HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Exploration of the Moon and Cislunar Space (1)

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SITE SELECTION AND TRAVERSE PLANNING FOR HUMAN SORTIE MISSIONS: LESSONS LEARNED FROM ANALOGUE MISSIONS AT THE MISTASTIN LAKE IMPACT STRUCTURE, CANADA.

Abstract

Simulated missions at analogue sites on Earth provide unique opportunities to prepare for future human and robotic missions. Through a Canadian Space Agency funded lunar analogue mission, our team conducted scientific exploration in a simulated robotic precursor and follow on human-sortie sample return mission at the Mistastin Lake impact structure in Labrador, Canada. Two separate mission scenarios were conducted at different sites, with rover assistance either at the same location as the astronauts, or at a site previously visited by astronauts to complete follow-up tasks.

Prior to deployment, a rigorous site selection process was conducted. Both Mission Control (based in London, ON) and astronauts reviewed available remote sensing and precursor rover data. They formulated scientific questions that addressed mission goals, identified landing areas and outcrop-scale sites for the astronauts and rover to further investigate, and planned traverse routes. High priority science objectives for the astronauts included structural mapping, ground-truthing remotely observed spectral anomalies,

and characterizing target rocks. During the deployment Mission Control reviewed new data acquired in the field, made scientific interpretations, gave additional directions to the rover, and facilitated the direction of science carried out by the astronauts.

Following the review of pre-existing image and multispectral data, Mission Control was able to identify sites with the potential for sampling rocks to understand the geology of the crater area and meet both logistical and engineering constraints. Sites were further filtered down to include only prioritized key areas, i.e. specific spots that need to get visited for addressing multiple scientific objectives. Astronaut traverse routes were designed with the intent of accessing several sites with high science priority and meeting all constraints. Rover traverse paths were selected once deployment commenced to get on-site astronaut assessment regarding rover navigable terrains.

Several factors contribute to a scientifically accurate process of site selection and traverse planning. All mission participants (MC, astronauts, and field support team) must be involved to understand the rationale and objectives behind each site selection. Defining a specific and testable scientific hypothesis that is within the confines and restrictions of the mission is very critical. Access to robotic precursor data, particularly panoramic images, greatly helps MC in planning traverses for this human sortie mission. Recognizing traverse constraints of both the rover and astronauts, and determining exact amounts of resource consumption for various scientific activities can result in a more efficient site selection and traverse planning process.