SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

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A NOVEL DESIGN APPROACH BASED ON BUILDING BLOCKS FOR SERVICABLE SATELLITES ENABLING ON-ORBIT-SERVICING

Abstract

The growing interest in the enhancement of space system's efficiency, economically as well as technologically, and the awareness of increasing space debris form the basis for On-Orbit Servicing (OOS) of satellites. Servicing capabilities allow for example the maintenance and refilling of spacecrafts, the performance of orbit changes or even the reconfiguration of the whole satellite assembly to implement new payloads and components, leading to an improvement of satellite performance, extension of life time and enables new application scenarios. While much of the relevant research conducted so far dealing with the challenges of OOS mainly focuses on the servicing satellite, the research activities at Technical University (TU) of Berlin concentrate on the target satellite itself. A key feature which was identified as crucial for serviceable satellites is the modular design of the spacecraft combined with robotic capabilities. In cooperation with our partners RWTH Aachen University and FZI Karlsruhe the TU Berlin develops a novel approach for modular and serviceable satellites which will be presented in this paper. To begin with, the paper provides a short state-of-the-art summary of modular satellite architectures, concepts and surveys. This will be followed by an introduction of the research progresses at TU Berlin to develop a concept for future serviceable and modular satellite systems. The consideration of different approaches for modularization of a conventional monolithic satellite led to the idea to fragment a satellite into intelligent building blocks for OOS (iBOSS). As system modules, those building blocks perform distinct functions containing dedicated subsystem components for AOCS, communication, power etc. Equipped with standardized mechanical interfaces for interconnection, a complete reconfiguration of the satellite will be possible considering the requirements and limitations for location of each block within the satellite system. Besides the mechanical interfaces each module implements interfaces for data and power transfer. In this context the paper addresses in particularly the challenges of plug-and-play connection for power and heat-transfer between the satellite modules, for which first demonstration models were developed to study the functionalities. This paper provides an overview of the current development status for the proposed modular satellite design and presents the results of research work at TU Berlin. It will be concluded with an overlook on upcoming development work and expected results of the project, which

will provide relevant input for the following OOS research activities and will be an important milestone for future realization of OOS attempts.