



Rover Mission Control

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Company Background:

Lunar Outpost Inc. is an advanced technology company with a focus on developing technologies that have both terrestrial and space applications. Comprised of engineers with experience working on NASA, defense, and commercial programs, Lunar Outpost is engaged in contracts with the U.S. Department of Defense, NASA, local and state government organizations, and leading research institutions. Other ongoing projects include development of the MAPP rover, a robotic prospector designed to map resources and carry payloads on the lunar surface; deployment of the Canary environmental monitoring system in the energy sector and municipalities across the continent; and contribution to the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) onboard the Perseverance rover.

Description of Work to Be Done:

The goal of this project is to build upon NASA's open source, next-generation mission operations data visualization framework, Open MCT, and integrate the software with Lunar Outpost's MAPP rover architecture. Students will be challenged to test the limits of Open MCT by implementing mission operation control on a novel robotic platform starting from the open-source repository provided by NASA Ames Research Center. Development will be performed using several different robotic dev platforms and Lunar Outpost's cutting-edge simulation technology. This is a multidisciplinary project, and will require interaction with cloud platforms, robotics systems, web development frameworks, and networking challenges.

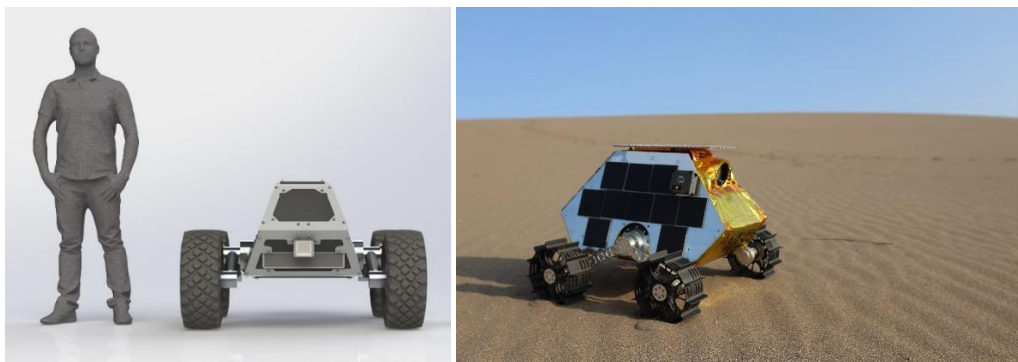


Figure 1: HL-MAPP for Earth based Applications and MAPP being tested at the Great Sand Dunes.

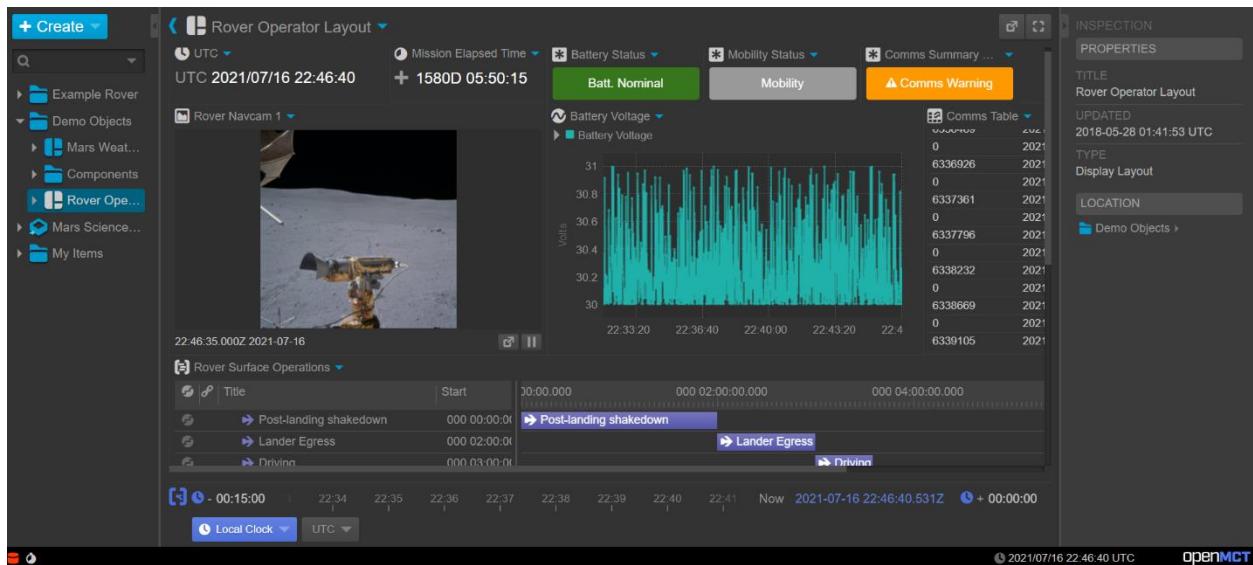


Figure 2: Screenshot from Open MCT Demo (NASA).

Students will focus their efforts into three specific areas:

1. Integrating Open MCT with relevant data streams from Lunar Outpost's MAPP rover platform. This will include video feeds and data from various other sensors on board.
2. Developing rudimentary concept of operations (CONOPS) and scheduling functionality in Open MCT for Lunar Outpost robots.
3. Performing an overall evaluation of the Open MCT software as a potential asset in future iterations of the Lunar Outpost rover control stack.

The students will be involved in every phase of the project 'from design through implementation'. During the design phase the students will interact with Lunar Outpost engineers to see what will provide value for operation. From there, the project overview will be created, and the work divided into tasks. As a final product, the Field Session team will develop a MAPP-adapted implementation of the Open MCT software suite.

Grant Schmaedick, a Software Engineer at Lunar Outpost and Mines alum, will be managing this project on the Lunar Outpost side. Mr. Schmaedick has extensive software development and project management experience and can help mentor the student team throughout this course.

Desired Skills for Students:

- C++
- Javascript
- Python
- Understanding of cloud architectures
- HTML/CSS

- Networking

We understand not all the students in the group might have the desired technical skills. However, if they can problem solve and have a willingness to learn, they can excel in this project with the help of our talented engineers.

Preferred Team Size: 4 students

Given the scope of this project a group of 4 students is preferred but 3 students could also excel given they are willing to problem solve and learn.

Internships at the End of the Course:

We are happy to consider offering internships at the end of the course.

Location Where Work Would Be Performed:

We have offices in Golden and in Arvada, CO. The office in Golden, CO is located at 17700 S Golden Rd Unit 102 and has space for a student team. This office is less than a 5-minute drive from CSM campus and should provide a convenient location for the students to meet. We also provide free beverages and snacks to keep the team fueled throughout the day.