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Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development (1)

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DEVELOPING MISSION ARCHITECTURES FOR FORTHCOMING SPACE EXPLORATION PURSUITS USING EXPERIENCE OF MULTI-DISCIPLINARY INTERNATIONAL PROJECTS.

Abstract

World national space agencies announced ambitious near-future plans of human spaceflight to Mars, asteroid protective systems and commercial exploration of the moon. Once seem to be fantastic projects can become reality only if new and the most bold ideas are generated and discussed systematically. This paper presents multi-year experience of developing advanced space exploration conceptual architectures by participants of the international program "Space development: Theory and Practice" created and led by the Bauman Moscow State Technical University in Russia. The goal of the program is to investigate and elaborate on projects that currently are not prioritized by space agencies due to their extraordinary goals that require cutting-edge and emerging technologies development and applications. A large group of international students and young professionals from around the world work together and under advisory of leading space industry scientists and engineers to ensure maximum of the outcome of this short but intensive program. Participating countries include Russia, USA, Italy, France, China, Switzerland, UK, Germany, Australia, Mexico, South Korea and more. Such approach allows getting a fresh look at the design problem and bright ideas from about 100 motivated scientists, engineers and designers who can effectively generate new ideas without a burden of previous industry experience. The mission architecture methodology that was developed and applied for all projects is presented using exemplary projects such as: Lunar Tourist Base, Artificial Gravity Manned Orbital facility, Rover for Mercury Surface, Human Mission to Mars Using Asteroid Itokawa, Autonomous Spacecraft for Inter-star Space Research, One-kilometer Space Telescope Construction Using Asteroid Materials, Universal Autonomous Spacecraft for Giant Planets Atmospheric Research, Space Transportation System for Mars Missions with Manned Phobos Base in the Loop. The outcomes of several projects conducted within the program are in-line with space exploration and commercialization plans considered by all space faring countries now. For example, conducted in 2013 project "Development of Advanced Spacecraft Complex for Venus Atmospheric and Surface Research" aimed to enable long-term interactive exploration of the atmosphere and large-regions on the surface of Venus. Such projects can materialize now for two reasons: because previous projects with similar objectives are close to their conclusion, and because development of new heavy launch systems for deep space exploration allow more ambitious projects to become a reality. The paper concludes with analysis of evolution of projects' implementation by the space industry up to date and discussion of potentials for such developments in the future.