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

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MEDIUM-CLASS LUNAR ROVER PROTOTYPE FOR SCIENCE & ISRU

Abstract

In 2010 the Canadian Space Agency (CSA) commenced a large program of exploration prototype development geared towards rapid technology advancement, community development and international collaboration in preparation for future lunar and Mars exploration. Termed the "Exploration Surface Mobility" initiative the program funded the development of an architecture of exploration systems including core mobility platforms, vehicles subsystems, utility payloads and science instrumentation.

The Lunar Exploration Light Rover (LELR) is a medium-class lunar mobility platform designed for science, prospecting, surveying and early in situ resource (ISRU) activity with upgradability to short distance unpressurised crew transportation. LELR supports teleoperation and fully autonomous modes for simulation of a range of lunar exploration architectures – from ground control to telepresence via orbital assets, e.g. L2 Outpost – and supports a wide range of lunar utility and scientific payloads via standardized interface connections.

The vehicle chassis is based on a rugged, custom mobility platform built by the advanced technology centre of worldwide terrestrial vehicle provider Bombardier Recreational Products (BRP), providing an exciting cooperation between the space program and terrestrial vehicle sector. Low ground pressure, hybrid steering and an innovative suspension design - fusing advantageous elements from planetary rovers and terrestrial ATVs - provide strong vehicle terrainability. Substantial accommodation options for domestic and international payloads are provided via by payload plates on the front, rear and top surfaces as well as a payload mast, with the largest available space accommodating up to 300 kg and 1.5 x 1.0 x 1.0m. A comprehensive onboard sensor suite provides feedback and situational awareness to support the multi-mode control architecture, including: high speed tele-operation under Earth-Moon latency / band-

width constraints, onboard autonomy for safe, precise traverse and positioning of instrument workspaces and full compatibility with future crewed drive modes. A modular onboard software architecture ensures future upgradeability while providing current features such as high-accuracy absolute localization without external navigation aid and a visual teach and repeat mode, developed in collaboration with UTIAS, with particular applicability to lunar outpost and sample return mission scenarios.

With delivery in 2012 the LELR will first be tested with its baseline suite of lunar utility, advanced vision and science payloads also developed under CSA's ESM initiative, after which it will be available to support a number of lunar analogue scenarios, as a cooperative element alongside international lander and / or mobility systems, or a host vehicle for international lunar science and ISRU payloads.