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CONCEPT OF A ROBOTIC TEST FACILITY FOR FUTURE COLONIZATION AND EXPLORATION MISSIONS

Abstract

During the last century, the exploration and colonization of our solar system has been one of the main goal of national space programs throughout the world. With particular reference to the Moon, Mars and near-Earth asteroids, several efforts have been made to understand which is the best strategy to make these extraterrestrial bodies suitable for hosting human life. To date, robotic exploration missions have been the most effective solution to this issue. Since the early 1960s, considering orbiters, landers and rovers, more than forty spacecraft have been sent to Mars. Through those missions, vehicles equipped with high-tech instruments have collected a large number of scientific data and several outstanding discoveries have been made. Currently, two rovers, namely Curiosity and Opportunity, are actively operating on the Mars surface, sending useful data and images to Earth periodically. Recent progresses in electronics, robotic and computing science made these vehicles increasingly autonomous and intelligent. Currently robotic missions are the keystone to future exploration and colonization missions. It is clear that, even after the human landing and colonization of Mars, robotic systems will continue to play a fundamental role in servicing and maintaining the settlements. On planetary surfaces, indeed, astronauts will need different vehicles to explore multiple sites, and thus, the need of developing a new class of pressurized vehicle, habit modules, and extraction tools could become necessary. The development of new robotic technologies can only pass through extensive test campaigns. In this scenario, the Italian Aerospace Research Centre (CIRA) has carried out a feasibility study to develop an integrated facility consisting of innovative infrastructures able to cover and control a wide range of martian environmental conditions. This paper presents the feasibility study results with a particular focus on the facility devoted to robotic system testing, namely Robotic facility. It will consist of an external open rover area and a robotic laboratory. The open area will be a test area of relevant size intended to replicate the martian landscape, while the advanced robotic laboratory will be an area dedicated to activities related to design, development and testing for novel robotic components, tools, platform and technologies.