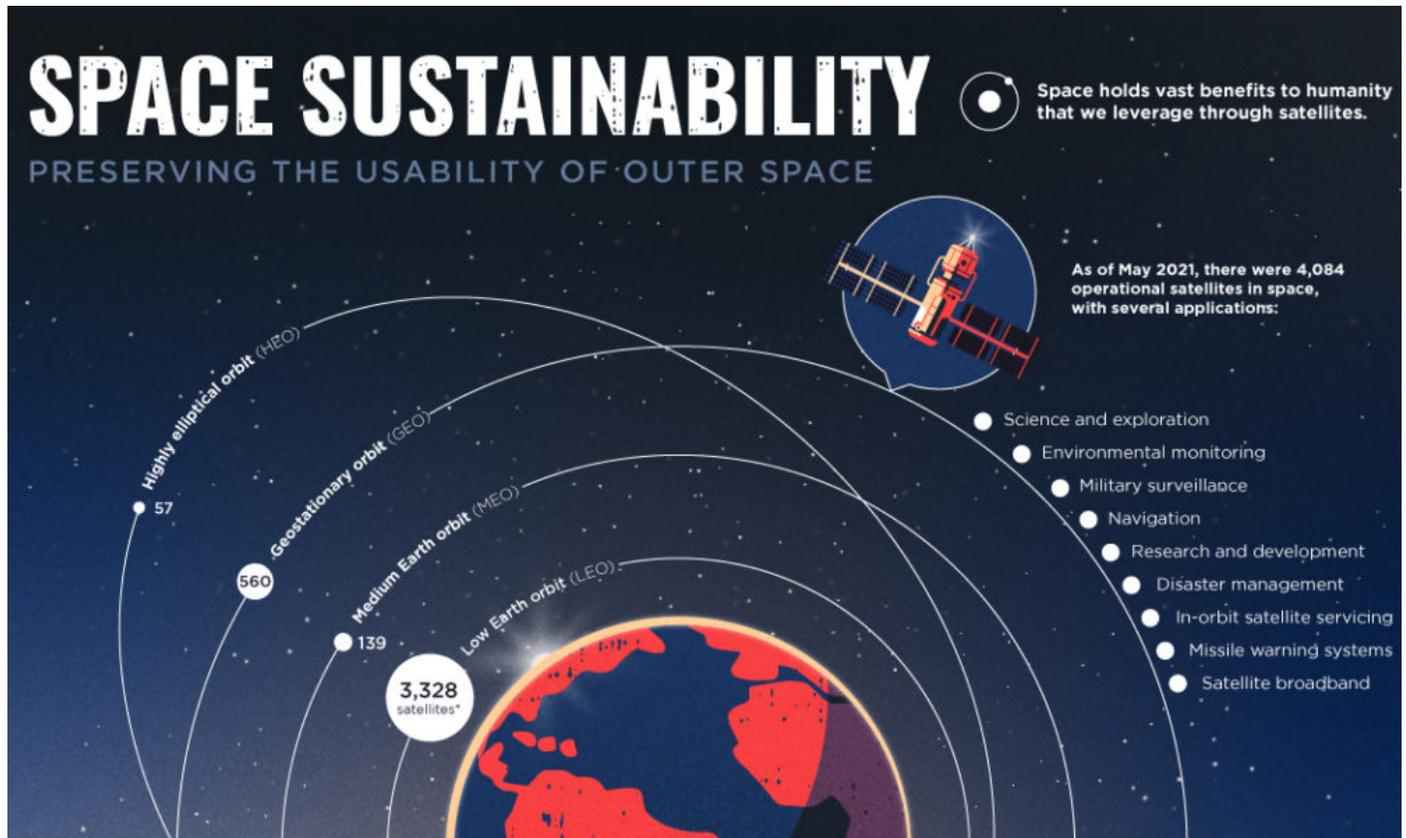
(GS Paper 3, Science and Tech)

Why in news?

- Recently, the U.K. hosted the **fourth summit for Space Sustainability in London** in collaboration with the Secure World Foundation.
- In line with the ambitious U.K. National Space Strategy, it announced a new '**Plan for Space Sustainability.**'

Aim:

- This plan aims to “set a global commercial framework for the insurability, the licensing and the regulation of commercial satellites.”
- It also aims to reduce the cost for those who comply with the best sustainability standards and thus encourages a thriving ecosystem for the industry.



What does sustainability in outer space mean?

- The earth’s orbital environment has more than tripled in the past decade. As the cost of missions reduce and the number of players increase, the complexity of missions and slot allotment issues also increase.
- With the emergence of large constellations and complex satellites, there is a risk of collisions and interference with radio frequencies.
- As the **outer space is considered a shared natural resource**, the **United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) in 2019 adopted a set of 21 voluntary, non-binding guidelines** to ensure the long-term sustainability of outer space activities.

Orbital crowding:

- One of the hot issues when it comes to space sustainability is orbital crowding. It poses a direct threat to the operations and safety of a mission and is likely to cause legal and insurance-related conflicts.

Space debris:

- Space debris is another prominent issue. After the completion of a mission, an ‘end-of-life protocol’ requires space objects to be moved to the graveyard orbit or to a low altitude. Neither of the options are sustainable in the long run.
- Other causes of concern are **solar and magnetic storms** which potentially damage communication systems. Such space weather threats need to be addressed along with the efforts to identify the terrestrial carbon footprint of outer space missions.
- Long-term sustainability looks toward space research and development of technology to ensure the **reuse and recycling of satellites at every stage**. The U.K. plan proposes active debris removal and in-orbit servicing.

What does the U.K. plan for space sustainability entail?

- The U.K. calls for an “**Astro Carta**” for space sustainability, based on the Artemis Accords model for sustainable space exploration.

The U.K. Space Sustainability plan mentions four primary elements:

- a) to review the regulatory framework of the U.K.’s orbital activity;
 - b) to work with organisations such as the G-7 and the UN to emphasise international engagement on space sustainability;
 - c) to try and develop safety and quality-related metrics that quantify the sustainability of activities; and,
 - d) to **induce additional funding of \$6.1 million** on active debris removal.
- The U.K. also confirmed investments in its **National Space Surveillance and Tracking Programme**, which works on collision assessment services for U.K.-licenced satellite operators.
 - Post-Brexit, the U.K. space programme has been transformed. It now hopes to drive the sustainability factor internationally and provide an opportunity for the private sector to develop models that enhance operations' safety and reduce debris footprint.
 - The U.K. aims to draw investments not only from government investors but also from others.

Where does India stand on space sustainability?

- The headquarters of the **Indian National Space Promotion and Authorisation Centre (In-SPACe)** was formally inaugurated in 2022.
- One can expect an increased role of the private sector in India’s space activities. India hosts promising **start-ups like Agnikul and Skyroot**, which are developing launch vehicles for small payloads and Dhruva Space, which works on high-tech solar panels for satellites and satellite deployers. India is well on its way to create a subsystem that addresses global sustainability questions.
- The Indian Space Research Organisation (ISRO) has initiated ‘**Project NETRA**’ to monitor space debris. The domestic surveillance system would provide first-hand information on the status of debris, which would aid further planning on protecting space assets.
- In April 2022, **India and the U.S.** signed a new pact for monitoring space objects at the 2+2 dialogue. The **controlled anti-satellite weapons (ASAT) tests** and the risk of collisions must be collectively addressed.

SPADEX:

- To provide in-orbit servicing, **ISRO is developing a docking experiment called ‘SPADEX’**.
- It looks at docking a satellite on an existing satellite, offering support in re-fuelling and other in-orbit services while enhancing the capability of a satellite.
- This would not only ensure the longevity of a mission but would also provide a futuristic option to combine missions/experiments.

Course of action:

- Outer space in the 2020s can no longer be considered a ‘space race’ because of the cost, when compared to the beginning of this century. Today, any entity (government or private) with the necessary access to resources and technology can invest in outer space. Sustainable practices in outer space would directly help reduce orbital crowding and collision risk while nurturing future technologies.
- As the natural course of evolution, the Plan for Space Sustainability, which includes private industries, is a timely move. This would serve as a model for other space programmes.

- However, the broad question of sustainability cannot be driven by one country/entity alone. While most National Space Programs set sustainability standards, a collective effort by all space players, with the **active role of the UN COPUOS or the United Nations Office for Outer Space Affairs (UNOOSA)**, is needed to set equitable standards for the ease of activities.
- Many of the measures for sustainability are resource-consuming and expensive for medium-and-small space programs. In this case, private initiatives of sustainability standards would make accessibility more challenging, giving undue advantage to programs with stable investments.

Way Forward:

- The UK's Astro Carta idea throws light on the need for addressing the principles and rules that guide the activities of entities in outer space. More clarity is required to know the exact framework and guiding principles of the Astro Carta to determine the path it intends to take.
- India has always emphasised cost-effective and efficient missions with problem-solving applications. Its debris footprint is minuscule; it has 114 debris among the 25,182 pieces, of sizes larger than 10 cm, in the lower earth orbits.
- The emerging private sector could be encouraged with a set of sustainability guidelines to ensure optimum utilisation of resources and increase the safety and productivity of missions.