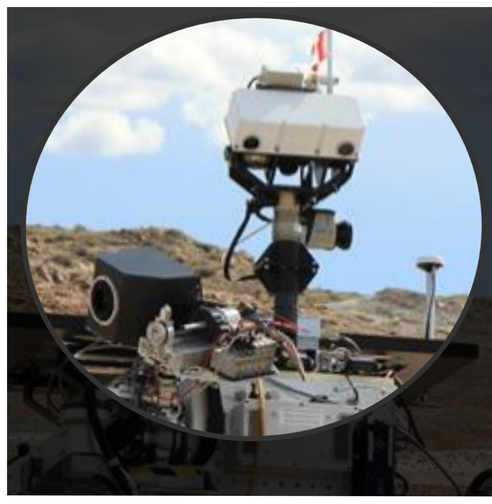

Implementation of Strategic Traverse Days During the CanMars 2016 Mars Sample Return Analogue Mission

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INTRODUCTION

CanMars 2015

In 2015, the Centre for Planetary Science and Exploration (CPSX) at the University of Western Ontario, in partnership with the Canadian Space Agency (CSA), executed a high-fidelity Mars Sample Return analogue mission, as part of the of the NSERC CREATE project "Technologies and Techniques for Earth and Space Exploration" (create.uwo.ca) [1]. The Mars Exploration Science Rover (MESR), developed by MDA, "landed" in Utah, USA in an unknown location, and 11 command-cycles (each consisting of 1 sol's worth of activities) were planned by the science operations team located at the University of Western Ontario, Canada.

CanMars 2016 – Strategic Traverse Days

The 2016 mission cycle continued from the previous year [2]. During the 2016 mission cycle, strategic traverse days were implemented, where pre-planned tactical sequences were implemented with activities involving long rover traverses and post-drive imagery. These pre-planned command cycles were included for two main reasons:

1. To eliminate the need for tactical planning for that sol, thus enabling the science team to process and interpret the immense data return with an extended science discussion (e.g., Figure 1).
2. To vet workflows for active and future rover missions, which are increasingly making use of strategic planning.

Figure 1. An example of a stratigraphic column created during one of the strategic traverse days. From these stratigraphic columns a depositional model was created that guided future exploration.

DIFFICULTIES WITH PRE-PLANNED CYCLES

The first strategic traverse day was scheduled for sol 15, and this provided some limitations to the activities that could be completed on the sols before and after the strategic traverse. The strategic traverse day was intended as a long driving day, which was the best use of the mission time and rover resources with little autonomy in play. Prior to this traverse, we had to ensure that we had completed any necessary science at our current location (the base of Jotunheim) before Sol 15. This was difficult to accomplish, as the southern slopes of Jotunheim had not been imaged until sol 14. Had the strategic traverse day not been included, the mission operations team would have possibly spent additional time examining the southern slopes of Jotunheim before moving on. In the end, the mission operations team decided that sols 12, 13, and 14 were best spent collecting a few final measurements and images in the Jotunheim region before traversing to-wards Horik.

IMPLICATIONS

The inclusion of pre-planned command cycles had both benefits and drawbacks. It allowed the science team to focus on the development – and improvement – of a depositional model for the landing site, which guided sampling strategies for the remainder of the mission. However, it limited the activities available to the mission operations team prior to – and immediately after – the strategic traverse days. This high fidelity analogue mission allowed our team to experiment with novel mission approaches and operational workflows. We propose that a combination of strategic planning days with multi-sol rover autonomy represents the best use of human and rover resources [4].

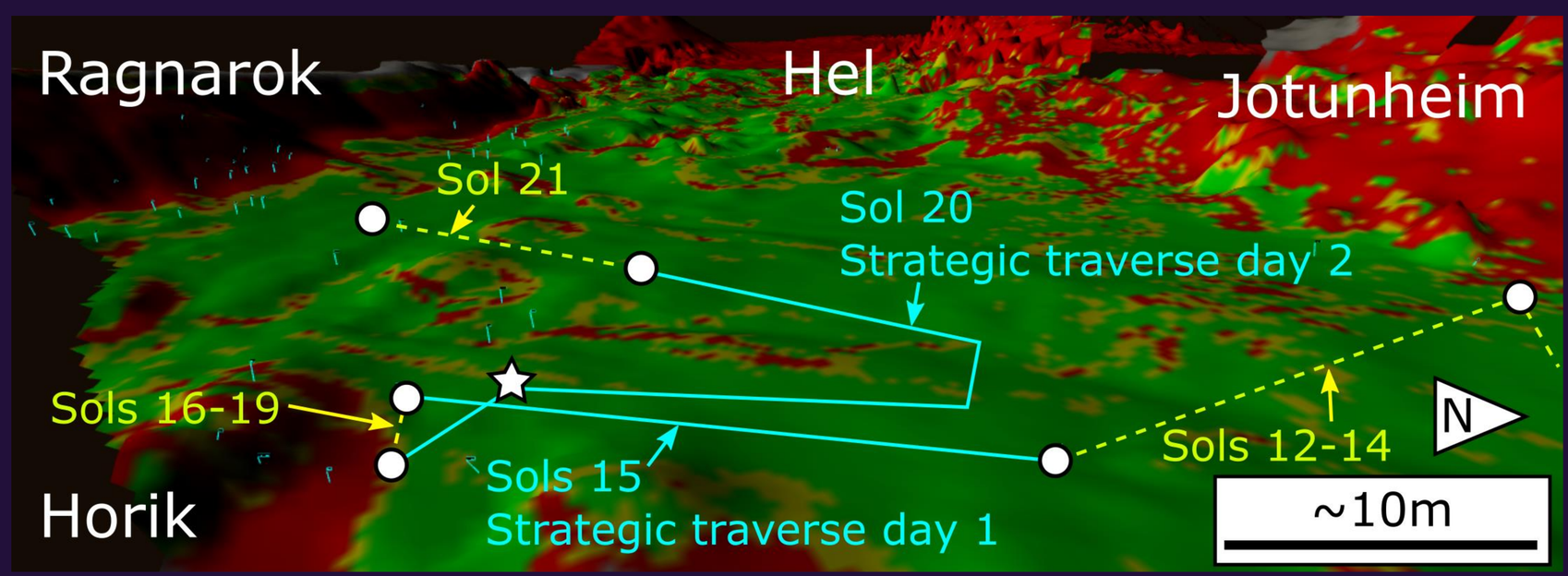

Figure 2. A 3D simulation of the landing site showing the path taken during the mission. Solid blue lines represent strategic traverse days.

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