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Mitigation and Standards: status, lessons learnt and future with smallsats and constellations (4)

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DE-ORBITING SMALL SPACE DEBRIS THROUGH SPACE-BASED LASER SYSTEM: THE CASE OF NANO- AND PICO-SATELLITES FLEET

Abstract

The number of small-sized space debris orbiting at the LEO orbit has exceeded the limit by which the Kessler syndrome takes place to create more objects. Rapid and effective mitigations for overpopulation and exponential debris creation of these orbits are needed. For old defunct satellites or rocket bodies several technologies and techniques are under development, whereas for small objects whose number exceeds thousands and even millions there is still large room for development. One of the most promising and reasonable approach consists in the adoption of space-based laser technology. Studies show that high energy pulsed laser radiation is the most feasible to cope with objects in the size range of 10 cm and below. The beam is precise and can either deflect the object trajectory or force an object on the upper atmospheric layer trajectory where it burns up during re-entry.

Laser irradiation is precise and can be used effectively and is financially effective compared to other methods being put out. With the influx of small satellite launchers such as Vector and Rocket lab, lowering of launch costs per kilogram, using a space-based laser on the cube-sat bus makes a perfect pitch.

This paper outlines the advantages of space-based space debris laser technology as mitigation for space debris orbital overpopulation. Current research focuses on the method of mounting a fleet of nano- and pico- satellites with laser to de-orbit small objects on the most populated orbits. The technology tree is presented for a particular mission, including the launcher, number of satellites, the total combined energy of mounted satellites, the efficiency per period of time and further end of life procedure.