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APPROACHING A NEW ERA IN ORBITAL DEBRIS MITIGATION: A HOLISTIC OVERVIEW OF ECONOMIC AND ENVIRONMENTAL FACTORS

Abstract

The number of orbiting bodies in Low-Earth Orbit has increasingly grown in an unrestricted and unregulated manner over the last decade. One collision can potentially trigger a cascade effect that may affect the access to space for a long time span. To aid in the mitigation of such problem, the arrival of On-Orbit Servicing (OOS) capabilities brings hope into the panorama.

This new commercial market sets its foundations in the arising of New Space economy and has seen a marked development in the last years. Recently, several proofs-of-concept have been demonstrated and the economic interest in this sector, along with its implications in asset liability, has risen supported by the maturation of space technology and reduced launching costs.

While OOS can include services comprising very handy capabilities to expand the lifetime of a spacecraft by simply refueling it or refurbishing damaged parts, it also brings the possibility of decommissioning inoperative spacecraft.

Active Debris Removal (ADR), consisting in the act of altering the orbit of a purposeless body in space with the sole intention of disposing it, can make use of different methodologies to accomplish such task: either by performing an orbit transfer towards a graveyard orbit or even reaching escape velocity, or by forcing that body into the atmosphere.

However, the effect of spacecraft incineration on Earths atmosphere is yet lightly studied, and the long-term impact on the sustainability of the mesosphere remains unknown. Simultaneously, the first trailblazing missions to demonstrate the feasibility of ADR through atmospheric incineration are around corner, leading to a new perspective on how to approach liability on defunct satellite collisions should ADR services be available.

Therefore, this study intends to present the relation between the OOS methodologies currently technically matured, the market size, the implications of systematic and continuous usage of such methodologies on Earth's atmosphere, and how it will allow for a new approach to end-of-life obligations for spacecraft operators.