

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

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## SMALL MISSIONS AND THE NEW LUNAR GOLD RUSH

**Abstract**

The past year has seen the space exploration landscape evolve dramatically, particularly in the area of lunar exploration. 2016 saw high profile stories across space exploration reach mainstream media from the popular saga of the Philae lander and policy shifts on space-based resources to tangible concepts for the first interstellar missions and the announcement of SpaceX's roadmap for human missions to Mars. The first months of 2017 alone, meanwhile, have revealed the first shifts in US policy around the Moon and SpaceX's announcement of its 2-person lunar flyby mission inside two years, swiftly followed by announcements from other companies such as Blue Origin with their own plans for commercial delivery options to the lunar surface. Internationally, missions continue to be launched from Asia to the lunar surface, while multiple GLXP and commercial lunar lander teams continue to progress towards launch in the next 1-2 years. All in all, the momentum seems to have returned for lunar exploration, just in time for the 50th Anniversary of Apollo, this time with a larger and more diverse fleet of spacecraft, both government and commercial, and with an emphasis on smaller, more frequent missions that are operationally and commercially sustainable.

At the same time, this new wave of missions face a number of challenges. The next generation of missions target more remote destinations, more challenging environments, greater unknowns, longer durations and / or more ambitious in situ capabilities, All under the tighter resource constraints associated with smaller, lower cost missions. Success will involve a combination of state of the art technology advancement, close consideration of the target environment and careful, clever system design to eke out the maximum possible performance from subsystem combinations pushed to their limit.

This paper reviews some of the developments underway at Canadensys and partners aimed at improving the viability of small missions in the lunar environment. Testing of a range of components under lunar conditions are discussed, from lunar drivetrain and mechanism components, small-platform thermal control and energy storage technologies, to low temperature avionics and sensor developments currently underway at Canadensys, in collaboration with the Canadian Space Agency. Results of some of the immersive visualization activities in the region of the Lunar South Pole is also described, in collaboration with the International Lunar Observatory Association (ILOA), with important implications not only for thermal, power and communications, but also education and engagement components of lunar initiatives.