Lunar Rover Drivetrain Development to TRL-6. P. Visscher[1], P. Emundson[1], Nadeem Ghafoor[2], Howard Jones[2], Julie Kleinhenz[3], Martin Picard[4].[1]Ontario Drive and Gear Ltd. (220 Bergey Court, New Hamburg, Ontario, N3A 2J5), [2]Canadensys Aerospace Corporation (10 Parr Blvd, Bolton, Ontario L7E 4G9), [3]NASA Glenn Research Center (21000 Brookpark Rd, Cleveland OH), [4]Canadian Space Agency, (St. Hubert, QC)

Introduction: In 2014, Ontario Drive & Gear Ltd. and Canadensys Aerospace Company began developing a pair of small to mid-size lunar rover prototypes funded by the Canadian Space Agency. Scheduled to be delivered in the first half of 2016, these lunar rover protypes will demonstrate the compatibility of the CSA four wheel skid-steer rover mobility architecture with higher technology readiness levels, with a target of achieving TRL-6. Additionally, ODG has developed a lunar wheel that is compatible with the lunar environment and is designed to remain compliant over a wide thermal range, thereby increasing tractive effort in both soft and rocky surfaces.

LRPDP: The Lunar Rover Platform and Drivetrain Prototype (LRPDP) is a mid-size (1.6 by 1.6 meter) mobility platform developed from the successful Juno Rover and Artemis Jr. Rover platforms used by CSA and NASA in multiple analogue deployments over the past 5 years. This rover is characterized by a robust, simple architecture that places an emphasis on extreme terrain capability, minimal mass, and modularity. This skid-steered rover features large (55 cm) wheels for maximum performance in rough terrain or soft regolith. All sensitive components such as motors, gearboxes, and avionics are located in sealed compartments in an effort to minimize heat loss and dust contamination. The chassis shape is optimized for quick change-out of large, centrally located payloads such as the RESOLVE payload tested in 2012 in Hawaii.

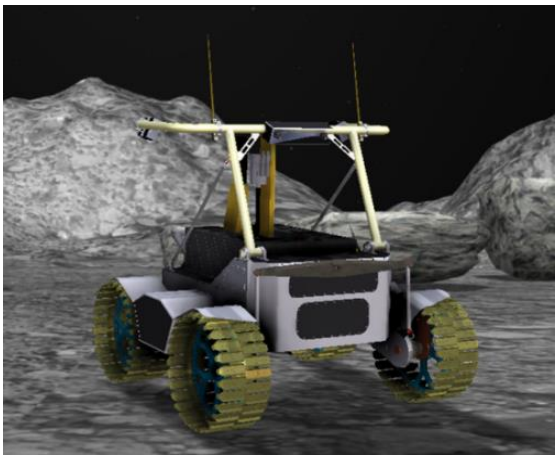

Figure 1: Lunar Rover Platform and Drivetrain Prototype

SPRP: The Small Platform Rover Prototype (SPRP) is a small (1.2 by 1.2 meter) mobility platform that, while similar to LRPDP, features a unique chassis designed to provide both thermal and contaminant protection for the avionics and power systems. The target mass is 90 kg with an allowable payload of 50 kg.

This rover will be used to develop both payloads and operational scenarios as well as to help determine the optimal rover size with respect to packaging, mass, and rough terrain capability.

Figure 2: Small Platform Rover Prototype

TRL-6 Testing: In an effort to achieve TRL-6 for the rover drivetrain, thermal vacuum testing will take place at NASA Glenn Research Center in Q4 2015. The vacuum chamber used at GRC allows the equipment to be tested in a vacuum envirionment together lunar simulant, while being exposed to a range of thermal scenarios traceable to the lunar surface thermal environment,. The testing exercises key components of the rover drivetrain under representative loading via a novel test rig and tests the design's robustness with respect to dust ingress, high & low temperature operation and multiple lunar day/night cycles.

Lunar Wheel Development: In conjunction with rover drivetrain development, a metallic wheel has been in development since 2011. Currently at TRL-4, the proprietary design has been tested for over a hundred kilometers in analogue terrains ranging from soft sand to extremely rocky mountainsides . In addition, lab testing was performed at Glenn Research Center to

determine traction characteristics in a lunar regolith simulant.

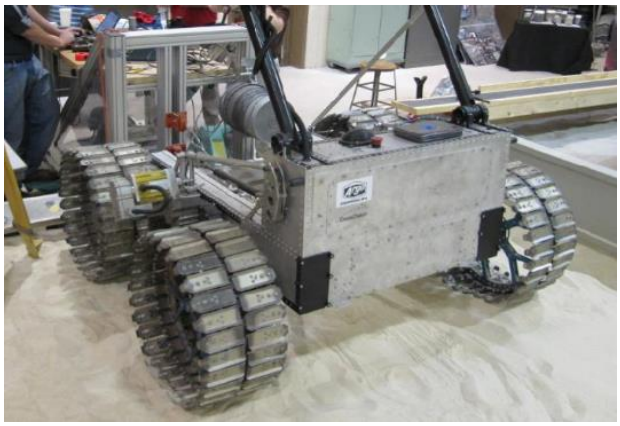

Figure 3: Metallic compliant wheel

References: [1] P. Visscher, E. Reid, (2012) "Continued development of Juno Rover", 50th AIAA, Tennessee

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[3] L. D. Graham, T.G. Graff, (2013) "Rover-based instrumentation and scientific investigations during the 2012 analog field test on Mauna Kea volcano, Hawaii", 44th Lunar and Planetary Science Conference,

Additional Information: Ontario Drive & Gear Ltd. is world leading producer of amphibious and extreme terrain manned and robotic vehicles marketed under the "Argo" brand. Canadensys is a space systems and services company with a focus on accessible space.