

CANADIAN SPACE AGENCY ACTIVITIES AND SCIENCE PRIORITIES RELATED TO LUNAR SURFACE EXPLORATION. V. J. Hipkin¹, M. Picard¹, T. Haltigin¹, Y. Gonthier¹, C. Lange¹ and P. Jean¹, Canadian Space Agency, 6767 Route de l'Aéroport, St Hubert, Canada, J3Y8Y9; Email: Victoria.Hipkin@Canada.ca.

Introduction: The Canadian Space Agency (CSA) is engaged in preparing for a role in human exploration beyond Low Earth Orbit. Studies are underway to determine potential significant contribution(s) of similar visibility and impact to Canada's Mobile Servicing System on the International Space Station. These studies include concepts and technology development for lunar surface mobility.

In parallel, in the context of Canada's Innovation Agenda, the CSA is renewing its planetary science priorities through consultation with the Canadian community, to better understand potential instrument and secondary payload contributions to robotic science as well as human exploration missions. In November 2016, 204 scientists, engineers and students from Canadian academia, industry and government gathered in Montreal for a workshop entitled 'Canadian Space Exploration: Science and Space Health priorities for next decade and beyond' [1]. Along with similar exercises for space astronomy and space health, four planetary science Topical Teams (*Astrobiology; Planetary Atmospheres; Planetary Geology, Geophysics and Prospecting; and, Planetary Space Environment*) were convened to take input from the workshop and develop reports detailing the community's priority science objectives and potential instrument, mission and human exploration investigations. A similar Canadian community workshop was held in 2008 [2], where the community was asked to develop specific priorities for the Moon, Mars and asteroids within the context of the Global Exploration Strategy. A number of new instrument investigation concept studies are planned for 2017 as well as small mission (secondary payload) concepts and investments to further mature concepts that were previously developed and for which the priority has been reaffirmed by Topical Teams in 2017.

Canadian science priorities for lunar surface exploration: This paper will present a summary of priorities from Topical Teams relevant to lunar surface exploration. Universally, the planetary topical teams chose to organize science objectives as broad questions applied to the solar system. With exception of the planetary atmospheres group, all topical teams identified lunar surface investigations amongst their 2017 priorities. An updated Canadian science priorities report is in preparation at the time of LEAG abstract submission.

Recent studies related to lunar surface exploration: This paper will present results from recent studies. Since 2009, the Canadian Space Agency has funded

several studies related to lunar surface exploration, from small rovers designed for scientific exploration to 'moon buggy' systems for human exploration, building Canadian expertise in surface mobility systems, drilling, and in analogue mission deployments using prototype systems [3]. Requirements for compact rovers were developed in the context of NASA's Resource Prospector and ESA's HERACLES [4] mission concepts. A major technology development study that has recently completed is the Lunar Rover Platform and Drivetrain Prototype (LRPDP), a TRL-6 prototype derived from the CSA's Artemis Jr platform [5] tested under lunar-representative environmental conditions of 'dirty' T-VAC using CHENOB1 regolith simulant. A TRL-4 Small Planetary Rover Prototype (SPRP) was also developed in 2016 to advance low cost solutions to surface exploration. Weighing in at 95kg it uses the same drivetrain as the LRPDP to ensure portability of the TRL-6 solution.

Current studies: CSA remains an active partner with JAXA in ESA's HERACLES mission concept development, leading the lunar surface rover component, with interest in using HERACLES to demonstrate technology solutions which could be scaled to a potential lunar surface human pressurized rover chassis contribution. Current CSA studies are described that include twin industry studies that will each develop a detailed lunar surface mobility concept for two main assets: (1) Precursor to Human And Scientific Rover (PHASR) (2) Lunar Pressurized Rover Core (LPRC). A CSA Lunar Demonstrator Mission Science Maturation Study is also underway which will provide input to a strawman rover payload for PHASR that will select samples for sample return.

It is anticipated that should an ESA-led HERACLES mission go forward with international partners, an international science definition study would confirm payload and landing site.

References:

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