

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and
Development (1)

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FUTURE SPACE EXPLORATION: FROM REFERENCE SCENARIO DEFINITION TO KEY
TECHNOLOGIES ROADMAPS**Abstract**

The human exploration of multiple deep space destinations (e.g. Cis-lunar, NEAs), in view of the final challenge of sending astronauts to Mars, represents a current and consistent study domain especially in terms of its possible scenarios and mission architectures assessments, as proved by the numerous ongoing activities about this topic and moreover by the Global Exploration Roadmap. After exploring and analyzing different possible solutions to identify the most flexible path, a detailed characterization of one out of several Design Reference Missions (DRM) represents a necessity in order to evaluate the feasibility and affordability of deep space exploration missions, specifically in terms of enabling technological capabilities. A human expedition to a NEA, milestone of the GER 'Asteroid Next' scenario, is considered the mission that would offer the largest suite of benefits in terms of scientific return, operational experience and familiarity on human deep space missions, test of technologies and assessment of human factors for future long-duration expeditions (including planetary bodies), evaluation of In-Situ Resource Utilization (ISRU) and, more specifically, opportunity to test asteroid collision avoidance techniques. The study started from the identification and analysis of feasible evolutionary scenarios for Deep Space Exploration. Different destinations were considered as targets, with particular attention to Earth-Moon Lagrangian points, NEA and Mars as an alternative path to a Moon campaign. In the frame of the scenario selected as the preferable one, a DRM to a NEA (reference target) was defined in detail in terms of architecture and mission elements, as well as of the subsystems composing them. Successively, the critical subsystems and the relevant key technologies were investigated in detail, from their status-of-the-art up to an assessment of their development roadmaps. They shall enable the DRM and support the whole scenario. The paper describes the process that was followed within the study and reports the major obtained results, in terms of scenarios and mission analysis. Furthermore the key technologies that were identified are listed and described highlighting the derived roadmaps for their development according to the reference scenario.