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MBSE APPROACH FOR A PRELIMINARY ARCHITECTURE DEFINITION FOR A FACTORY IN
SPACE

Abstract

The MBSE approach stands as one of the most widely employed methodologies in the definition of the activities and the operations integral to a space mission. It serves to create and use models to design, analyze and monitor the evolution of complex system such as, in the case of this study, a factory in space. In particular, this project starts from a mission statement and high-level primary and secondary objectives for an in-space manufacturing mission endeavoring to delineate all activities performed by the facility.

The needs to be fulfilled by the concept are related to the recycling of materials starting from decommissioned components, the repairing process that broken systems and tools could need during their operative life and the final decommissioning of a space system with the associated safety measures. The strength point of this approach would be the possibility to avoid all the constraints related to the launch environment, which is the most demanding in terms of structural and thermal loads and, for this reason, is usually the main driver of the costs, weight and complexity of a space system.

Following the consolidation of stakeholder needs and operational activities, an extensive identification process involving entities, actors, roles, activities, and concepts was conducted. This phase considered diverse applications of the concept, ranging from the aforementioned in-orbit repair of decommissioned satellites to the futuristic prospect of a facility capable of manufacturing large structures for in-situ applications using recycled materials, since the model aimed for inclusivity across potential applications. Once the operational analysis was consolidated, the further steps were the system analysis and the logical architecture, which have been carried out and defined at high-level. The physical architecture could be evaluated in the future, once the novel technologies and processes involved will reach an adequate level of readiness.