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LASER BASED ACTIVE DEBRIS REMOVAL TECHNOLOGY FOR ENVISAT

Abstract

The 21st century is representing the progress of human knowledge in space, quantum mechanics, and machine learning. With this knowledge leads to the emerging market in space, that attracts organizations to develop mega-constellations in space to provide new business opportunities. While current predictions estimate that space in Low Earth Orbit will be overcrowded in the future, and sustainability of space will become a critical question as estimated traffic of 89,000 satellites will be launched by the year 2035.

To allow sustainable development of space, especially in Low Earth Orbit, need to develop accurate traffic management and active debris removal mission planning. Lately, several organizations proposed

and completed space demonstration experiments for debris removal. The current designs are part of an ongoing project to develop contact-based debris removal technology. However, this technology poses several problems for satellite removal. We propose a complementary method based on a laser-based debris removal system. It will equally contribute towards the safety and sustainability of space. This paper evaluates contactless debris removal technology reliably using a space laser system. The laser is capable to operate from a safer distance by stopping the continuous rotation (detumbling) of space objects. In this paper, we present a case study using the ENVISAT satellite. ENVISAT is an 8,211 kg satellite, launched by European Space Agency. Since 2012, communication has stopped, and it is no longer operational. It is predicted to self-deorbit in the next 150 years. However, the orbital simulation of existing objects found two cataloged space debris which will pass within 200 m., result in a close approach every year. The elevated mass of the satellite and the number of close approaches, therefore, pose a considerable threat for production of debris. SKY Perfect JSAT Corporation is working jointly with Japanese institutions to collaboratively develop laser satellite to stop detumbling and carefully remove debris. The demonstration mission will be launched by the year 2025 to carefully remove a debris of mass 150 kg. This will be followed by an operational mission will be by 2027. With this case study, a laser-based contactless method can be practiced for removing mega debris like ENVISAT from the Low Earth Orbit.