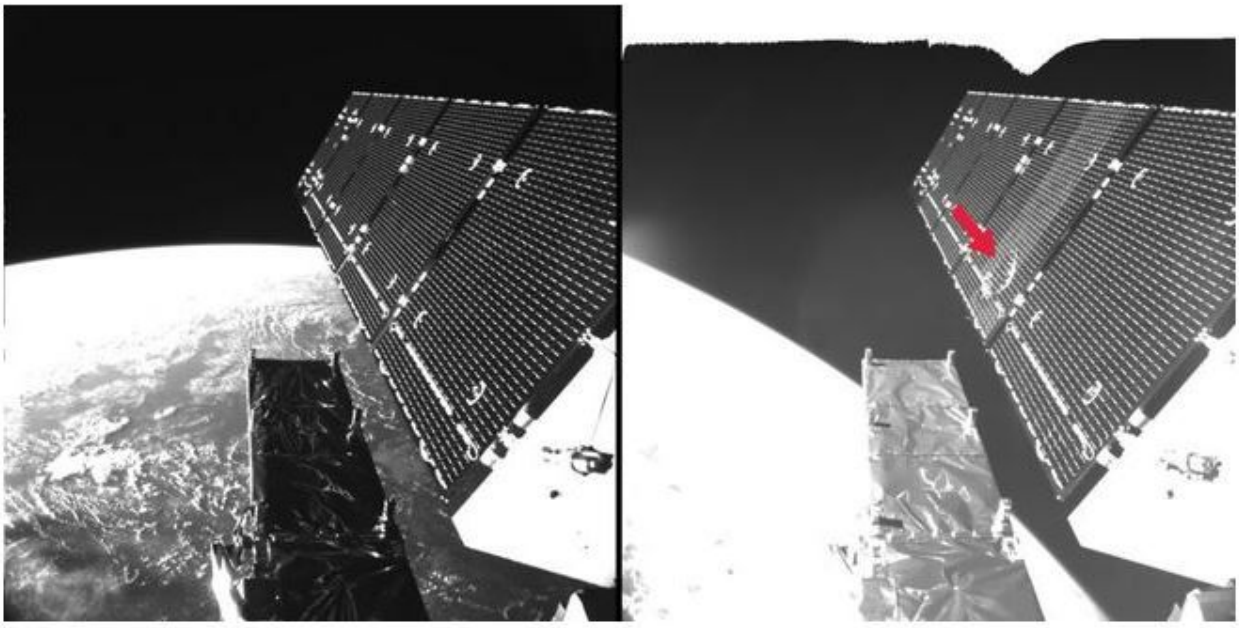
Aerospace Engineering

Resolving Space Junk

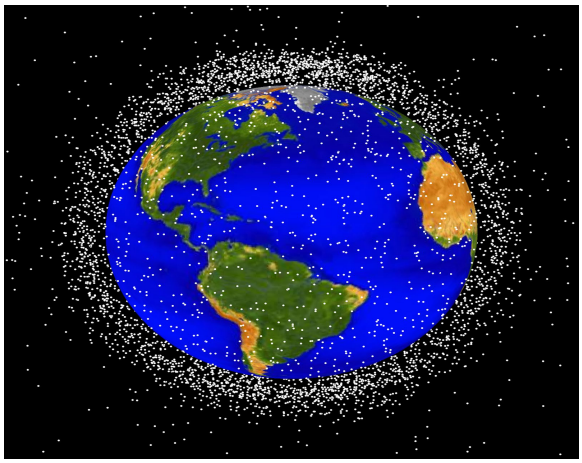
Diya Raman

Have satellites been affected by debris:



https://www.popsci.com/an-esa-satellite-was-hit-by-space-debris

In the past, satellites have been recorded to be hit by space debris. According to NASA, more than 500,000 pieces of debris or space junk have been reported to aimlessly orbiting the Earth. In addition, there are over 130 billion dollars, and about 100-150 tons worth of space debris surrounding our Earth. In the above picture it indicates the before and after images of a satellite being hit by debris and how much even the smallest piece of debris can be traveling at massive speeds can cause so much damage. For example, something as small as a paint particle from a leftover spacecraft can puncture the glass of a spacecraft. Essentially space satellites have been hit in the past repeatedly, just not to a critical point where the satellites have been damaged or needed to be replaced.



What happens when something comes near the satellite

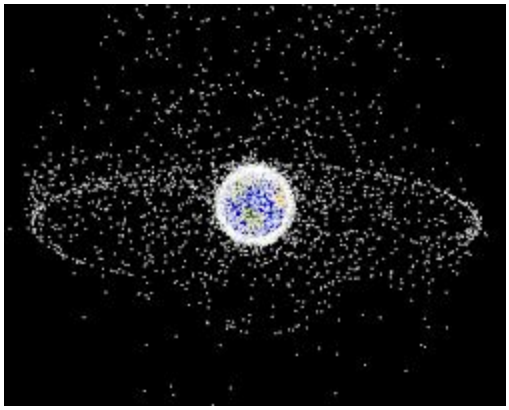
The laser satellite system functions with different aspects, first the motion sensors detect foreign particles that are nearing the system, the satellite is able to complete 360° turns in space. Lastly the satellite has a laser attached to it allowing the laser to aim at the debris and disintegrate it. Once it is converted to miniscule pieces it will be able to fall into the Earth's atmosphere where it can be burnt up. This method will be a completely new revelation when seeing the condition of space as it is now, as our planet is completely surrounded with junk. It will be able to significantly reduce the amount of space junk floating in space. In the near future, companies such as SpaceX are planning on launching many rocket ships into space in order to inhabit other planets such as Mars and essentially make the human race spacefaring and multiplanetary species. Many trips consequently will definitely be prone to different parts dismantling from the spacecraft which is where the laser would be useful in fragmenting the debris and the disposing of it.

How often does debris fly back in Earth

Although many pieces of debris that usually fall back burn up into the atmosphere of the Earth, there are larger particles that can surpass the heat and eventually reach the ground. According to NASA, an average of one piece of debris has fallen to Earth every day for the past 50 years. However it is *very* rare for people to be able to witness such events or even getting hit by the debris.

How will it get in orbit

The system will be launched into space the same way that satellites are. They are able to be typically launched in space shuttles where they are placed in the cargo bay. Due to the intensity of the satellite, in order for the rocket to be able to launch the satellite into space, the entire launch needs to be placed in a vertical orientation, that way the fuel consumption can be observed and preserved for the entire duration of the flight.



What is its lifespan

When the lifespan of a satellite is observed, there is a difference with the Low Earth Orbit (LEO) and the Geosynchronous Earth Orbit (GEO). The LEO is closer to the Earth, at an altitude of about 1200 miles and typically objects within that close proximity to the Earth do not last as long due to the rapid orbital decay. LEO satellites can span up to five years. In comparison, the GEO is much farther away, at 22,236 miles away from the Earth. GEO satellites can span up to The majority of the space junk is found in the LEO which means that the maximum lifespan of the system will be about five years.

How will it be powered

The main method to how the laser on the satellite will be powered is through the use of the sun, much like how satellites are currently powered. Satellites are currently powered through solar powered batteries and that is the most effective way to power it as especially in space the sun the the most abundant resource. The laser on the satellite will be fully functioning 24/7 and in order to meet its needs of that much constant power the sun would be the most useful resource. In addition the satellite has to be mobile as it can surround the Earth, surveilling it for debris. There are also motor sensors, also powered with solar powered batteries and it allows it to turn in 360° in case any debris happens to fly in from any direction and it will be able to detect it well in advance.

What happens once debris is hit by the laser?

Once the foreign particle is struck by the laser, the debris will disintegrate and then fall into the Earth's atmosphere where it is then burned. This system has considered the fact that there are very large pieces of space debris that are left over. Therefore the laser serves the purpose of

aiming and disintegrating it at a point that it is at a reasonable size to burn in the atmosphere of the Earth.

Are there precautions to satellites being hit by space junk?

Attached to the satellite system are motion sensors that allow the entire system to completely turn around well in advance to move around and disintegrate particles regardless of the speed the debris travels. Therefore this would be able to eventually eliminate all of the junk that space holds in a matter of time and number of satellite-laser systems to surround the Earth.