Lunar Exploration (2)
Lunar Exploration (1) (1)

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ADVANCED ROBOTICS FOR LUNAR MISSIONS

Abstract

This paper and presentation briefly describes the achievements of current robotic activities and missions planned by the German Aerospace Center (DLR) in the context of lunar and planetary exploration. It gives an overview of the upcoming ARCHES space analog campaign, planned for 2020/06/15 to 2020/07/11 on the volcano Mt. Etna (Sicily, Italy), which continues our campaign in 2017 for the ROBEX project. Furthermore, it describes technologies, developments, and methods that the DLR research institutions are actively working on to enhance the technology readiness level and become mission-relevant for future planetary robotic missions. As a contribution to the Hayabusa-II mission lead by JAXA, DLR research departments, in cooperation with CNES, developed the MASCOT mobility unit, which successfully explored the surface of the Asteroid "Ryugu" in 2018. A continuation has been established in the frame of the upcoming Martian Moons eXploration (MMX) mission, for which DLR and CNES will provide a mobile rover to explore the surface of Phobos. The outcomes of these research activities are

envisioned as future contributions to upcoming lunar missions where DLR / ARCHES research is cooperatively working on different modalities of tele-operating robotic assets on the lunar surface as well as in orbiter stations to support and assist astronaut operations. The goal of the ARCHES demonstration is to prepare for planetary robotic surface activities that will form the basis for long-term permanent bases on the lunar or Martian surface. The analog mission on Mt. Etna consists of two parts. First, it will demonstrate the robotic construction and operation of a radio telescope for the lunar surface. Second, it will show geological scientific exploration of the surface with in-situ analyses and the return of samples. This includes the use of a robotic LIBS instrument, spectral camera systems and various sampling tools. All of these robotic demonstrations demonstrate a high degree of autonomy: autonomous navigation and pathfinding on long traverses as well as autonomous task execution, including manipulation, object recognition, segmentation and semantic classification. The overall objective of the project is to demonstrate a heterogeneous robotic team capable of operating in large areas on long time scales with local autonomy for each robotic system, enhanced by collaboration that exploits the complementary capabilities of the different assets. This includes the exchange of data and commands within the robotic team, which is controlled and monitored from a scientific and operational control room located in Catania, 30 km from the analog site.