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MITIGATING ORBITAL DEBRIS IN LEO WITH HIGH POWER PULSED LASER

Abstract

There is a large amount of space debris in the size range of 1 to 10 cm that is orbiting the Earth at a very high velocity which could do tremendous damage to any space mission if it were to collide. This orbital debris has been generated from collision events between objects and fragmentations of objects in Earth orbits. The problem is that the amount of space debris is increasing exponentially with every major collision in space. To limit the probability of this happening, the rate of growth of space debris in orbit is being reduced through various design techniques employed in new space missions. However, the orbital debris already in space will require to be mitigated as well because in some of the bands,such as Low Earth Orbit (LEO),the density of space debris is very high. It is posing a threat to any operational satellite in orbit and the safety of spacecraft flights LEO is rather urgent.

The technique of using high power pulsed lasers on the ground has been viewed as the most feasible method to mitigate small space junk in the LEO band. It is one of the most viable solutions to mitigate the existing space debris in LEO. However, in order to design an effective orbital debris removal technique, the first logical step would be to gather as much information as possible on space debris that is known to exist within the orbital band of interest, like the two-line element of the space debris and its materials. This will help assess the design of the laser beam system and help give a more accurate picture of this de-orbiting strategy.

The objective of this poster is to provide a summary of the developed novel techniques for this de-orbiting model. It also presents the calculation and simulation of the required power that is necessary for the laser beam in order to slow down the orbital velocity of the space debris and also reduce its perigee. Reducing the space debris altitude by the amount necessary will significantly reduce its lifetime in Earth orbit and eventually cause it to re-enter the atmosphere where it will burn up.