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SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

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CONCEPTUAL DESIGN OF AN ACTIVE DEBRIS REMOVAL STRATEGY FOR SUN-SYNCHRONOUS LOW EARTH ORBIT

Abstract

The recent Iridium/Cosmos collision in 2009 served as a dramatic demonstration of a problem which was already 'floating', and growing, for over 5 decades above the head of mankind. Nowadays it becomes clear that the presence of man-made space objects in orbit around the Earth starts to pose a serious threat for future space flight. This space debris, as it is also favorably called, can range from inoperative satellites, like the Cosmos 2251, to tiny parts of paint originating from explosions or collisions.

To cope with the problem posed by space debris for (un)manned space activities, mitigation techniques are being implemented in international agreements as guidelines and standards. However, as these efforts will absolutely be useful for future space flight, they are aimed at reducing the creation of additional space debris. In order to safeguard the space environment for future sustainable use, a more active approach is required. The space debris problem is a genuine example of a global problem requiring a global solution. In this context, the agreements between various space agencies on the construction and operations of the International Space Station already provide a precedent of far reaching international cooperation in space but many complex issues remain to be solved for active debris removal (ADR).

In the present study a general overview is given of possible ADR techniques which are being proposed in the literature. Their feasibility will be assessed based on certain criteria, defined in the framework of a particular case study. This case study will handle the design of an ADR mission strategy to de-orbit different kinds of large space debris objects (e.g. upper stages and inoperative satellites) which reside in the Sun-synchronous Low Earth Orbit. This region was chosen because of its economic and scientific importance and because of the fact that it is heavily populated with space debris. The mission targets are selected based on certain criteria and will furthermore play an important role for the development of a suitable capture technique. In the present study, a conceptual design of a three-armed capture mechanism is being proposed and incorporated in the mission design of the case study. In order to make such a strategy as realizable as possible in the near future, certain policy drivers are identified and some proposals on the legal framework are being made.