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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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MOSAR: DEMONSTRATION OF MODULAR SPACECRAFT ASSEMBLY AND  
RECONFIGURATION**Abstract**

The concept of modular and reconfigurable spacecraft is a possible track to answer the future challenges of the space industry and exploration, that includes, space sustainability, economical profitability, system reliability and large structure assemblies. This concept is strongly associated with the development of autonomous robotic solutions, re-usable components and standardization of designs. This will lead to the emergence of more affordable and reliable components, also opening new possibilities for future space missions, like life-time extension or missions reconfigurations.

The main objective of the EC project MOSAR, part of the EU Strategic Research Cluster in Space Robotics, is to elaborate and refine the concept of modular and reconfigurable spacecraft in the context of on-orbit servicing and assembly. This is achieved by the development of a ground demonstrator of on-orbit modular satellite reconfiguration, and by the analysis and elicitation of recommendations for the exploitation and maturation of the associated technologies.

The MOSAR demonstrator aims at illustrating the servicing mission of a modular client satellite, from the initial mission design to the assembly and reconfiguration operations. It includes the following elements, developed during the MOSAR activity:

- Re-usable spacecraft modules representative of specific function of the spacecraft (power, control,

thermal, payloads), which assembled, compose the client satellite

- A walking manipulator arm for the capture and manipulation of the modules
- The standard robotic interfaces HOTDOCK, for the mechanical, data, power and thermal interconnections of the modules and the connection with the manipulator
- A Functional simulation environment for the design, simulation and monitoring of the assembly and reconfiguration operations

In addition, the demonstrator relies on the upgrade of robotics software and hardware building blocks components developed previously in the same research cluster, for autonomous planning or module data management. Following scenarios, illustrating modular spacecraft concepts, have been demonstrated:

- Initial assembly of client satellite, from set of modules delivered by a servicer
- Replacement of failed/depreciated functional module
- Thermal power management and transfer and between modules
- Automatic data and power network reconfiguration
- Software reconfiguration with scheduling analysis

The purpose of this paper is to present the outcomes of the MOSAR project, focusing on the results of the demonstration scenarios and the perspective of technologies exploitation and maturation.