IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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NEXT-GENERATION MISSION OPERATIONS SOFTWARE – A DEMONSTRATION FOR THE EMIRATES LUNAR MISSION

Abstract

Early Lunar micro-rover missions will be short-lived, have limited autonomy, sensors that produce increasingly greater volumes of scientific data, but will continue to be constrained in downlink capacity. The viability of commercial exploration depends on innovative technologies and operations strategies to ensure customer satisfaction under these constraints. To maximize scientific return and mission value, Mission Control is developing novel technologies in Artificial Intelligence and robotics to help mission operators prioritize data for real-time downlink and optimize rover navigation.

Mission Control will participate in the international science collaboration of the Emirates Lunar Mission (ELM) to the Lunar surface. ELM is led by the Mohammed Bin Rashid Space Centre (MBRSC) and constitutes a small rover called Rashid. This Lunar rover mission will be an opportunity for Mission Control to demonstrate its advanced computing technologies for AI-based perception and distributed team operations through several investigations.

The primary investigation will demonstrate the feasibility and usefulness of automated terrain classification for science and navigation operations using deep learning models embedded on a compact and high-performance flight-ready processor that may be integrated on the mission's lander spacecraft. The classifier would identify high-level geological features in images from the rover's navigation camera and downlink the outputs to science teams, to be used in rapid terrain assessment for science and navigation decision-making. This is targeted to be the first demonstration of Deep Learning on a Lunar mission, unlocking potential applications for autonomous decision-making in future missions.

These and other data products will be distributed to our extended Canadian science team in near-real-time using our web-based Mission Control Software platform, to support additional science and robotics investigations. In addition to AI-based terrain classification, Mission Control will lead investigations in trafficability estimation, path planning, and power modeling for skid steer vehicles, to mature our suite of advanced rover navigation applications. The data from Rashid will be used to train the terrain classifier, whose outputs can then be used to intelligently estimate rover wheel slip hazards and power consumption. While these estimates are not intended to be used directly for Rashid's navigation in ELM, this will be an important demonstration of capabilities for future Lunar rover missions.

In addition to these technology demonstrations, Mission Control will also aim to test novel strategies for educational outreach and public engagement for Lunar missions such as live mission tracking and data hackathons. We acknowledge the support of the Canadian Space Agency (CSA) [3CAPDEMO21].