IAF SPACE SYSTEMS SYMPOSIUM (D1)
Cooperative and Robotic Space Systems (6)

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# MODULAR ACTIVE PAYLOAD MODULES FOR ROBOTIC HANDLINGS IN FUTURE ORBITAL MISSIONS

**Abstract**

The Low Earth Orbit is most easily accessible from Earth and has a low-energy state, therefore it has been the most exploited orbit since the dawn of spaceflight, resulting in alarming densities of man-made objects in its certain regions. In order to avoid a future onset of a self-sustaining cascading process and provide more cost-effective access to space, the future of satellite operations will be asked for an option to reuse/refit existing on-orbit space assets instead of sending new ones. To this end the robotic on-orbit servicing/assembly of modular and re-configurable systems represents one of the most mature and versatile technologies. Nevertheless, robotic servicing of a cooperative satellite is still an open research area facing many technical challenges, as it is evident by the amount of public/private funded projects in this area of research. One of those projects is the H2020 EU-funded project SIROM (Standard Interface for Robotic Manipulation of Payloads in Future Space Missions), which aims at developing an optimized multi-functional standard interface for mechanical, data, electrical and thermal connectivity. This interface in combination with modular and re-configurable spacecraft units would allow modular spacecraft that would be upgraded/re-configured at need via the so called Active Payload Modules (APM) which can be arbitrary payload elements, exchangeable subsystems, e.g. special processing units, tools and mechanisms for replacement of the module on-board. Within this context, this paper describes the APM concepts developed for on-orbit usage, their integration with the developed modular interface and planned testing. The core APM structure consists of a cube-shaped box of 150mm x 150mm x 150mm in size. The APMs have easily detachable side panels and two interfaces per module for connection to other APMs or the manipulator‘s end-effector. The mass of an APM, consisting of a payload, two interfaces and core structure, is approximately 8,5kg. APM payloads will depend on the task of an APM. However, in our implementation one used payload will be a camera, which will take pictures of the test environment. The camera‘s operation will demonstrate the interface capability to transfer power and data loads as well as the transfer of data packages via SpaceWire to the Electrical Ground Support Equipment (EGSE). This

paper describes the development of the orbital APMs with a short overview about the SIROM interface by consideration of the requirements with selection of one concept for a final development, as well as lessons learned by verifications within first tests.