

Executive Summary

While tracking exploration vehicles on Mars, the rover must have a communication link to a ground station to send and receive data signals to and from the rover. When the rover moves too far away from the ground station or when the line of sight becomes obstructed the ability to receive these signals can be lost. This project is aimed toward improving the communication link of the Oregon State University Robotics Club's Mars Rover by implementing a radio frequency communication link between the ground station and the rover whose sole purpose is to optimize the data signal strength. These improvements will be tested at the Canadian International Rover Challenge.

The project will incorporate a transmitter on the rover which will transmit a signal on a frequency of 915MHz using the LoRa protocol. Originally, the plan was to use an antenna array which would be multiplexed with a microcontroller development board to generate a pseudo-doppler effect to determine the direction of the beacon signal. Upon further research, it was determined that this was not going to be a viable option for directional finding. We have decided to replace the pseudo-doppler antenna with a small GPS module which will send data to the transmitter on the rover. The transmitter on the rover will then broadcast the GPS data to the ground station. The ground station will also have a GPS module with a fixed location. The difference in the coordinates will determine the heading of the rover relative to the ground station.

The transceiver itself will use an RP2040 microcontroller and a LoRa based modem module to send and receive data to and from the rover and base station. A GPS module mounted on the transceiver will pick up location information from the satellite and send it to the microcontroller via the PCB. The PCB itself will have a USB connection that powers it at 5V, and the receiver will have a communication line to the base station. The RP2040 will be supported by various peripherals including a clock, flash memory and a voltage regulator. In the case of rover failure a battery backup system is implemented. This is done with a power mux and a 5V boost converter connected to a 3.7V LiPo battery.