SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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HERCULES: ANALOGUE TESTING OF A CANADIAN LUNAR ROVER PROTOTYPE

Abstract

In 2010, the Canadian Space Agency (CSA) commenced a large program termed the "Exploration Surface Mobility" (ESM) initiative that funded development of an architecture of systems with a central focus on surface mobility, including core vehicles, subsystems, utility payloads and science instrumentation. In 2012 and 2013, the 3 year development was completed with these systems delivered and tested at the CSA Analogue Terrain in Quebec, Canada.

A key component of ESM was the development of Hercules, a class of lunar rover prototype developed by MDA in conjunction with a team of 14 partners under the Light Exploration Lunar Rover (LELR) project. Each Hercules rover is a medium-class lunar mobility platform designed for science, prospecting, surveying and early in-situ resource utilization (ISRU) mission scenarios, with full upgradability to short distance crew capability. The vehicle is comprised of a rugged mobility platform, substantial payload accommodation, a comprehensive sensor suite for high-latency tele-operation and autonomy, and modular software designed for upgradeability and payload compatibility.

Two Hercules rovers were put to the test at various points throughout the program. From mobility testing at BRP's vehicle proving grounds demonstrating 25 gradeability under maximum payload, to autonomous guidance navigation and control development testing demonstrating 5 km/h autonomous driving, and ultimately culminating in analogue field testing at the Canadian Space Agency demonstrating tele-operation at up to 10 km/h and including the effects of lunar latency and bandwidth constraints.

A second pair of vehicles developed as early testbeds for Hercules to support manned, tele-operated and autonomous modes of operation were the SL-Commanders. Based on an electric version of a commercial ATV design from BRP, the SL-Commander program helped catalyze a new line of commercial electric vehicles from BRP that is manufactured exclusively in Quebec, Canada. This represents a significant direct and tangible return on national space exploration technology investment stemming from CSA's

ESM program. Other systems developed as part of the ESM program include the autonomous and highly terrainable Mars Exploration Science Rover (MESR), Next Generation Power, Communications and Vision Systems as well as science payloads such as a 3D microscope, ground penetrating radar and Raman spectrometer.

Hercules and other ESM systems are now available to support planetary analogue scenarios, as cooperative elements alongside international lander and / or mobility systems, or as host vehicles for international exploration science and ISRU payloads, collectively advancing both partnerships and technology developments ahead of a number of upcoming international exploration missions.