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Author: Mr. Dionisis Tsigalidas
Beyond Orbit, Greece

Ms. Dimitra Argyrou
Beyond Orbit, Greece
Mr. Ioannis Kasionis
Beyond Orbit, Greece
Mr. Alexandros Tasoulis-Nonikas
Beyond Orbit, Greece
Mr. Tilemachos Moumouris
Beyond Orbit, Greece
Mr. Miltiadis Zisimopoulos
Beyond Orbit, Greece
Mr. Efstratios Rigas
Beyond Orbit, Greece

BEYOND ROBOTICS' TALOS 1 SCIENCE TEAM: BEST PERFORMANCE IN SCIENCE TASK IN ERC 2023

Abstract

The European Rover Challenge (ERC) serves as a global student competition and a dynamic platform where student teams from technical universities worldwide converge to design and test their innovative rover prototypes in Mars Simulant Environment. Beyond Robotics, the first Greek team to participate in ERC, demonstrated their technical and scientific abilities in ERC 2023 with Talos 1, a newly developed rover platform capable of performing various operations. The team managed to secure the first place in Science Task. This paper is focused on the workflow and methods used in the Science Task, which simulates a real rover mission (Landing Site Selection, Geological History/Features Identification, and test of Scientific Hypothesis).

Choosing the optimal landing site in Arcadia Planitia was pivotal for the simulated mission's success. To achieve this, the team conducted a thorough assessment, integrating engineering constraints, scientific objectives, and Mars 2020 mission guidelines. Scientific criteria, like atmospheric density, terrain features, and thermal characteristics were scrutinized. The team also followed planetary protection guidelines, confirming no evidence of water near the landing site. With meticulous evaluations, they optimized the mission's landing site selection using tools like JMARS and Google Earth.

Moreover, the team thoroughly digitized the entire terrain relief of Mars Yard to create a comprehensive geological map using QGIS. This enabled the successful identification of geological features from recent terrain data and the formulation of two primary geological hypotheses: (i) assessing the presence of paleolake indicators within an impact crater, and (ii) determining whether specific depressions in lava flows were lava tubes or pseudocraters, each scenario offering distinct geological interpretations with significant scientific implications. These hypotheses were validated by rover exploration, wherein the rover entered the impact crater, collected rock samples using its robotic arm, captured images of the crater floor, and utilized a flying drone to capture aerial images confirming the presence of underground lava tubes. Additionally, the team distinguished itself by identifying a moraine (glacier footprint), a

feature not commonly recognized by other teams, further enriching the geological understanding of the area.

All of the processes and methods described above distinguished the Science Subsystem Team for innovation and out-of-the-box thinking. The scientific approach the team adopted is very close to realistic space mission planning. The efficient work and winning results were the outcome of collaboration between interdisciplinary scientists and geologists with complementary expertise both in GIS and geomorphology.