Paper ID: 21789
student

SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Poster session (2D)

Author: Mr. Christopher Nicol
Faculty of Engineering, Carleton University, Canada

Prof. Alex Ellery
Carleton University, Canada
Prof. Edward Cloutis
The University of Winnipeg, Canada

IMPROVING RELIABILITY IN DETECTING ICE IN LUNAR REGOLITH FOR THE RESOURCE PROSPECTOR MISSION

Abstract

The current Resource Prospector Mission is a mission to search the lunar south pole for water ice and to demonstrate in-situ resource utilization (ISRU) principles. A rover employs a drill to take core samples where ice is thought to be located in the lunar regolith. Due to the short duration of the mission lasting up to 7 days, it is critical that false positives of water ice do not occur, else risk wasting time taking core samples where no ice exists. There is a need for simple and low-cost methods to determine locations of high probability of ice existing. A neutron spectrometer is employed to detect subsurface hydrogen which is a proxy for water but is unable to detect water ice directly. Another method for determining whether there is water ice in the regolith is by extracting soil parameters of regolith as the rover drives. The soil parameters differ between dry regolith and both regolith containing ice and regolith which has a void due to past ice which has since evaporated. We propose the use of such a method on the Resource Prospector Mission due to its cheap addition and potential to improve reliability in taking samples which contain water ice. The concept of using soil parameter estimating is demonstrated on the Canadian Space Agency's Kapvik micro rover located at Carleton University. Soil parameter estimation can be achieved with a standard navigation sensor suite, with few additional instruments. The most prominent of these instruments is a load cell for determining the weight on each wheel of the rover. We show the required sensitivity of these instruments for detecting different levels of ice in the soil. In addition, we show the maximum depth of the ice detectable by such a method.