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FUTURE OF SPACE DEBRIS MITIGATION AND REMEDIATION ACTIVITIES IN THE SPACE BUSINESS

Abstract

The business regarding any space related activities is limited by on-orbit failures, launch failures and the amount of supplies that can be carried as part of a space mission. In the common spacecraft, it is possible to identify "expendable' sources, such as on-board fuel, power batteries or critical subsystems. Once these vital supplies are depleted or critical failures occur, the spacecraft can no longer function routinely leading to the end of service, factually the final loss of investment.

In addition, the current space debris environment and the increase in collision probability lead to the need to search for in-orbit solutions. This provides a better alternative compared to the current mitigation methods of collision avoidance manoeuvres or redundancy philosophy in spacecraft design as they prove to still be insufficient and expensive.

In orbit manipulations, debris removal, refueling, de-orbiting/re-orbiting operations and on-orbit recycling/manufacturing are only some of the future opportunities offered by space debris mitigation and remediation activities. This lead to changes in our current way of managing risk in space by adding safety and operational flexibility. These activities will require cooperative design and standard interfaces. Many benefits can be extracted from the application of on-orbit services into the current space project management philosophy.

In this work the rationales, current studies, challenges and an outlook on future potential space debris mitigation and remediation solutions, are identified. However, many doubters discuss about the economic rationale that affects this concept and legal and policy issues as well.

An investigation of different aspects has been undertaken, considering several assumptions for short term, mid-term and long-term scenarios. For each scenario the engineering aspects, economic challenges, legal issues and risks have been analysed. The result is an overall understanding of the business model for space debris mitigation and remediation activities and recommendations for the future.