Space Satellite Garbage - The Earth Debris

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Introduction : Communications satellite, Earth-orbiting system capable of receiving a signal (e.g., data, voice, TV) and relaying it back to the ground. Communications satellites have been a significant part of domestic and global communications since the 1970s. Typically they move in geosynchronous orbits about 22,300 mi (35,900 km) above the earth and operate at frequencies near 4 gigahertz (GHz) for downlinking and 6 GHz for uplinking.

Keywords : Debries, satellite, signal, geosynchronous, downlinking, uplinking

Space Debris – Visualizing the Risk and Informing Stakeholders

Discussions : *Space debris* usually refers to the remains of spacecraft that have either fallen to Earth or are still orbiting Earth. Space debris encompasses both natural (meteoroid) and artificial (man-made) particles.

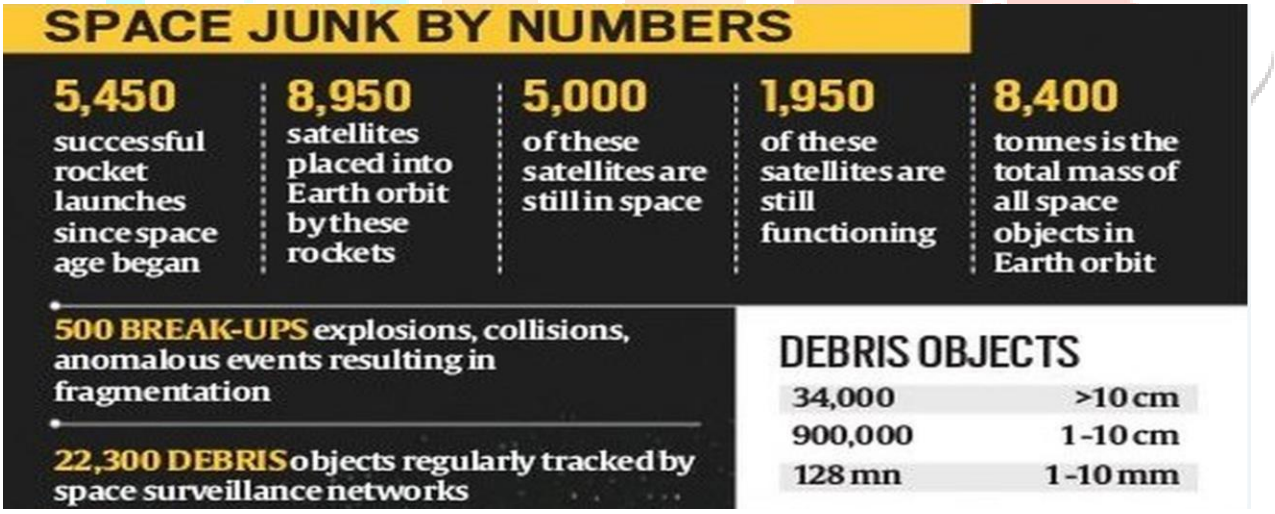
Artificial debris (also referred as orbital debris) includes non-functional spacecraft, abandoned launch vehicle stages, mission-related debris and fragmentation debris

Status of Orbital Debris: According to ESA's Space Debris Office, in almost 60 years of space activities, more than 5200 launches have placed some 7500 satellites into orbit, of which about 4300 remain in space; only a small fraction – about 1200 – are still operational today (data as on January 2017). Space junk will further increase due to –

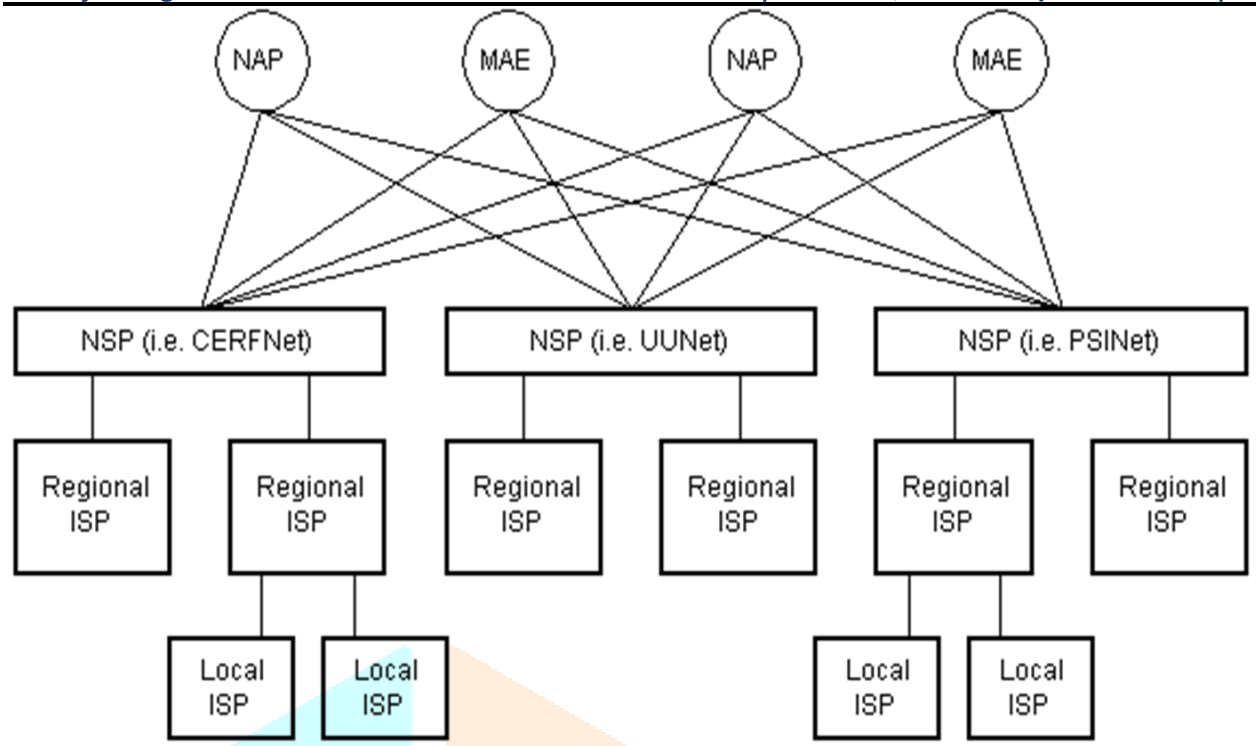
Launching of CubeSats (inexpensive, tiny satellites) are going to add space junk in coming years, entry of private players like SpaceX in the space domain and Kessler syndrome.

Threat due to Space debris: These pieces move at very great speeds, thus a collision with any other satellite in space could render that satellite dysfunctional, if not destroy it.

Debris Avoidance Manoeuvres (DAMs): If an object is assessed to have the potential to hit the International Space Station (ISS), then ISS navigates away from its normal trajectory which is called as DAMs.



The Internet's growth has become explosive and it seems impossible to escape the bombardment of *www.com*'s seen constantly on television, heard on radio, and seen in magazines. Because the Internet has become such a large part of our lives, a good understanding is needed to use this new tool most effectively.



Internet Infrastructure

The Internet backbone is made up of many large networks which interconnect with each other. These large networks are known as Network Service Providers or NSPs.

Some of the large NSPs are UUNet, CerfNet, IBM, BBN Planet, SprintNet, PSINet, as well as others. These networks peer with each other to exchange packet traffic. Each NSP is required to connect to three Network Access Points or NAPs.

At the NAPs, packet traffic may jump from one NSP's backbone to another NSP's backbone. NSPs also interconnect at Metropolitan Area Exchanges or MAEs.

MAEs serve the same purpose as the NAPs but are privately owned.

NAPs were the original Internet interconnect points. Both NAPs and MAEs are referred to as Internet Exchange Points or IXs. NSPs also sell bandwidth to smaller networks, such as ISPs and smaller bandwidth providers.

Below is a picture showing this hierarchical infrastructure.

As of 2021, the United States Space Surveillance Network was tracking more than 15,000 pieces of space debris larger than 10 cm (4 inches) across. It is estimated that there are about 200,000 pieces between 1 and 10 cm (0.4 and 4 inches) across and that there could be millions of pieces smaller than 1 cm.31-Jan-2022

Trashing space

A lot of effort has been spent to raise public awareness about environmental issues on Earth, related to the persistence of trash, the harm to the environment, the unsightliness and dangers of trash heaps and landfill. What if someone told you that humanity has the same problem in space, with the same serious consequences? Since nobody lives there on a permanent basis, you can describe the process as everybody leaving trash and waste from their picnic in a national park. And it has been piling up for over 60 years, since the first man-made object, Sputnik, launched into space. According to the European Space Agency, as of January 2017, the total mass of space debris in orbit is 7,500 tons, divided by size as follows:

29 000 objects >10 cm;

750 000 objects – from 1 cm to 10 cm;

166 million objects – from 1 mm to 1 cm.

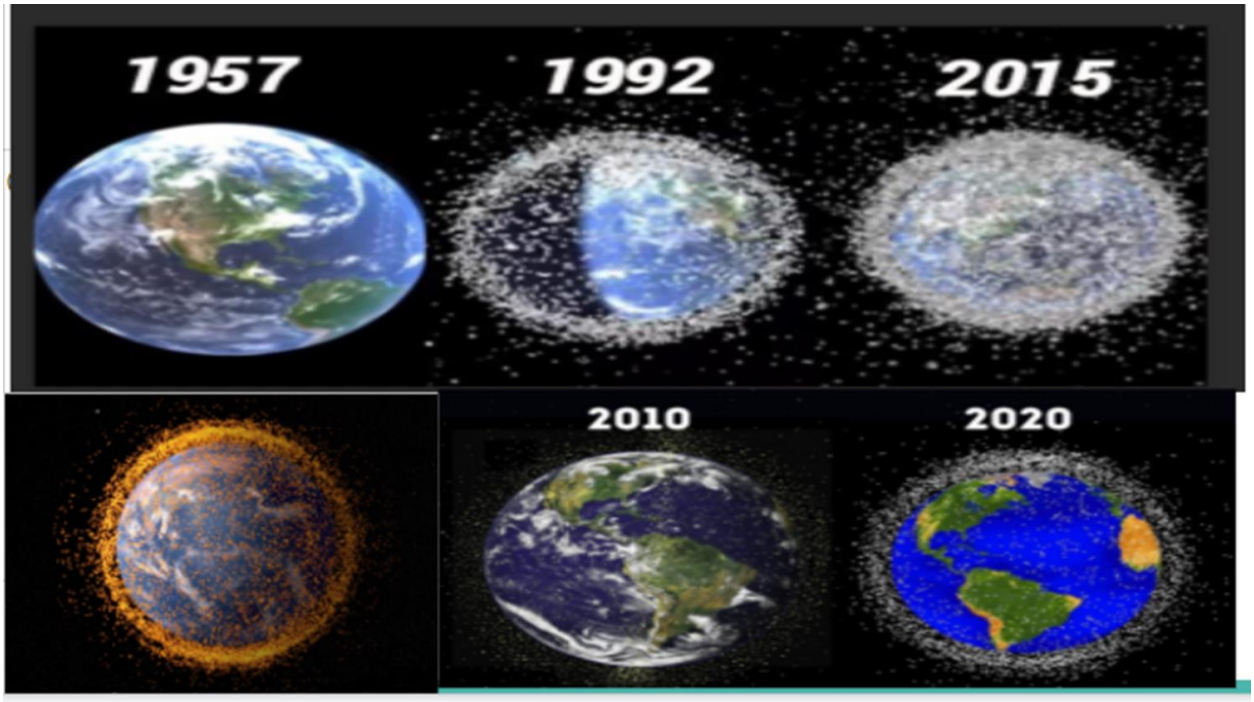
that orbital pollution will increase significantly. A report from the SATCOM1 workshop in 2020 concluded that the effects of large satellite constellations can severely affect some astronomical research efforts and lists six ways to mitigate harm to astronomy.Some notable satellite failures that polluted and dispersed radioactive materials are Kosmos 954, Kosmos 1402 and the Transit 5-BN-3. Using wood as an alternative material has been posited in order to reduce pollution and debris from satellites that reenter the atmosphere.

However, SpaceX, OneWeb, Boeing, Samsung, Telesat, and others are planning to launch more than 20,000 new satellites for broadband coverage, c. 16,000 into LEO & c. 4000 in MEO! Governments & universities will be launching other spacecraft into orbit as well.

List of Indian Satellites (1975-2022)

From India's first satellite Aryabhatta launched in 1975 to EOS-04 in 2022, India's space journey has spanned 47 years and over 120 satellites. In this article, we have mentioned a list of all the Indian satellites from 1947 to date.

With future increase in numbers of satellite constellations, like SpaceX Starlink, it is feared especially by the astronomical community, such as the IAU, that orbital pollution will increase significantly.



Everybody in a reasonably advanced society (and many of the not so advanced ones) uses products and services that are dependent on satellites and their specific capabilities, many of which cannot be substituted for on Earth. You may use satellite communications and weather prediction services, and sometimes you may use GPS (for transport, tourism and for tagging your friends on Facebook), but you are also consuming space services through intermediaries. Your Amazon order arrived safely, cheaply and on time through a GPS dependent global distribution service. The gadget you bought was the result of a globalized production chain kept viable by global communications, global transport and global finance. Your online payments, bank transactions and stock market investments are time stamped by atomic clocks located in GPS satellites. One day, you may even receive medical services or even have a robot perform surgery on you through telemedicine. And, in a crisis and emergency situation, space services such as Earth Observation are invaluable for decision makers and responders. The list goes on and on.

The Union of Concerned Scientists maintains an open source database of all satellites in Earth's orbit, though the current numbers are just a fraction of the number of satellites launched throughout the last half century.

Conclusion : Space systems are a critical enabler for a wide variety of applications which ultimately benefit billions of users and make the modern world, with its conveniences, possible. The risk profile of space systems is a complicated one and, for every application where they increase general efficiency and resilience, there is an instance where our increased dependence on space systems puts us at risk. This risk must be understood and managed through an appropriate system of governance which provides for the development and adoption of best practices, but also for collective action to protect mankind's interest in the global orbital environment. The space vulnerability cadaster is one such instrument, which lowers the opacity of the space debris threat to non-expert stakeholders and uses existing concepts and systems with which they are already comfortable working. The end result is not only more transparency, but also the gradual change of the incentive structure of space actors, whether national or corporate, in the direction of sustainable practices and exploitation of space. This approach complements existing space governance systems and plugs a few of the gaps regarding positive and negative reinforcements of beneficial behavior which was lacking in the existing system.

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