1. Space Internet

Prelims Level: Space Technology

Mains Level: GS-III Awareness in Field of IT & Space

Why in News?

- The SpaceX, the world's leading private company in space technology, last week fired a spray of 60 satellites into orbit. Following last week's launch, the company has now deployed 122 satellites in orbit with a target of 12000 in all.

Space Internet:

- SpaceX announced the satellite Internet constellation in January 2015, and launched two test satellites in February 2018.
- The Starlink network, as the project is called, is one of several ongoing efforts to start beaming data signals from space, and also the most ambitious.
- This launch is the first operational batch of what is intended to eventually evolve into a constellation of nearly 12,000 satellites.
- They are aimed at providing low-cost and reliable space-based Internet services to the world.

Why Space Internet Services?

- This is mainly to ensure that reliable and uninterrupted Internet services is ensured across the world
- Currently, about 4 billion people, more than half the world's population, do not have access to reliable Internet networks.
- And that is because the traditional ways to deliver the Internet — fibre-optic cables or wireless networks — cannot take it everywhere on Earth.
- In many remote areas, or places with difficult terrain, it is not feasible or viable to set up cables or mobile towers.
- Signals from satellites in space can overcome this obstacle easily.

Orbital Details:

- Space-based Internet systems have, in fact, been in use for several years now — but only for a small number of users.
- Also, most of the existing systems use satellites in geostationary orbit.
- This orbit is located at a height of 35,786 km over the Earth's surface, directly above the Equator.

- Satellites in this orbit move at speeds of about 11,000 km per hour, and complete one revolution of the Earth in the same time that the earth rotates once on its axis.
- To the observer on the ground, therefore, a satellite in geostationary orbit appears stationary. Owing to their lower height, their signals cover a relatively small area. As a result, many more satellites are needed in order to reach signals to every part of the planet.
- Additionally, satellites in these orbits travel at more than double the speed of satellites in geostationary orbit — about 27,000 km per hour — to balance the effects of gravity.

Significance of Geostationary Orbit:

- One big advantage of beaming signals from geostationary orbit is that the satellite can cover a very large part of the Earth.
- Signals from one satellite can cover roughly a third of the planet — and three to four satellites would be enough to cover the entire Earth.
- Also, because they appear to be stationary, it is easier to link to them.
- But satellites in geostationary orbit also have a major disadvantage. The Internet is all about transmission of data in (nearly) real time.
- However, there is a time lag — called latency — between a user seeking data, and the server sending that data. And because data transfers cannot happen faster than the speed of light (in reality, they take place at significantly lower speeds), the longer the distance that needs to be covered the greater is the time lag, or latency.

Limitations:

- Three issues have been flagged — increased space debris, increased risk of collisions, and the concern of astronomers that these constellations of space Internet satellites will make it difficult to observe other space objects, and to detect their signals.
- To put things in perspective, there are fewer than 2,000 operational satellites at present, and fewer than 9,000 satellites have been launched into space since the beginning of the Space Age in 1957.
- Most of the operational satellites are located in the lower orbits.
- The European Space Agency (ESA) this year had to perform, for the first time ever, a “collision avoidance manoeuvre” to protect one of its live satellites from colliding with a “mega constellation”.