

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Space Technology and System Management Practices and Tools (4)

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SCENARIO ASSESSMENT FOR THE DEMONSTRATION OF ENABLING TECHNOLOGIES FOR
SPACE EXPLORATION**Abstract**

The paper deals with the identification and analysis of a reference mission scenario defined to test advanced technologies needed for future human space exploration missions. Some technologies are critical for future manned missions to outer space, like regenerative fuel cells, inflatable, environment protection and rendezvous and docking systems (especially for what concerns the software). In order to have them available for future missions, a specific scenario was identified to test and validate these technologies in a significant environment. The first step was the identification of the technologies to be tested and the assessment of the final target, which can be for example a mission on the Moon surface. Then the scenario was defined, identifying the various missions to consider for the qualification of the selected technologies. In particular, the building blocks associated to the missions were assessed and the way of implementing the technologies was determined through the definition of specific requirements. Several trade-offs are performed to select the most suitable solutions, in terms of mass/cost and cost effectiveness. For example, a specific technology could be firstly deployed as a demo in a low Earth orbit, maybe at the International Space Station. Then it can be moved to a higher orbit to test different functionalities, and finally it can be implemented in a module for a cis-lunar mission (or in a lunar lander). In particular several options are considered and among them only the most convenient is selected: different requirements are derived and the relevant missions are described in details. The scenario evaluations have been done relying on the Scenario Evaluator Tool (SET), which is a tool conceived to support the engineering team in the framework of space mission design process. SET allows building mission architectures with significant reduction of development time and computational effort, allowing the characterization, comparison, and optimization of exploration scenarios and building blocks design through a user friendly graphical interface. The tool is one of the results of STEPS (Sistemi e Tecnologie per l'Esplorazione Spaziale) and is currently used of further analyses being carried out in the frame of STEPS-2 (Phase 2), which is a research project co-funded by EU on the "Misura Piattaforme Innovative" - Phase 2 of POR FESR 2007/2013. The paper describes both the adopted methodology and the major obtained results, focusing on the technologies and the way they are implemented through several missions and building blocks to be tested and validated.