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

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DESIGN OF A MODULAR MULTIPURPOSE MARS LANDER CONCEPT AS HIGH RELIABILITY DEPLOYMENT ARCHITECTURE FOR A ROBOTIC RECONNAISSANCE UNIT

Abstract

Nowadays, exploration missions to other celestial bodies, such as planets, moons or asteroids are based in the delivery of only one kind of instruments or equipment with limited purpose. These instruments generally consist of an orbiter module and a payload, typically either a lander or an exploration mobile robot or rover, which does not allow the interaction and collaboration of more than one kind of device within the same mission. These restrictions also impact parameters such as the lifetime of the mission, coverage area and its scientific scope as well. The proposal of designing a modular multipurpose exploration concept responds to the growing need of developing high reliability platforms capable of adapt to several different mission profiles, minimizing their development time and maximizing the versatility and robustness of the system in each implementation, improving the mission capacity and scope. The purpose of this article is to present the work of the authors in the development of a Space Exploration Architecture, consisting of the following elements: The Modular Multipurpose Mars Lander (M3L), central element of the architecture. This will serve as a core platform for the design, development and testing of the multiple missions to be implemented through it, this being the device for deploying one or more devices on the surface of the celestial body to be explored. The Advanced Recognition Unit (ARU), which will make up the payload of the M3L and will be implemented dynamically according to each mission profile. In other words, the elements of this unit can be adapted to the different needs of the mission. These can be one or more Rovers, and even a fleet of specialized drones, capable of working in synchrony through the implementation of collaborative control algorithms. The last element to be described is the Descent Control Unit (DCU), which consists in the spacecraft designed to carry both the M3L and the ARU safely from earth to the surface of the celestial body to explore. As the both elements previously described, it must be designed to suit different descent environments in order to make it easy to adapt depending on each the mission profile. The outcome of the article focuses on the the first design of the conceptual M3L, proposed to suit its first Proof of Concept Mission to be tested in an Analogue Mars Simulation.