ADVANCED TECHNOLOGY DEVELOPMENT FOR SPACE EXPLORATION AT THE CANADIAN SPACE AGENCY. Jean-Claude Piedbœuf[1], Éric Martin[1], Martin Picard[1], Christian Lange[1] and Vicky Hipkin[1], [1]Canadian Space Agency, 6767 Route de l'Aéroport, St-Hubert, Québec, Canada, J3Y 8Y9, Jean-Claude.Piedboeuf@asc-csa.gc.ca.

Introduction: The Canadian Space Agency (CSA) is one of the fourteen agencies that developed the Global Exploration Strategy and is also an active member of the International Space Exploration Coordination Group (ISECG). At the CSA, Space Exploration includes the International Space Station (ISS), space robotic servicing, and exploration of the Moon, Mars and asteroids as well as astronomy. Recently, the CSA was reorganized and a dedicated branch was created for all exploration activities, for science and human exploration objectives.

From 2007 to 2010 considerable emphasis has been on developing advanced technologies for lunar exploration, though many of these are relevant to multiple destinations

In 2007, the CSA started the Exploration Core Program to ensure Canada's readiness for future exploration missions. The Canadian Stimulus Budget of 2009 increased the pace of activities targeting lunar and mars surface mobility systems, and robotic servicing in two special projects: Exploration Surface Mobility and Next Generation Canadarm. By the end of 2012, the CSA will have a fleet of rovers along with payloads all controllable from a central operation centre.

Exploration Core Preparatory Activities: The Exploration Core was created in 2007 to shape and determine the nature of Canada's contribution to potential international space exploration and astronomy missions. Exploration Core includes the design and development of advanced signature technologies to be used in potential missions destined for Space Exploration targets. In addition, it includes terrestrial deployments in analogue sites to test prototypes and develop proof-of-concept for surface science and In Situ Resource Utilisation (ISRU) operations. Canada's vast and varied geography includes significant impact crater sites (Sudbury, Haughton, Mistastin and Manicougan) as well as polar desert, badlands and mine tailings which provide analogue environments for many different lunar activities and investigations. Other sites across the world also present significant interest for moon terrestrial analogue missions.

Exploration Core is performed in collaboration with Canadian industry and academia, and with other space agencies. Technology developments are informed by the Canadian Space Agency's participation with international groups such as the International Space Exploration Coordination Group (ISECG) or iMARS. CSA is developing international partnerships in analogue activities, and has enjoyed successful partnership with NASA in lunar ISRU test deployments in Hawaii in 2008 and 2010.

Exploration Core activities are incremental, flexible and adaptable, gradually building on the niche technology expertise developed for the International Space Station and other missions. When beneficial, Exploration Core supports the development of spin-off products used in other sectors. For example, developing an electric vehicle or an automated resource extraction plant could benefit the automotive and mining industries; two pillars of the Canadian economy. Technological advances from developing medical autonomy for crew members are likely to offer commercial potential in the health sector, both nationally and internationally.

Exploration Core engages in three types of activities: (i) requirements development; (ii) prototyping and deployment; and (iii) building and maintaining operational infrastructure required to support prototype integration and deployment.

**Special Projects:**

The *Next Generation Canadarm Project* is developing prototypes of the next generation of the "Canadarm" on-orbit servicing system.

The *Exploration Surface Mobility Project* is an umbrella project that covers contracts for the development of small and medium sized rovers, advanced laser-based vision systems, drills, manipulators and science instruments. The systems will be integrated and deployed in 2012, and will make use of CSA's ExDoc, a centralised operations centre being built at CSA HQ for command and control.