IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

Author: Dr. Mihkel Pajusalu
University of Tartu, Estonia, mihkel.pajusalu@ut.ee

Mr. Quazi Saimoon Islam
University of Tartu, Estonia, quazi.saimoon.islam@ut.ee
Mr. Hans Teras
University of Tartu, Estonia, hans.teras@ut.ee
Ms. Karin Kruuse
University of Tartu, Estonia, karinkruuse98@gmail.com
Mr. Rando Avarmaa
University of Tartu, Estonia, rando.avaramaa@ut.ee
Mr. Aditya Savio Paul
University of Tartu, Estonia, aditya.savio.paul@ut.ee
Dr. Aire Olesk
University of Tartu, Estonia, aire.olesk@ut.ee
Dr. Kristel Mikkor
Milrem Robotics, Estonia, kristel.mikkor@milrem.com
Mr. Silver Lätt
Milrem Robotics, Estonia, silver.latt@milrem.com
Mr. Janek Press
Milrem Robotics, Estonia, janek.press@eesti.ee
Dr. Mart Noorma
University of Tartu, Estonia, mart.noorma@ut.ee
Mr. Sebastian Martin
ESA - European Space Agency, Germany, sebastian.martin@esa.int

LARGE SCALE MOBILITY ON THE MOON BY TRANSFERRING TERRESTRIAL AUTONOMY CAPABILITIES

Abstract

In this paper, we present the results of Milrem Robotics and Tartu Observatory, University of Tartu in developing very large scale autonomy for rovers on the Lunar surface. This is an offshoot of a larger scale development of such systems for terrestrial industrial use (for example, automated forestry). The study is a part of an ESA contract "Operations and mobility planning system for Lunar rover missions", aimed to prototype methods for large scale operations planning on the Moon and potentially also on Mars.

Planning large rover missions is currently very time consuming and in case of any changes, such as operational difficulties or availability of updated mapping data, the process needs to be repeated. This will be accentuated if large scale multiple and simultaneous rover operations are to be planned for exploration or industrial purposes, making many robotics concepts practically infeasible. To solve this problem, automatic path and operations planning tools can be used. Milrem Robotics and University of Tartu are developing a general planetary autonomy pipeline, which contains multiple tools, including large scale planning interfaces that allow to plan points of interest on a 3D map of terrain spanning hundreds of

square km. Then, automatic path planning algorithms, which use both remote sensing and in-situ data, are used to find optimal trajectories between points of interest and in which order these points are to be visited, both to maximize scientific value in a fixed time window and to reduce risks.

To validate and test the developed tools, we are using simulators that are based on remote sensing and in-situ data from the Moon (from Apollo missions). In addition, we also use the workflow to physically drive robots owned by Milrem Robotics and Tartu Observatory in various terrestrial environments.

We will present the results of this project and its preliminary validation phase in terrestrial analogue environments and Lunar driving simulators. An early concept of this activity was presented at IAC 2020, as IAC-20-A3.2B.14 Lätt et al "Converting an Industrial Autonomous Robot System into A Lunar Rover".