SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

Author: Dr. Wanping Zheng
Canadian Space Agency, Canada

Mrs. Luminita Ilinca Ignat
Canadian Space Agency, Canada
Dr. Christian Lange
Canadian Space Agency, Canada
Dr. Jean-Claude Piedboeuf
Canadian Space Agency, Canada

KAPVIK – A CANADIAN SMART MULTI-MISSION MICROROVER FOR LUNAR EXPLORATION

Abstract

The science rich areas on the Moon are expected to be the South Pole, where there is a possibility of finding ice, and the central peaks and crater rims of major craters such as Copernicus, where mantle material may be exposed from the impact, giving insight to the origin of the Moon and the formation of the planets. However, many of these science rich areas are in craters or on steep hills, and are difficult and dangerous for astronauts and even rovers to reach. Microrovers, having low mass, low power consumption, and low cost, can be used to help reduce the operation risks of lunar human or robotic exploration missions as well as to obtain highly desired science data.

The Canadian Space Agency developed a prototype microrover – KAPVIK – for both lunar and Mars exploration. KAPVIK was designed for three mission scenarios: scouting, sample return, and science exploration. It can be used as a stand-alone system or in combination with a large rover or lander, especially for the purpose of exploring areas of rough terrains and steep slopes, with three operation modes: tele-operation; supervised autonomous, and tether-aided. It has a mass 40 kg, solar power generation, on-board autonomous navigation system, a robotic mast for sample acquisition, and on-board camera and scientific instruments.

KAPVIK microrover was field tested in an analogue mission in a deserted mine site in Norbestos, Quebec, Canada, for its functions and performance, operations, and scientific capabilities. The microrover was commanded and monitored from a mission control center 120 km away. KAPVIK demonstrated that it is a useful science driven platform with great robotic and autonomous navigation capabilities for planet exploration. .

Based on KAPVIK, a lunar mission concept, named CABLE, was developed with international collaboration of Canada, US, and UK. The baseline science mission is to investigate surface characteristics of a region of the Moon that has never been explored in situ, Aristarchus Plateau, to address fundamental geologic and lunar resources issues for the first time. The main science goals for this mission address key international interests, including mapping lunar surface geology to determine the extent and composition of pyroclastic deposits on the plateau.

This paper reports the development, field testing, and a potential international mission of the Canadian KAPVIK microrover