

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)

Author: Dr. Pierpaolo Pergola
Sitael/Alta, Italy

Prof. Mariano Andrenucci
Sitael Spa, Italy

BUILDING BLOCKS OF A FLEXIBLE ARCHITECTURE FOR OUTER SPACE EXPLORATION

Abstract

The future of human and robotic space exploration, outlined in the last few years by the NASA Human Spaceflight Program and more recently by the International Space Exploration Coordination Group in the Global Exploration Roadmap, is based on flexible pathways aimed at extending the human presence beyond Low Earth Orbit (LEO). These options take advantage of modular multi-purpose structures and of the heritage gained during tens of years of manned and robotic space operations in the LEO region. In this framework, single-mission spaceships are replaced by reliable and efficient platforms where the reduction of mission development costs and, at the same time, the spreading of the range of possible targets are the design driving criteria. In particular, multi-target scenarios are based on the increased capability in space operations gained with the International Space Station (ISS) programme and on the advances in efficient in-space power generation and transportation systems. Electric propulsion systems coupled with large power generators (likely based on nuclear reactors) together with inflatable structures and surface modules are the key enabling technologies here considered. The exploration roadmap conceived and outlined in this paper originates from the ISS and moves toward a set of targets to extend the human presence in the outer space. The steppingstones envisaged in this path are the Moon and asteroids as test benches for advanced enabling technologies. The flexible architecture described is intended to be a valuable approach to this new space exploration concept representing the pathfinder for the next generation space missions. With this aim the reconfiguration capacity is privileged and in-orbit assembling capabilities are considered for building up ad-hoc configurations suitable for the specific target. The platform conceived is designed to be able of reaching different targets boarding multiple payloads to enable a wide range of different mission scenarios. In particular, it is envisaged to be a multi-purpose space laboratory in Medium Earth Orbit (MEO) or in the Earth-Moon L1 equilibrium point, a cargo and a crew carrier, a building block for future space ports or a support platform for future Moon/asteroid based space stations.