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Assuring a Safe, Secure, and Sustainable Space Environment for Space Activities (4)

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INTERNATIONAL SPACECRAFT DESIGN POLICIES FOR ORBITAL SERVICING

Abstract

The launch of a satellites may account for up to, or even more than, a third of the cost of a satellite mission. Therefore, enhancing the orbital lifetime of satellites and delaying their end of life is critical for satellite operators and manufacturers.
Two major factors limit the productive lifetime of a space system: lifetime of critical components and increasing requirements on the payloads (e.g. bandwidth capabilities for telecommunication satellites). Exceeding relevant thresholds in any of these two areas eventually lead to a system malfunction or the decommissioning of the satellite. In both cases, the dead satellite may pose safety hazards or give rise to new space debris objects.
Recently, the concept of orbital servicing has been studied in order to assess the possibility of increasing the life of satellite systems, thereby reducing costs and increasing safety and sustainability in the space sector. However, a number of obstacles have prevented the implementation of orbital servicing. These obstacles include the configuration of current satellites, whose design does not take into account reparability or refueling interfaces. Learning from the errors of the past, next generation of spacecraft should be designed with maintainability and servicing in mind. Considering the international context of space activities, a crucial first step in achieving this goal is formulating a set of commonly-agreeable guidelines and engineering standards to guide the design of the next generation of spacecraft. Such standards will not only benefit satellite service providers and users, but will also help address some of the critical issues in space safety and sustainability that we are facing today.
In this paper, spacecraft subsystems which could be targeted for on-orbit servicing will be identified and recommendations will be made on how such components may be designed for serviceability. Next, the implications of such design practices will be reviewed, considering factors such as cost and lifetime increase. Finally, this paper will also address some of the legal and policy hurdles to on-orbit servicing. The final

recommendations of this paper can act as a guideline for future spacecraft designers in the creation of detailed standards for on-orbit serviceable spacecraft.