



# Science Preparations for Early Exploration

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**MDA**

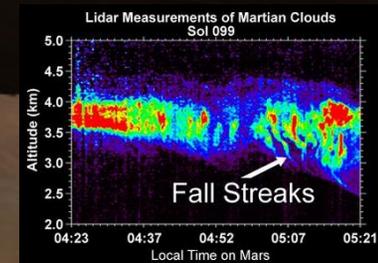
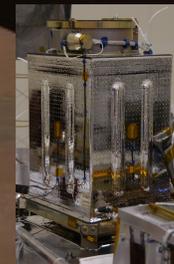
*PTMSS 2011*



# Canadian Planetary Science Foundations Laid...

 **Phoenix MET**  
Canada graduates  
on Mars, 2008

- First CDN surface sci inst to Mars
- Lessons learned
  - Sci-tech & Multi-agency collaborations
  - Mars environment, planetary rigour
  - Mission & science ops



 **Technology**

 **Discovery**

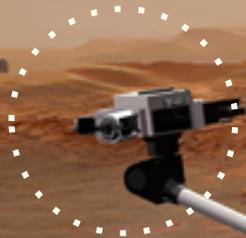


# Mission Resume About to Grow...

UNIVERSITY  
of GUELPH

 **MSL APXS**

*Ready for Launch  
end 2011*



- Delivered on schedule
- Lessons learned
  - More Sci-tech & Multi-agency collaborations
  - Mars environment, planetary protection
  - Mission & science ops

**\*\* Breaking News! \*\***  
**The Next Adventure...**

 **OSIRIS-REX**  
**Mapping Lidar**  
NASA New Frontiers  
2016 Mission  
NASA announced  
end May '11



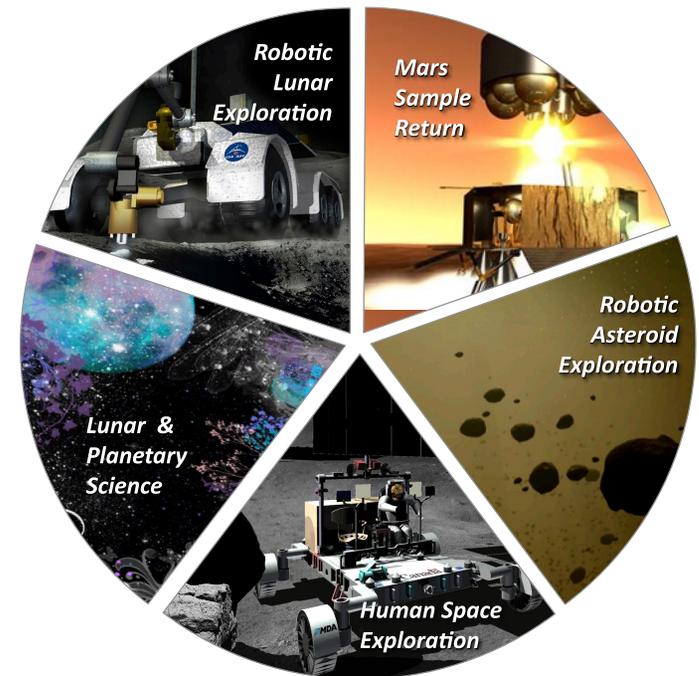
Optech





- *Science is an inextricable element of lunar & planetary exploration*
  - Especially key during early exploration (characterization phase)
- Policy
  - Fundamental exploration driver
  - Key stakeholder community
- Program planning & mission design
  - Environmental data
  - Resource availability
- Instrument development
  - Measmt & performance specifications
- Spacecraft / rover / lander design
  - Significant fraction of payload
- An adjustment from non-PLN missions (eg ISS) where no direct science i/f

## **Lunar & Planetary Science & Exploration**



# Science Across Exploration Preparation



2007



2004+



2001+



2004+



2007+



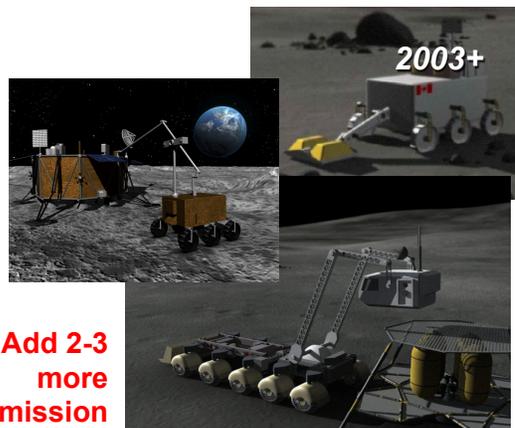
2008

*Mars Flight*

*ExoMars Ph A-B*

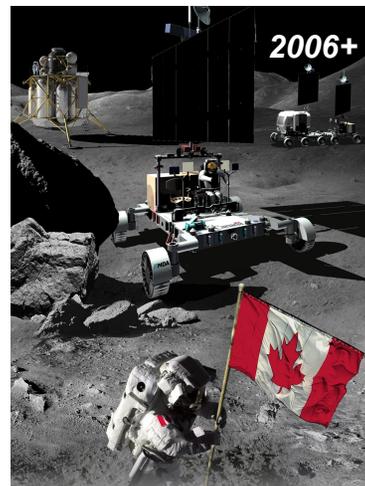
*Exploration Tech Dev*

*NASA & ESA Rover Collaborations*



2003+

Add 2-3 more mission pics



2006+

*Next Canadarm Preparation*



2009+

*NASA Space Science*

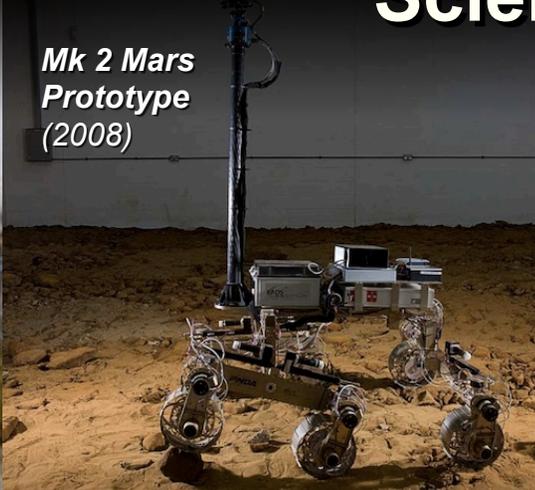
- Proud to be a part of CSA's exploration success & growth

# Scientific Delivery Vehicles

*Mk 1 Mars  
Prototype  
(2005)*



*Mk 2 Mars  
Prototype  
(2008)*



*Mk 3 Mars  
Prototype  
(2009)*



*Lunabotics  
Vehicle Sensing  
(2009)*



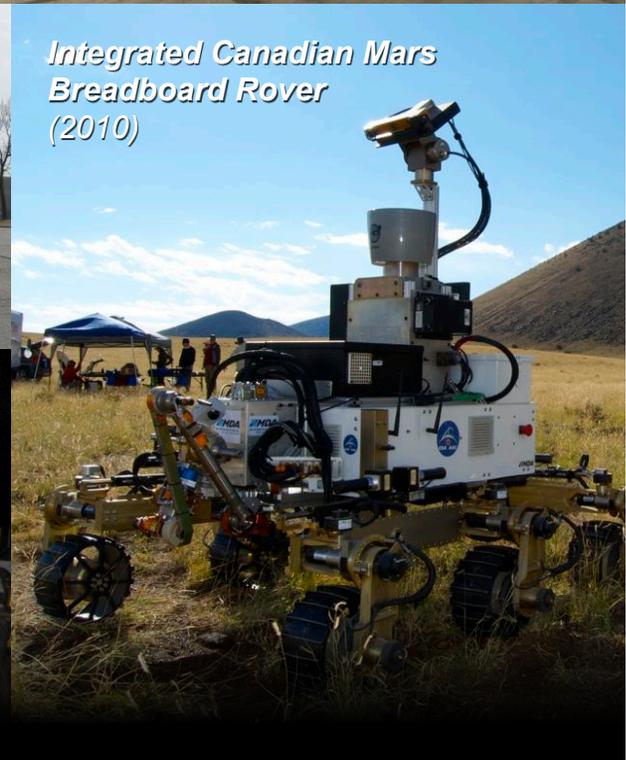
*Navigation  
Testbed  
(2009)*



*Manned Testbed (2009)*



*Integrated Canadian Mars  
Breadboard Rover  
(2010)*



*Rover Vision (2007)*



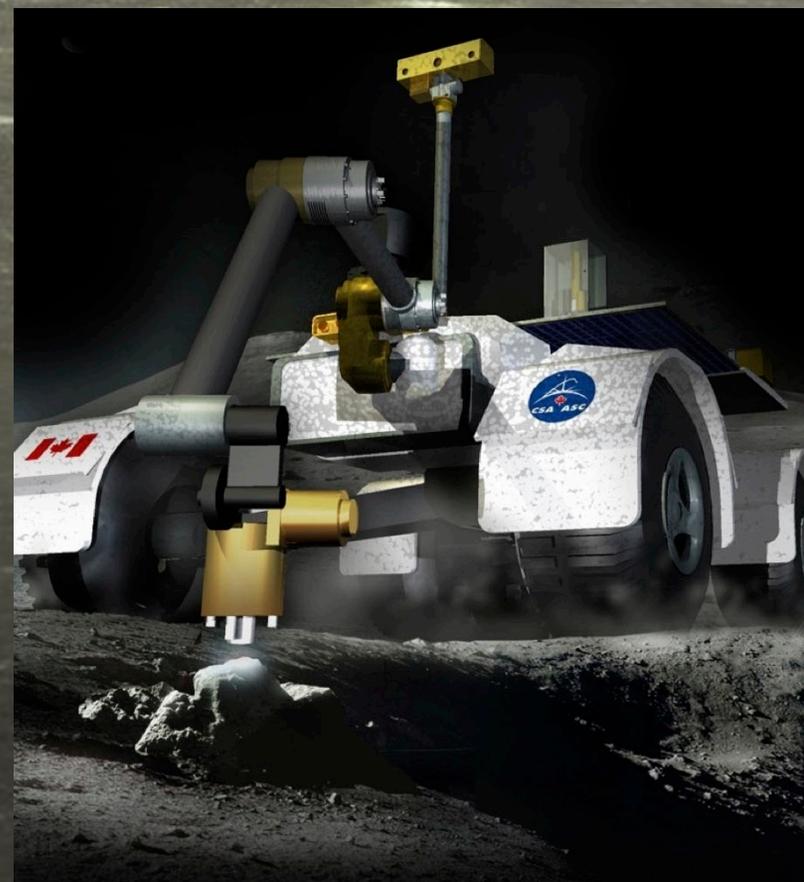
*Human Rover Nav Aids (2009)*



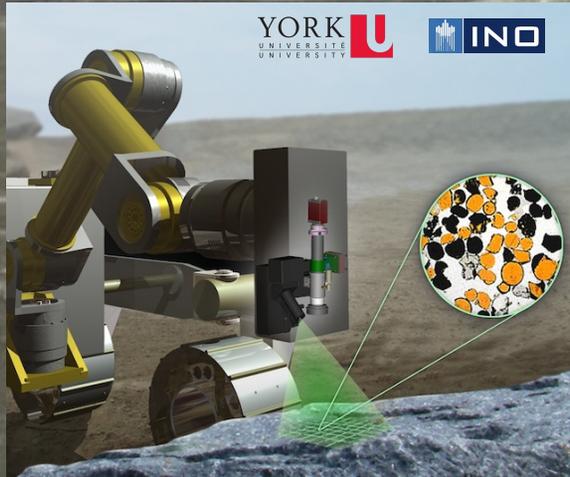
# New Canadian Rovers: Coming 2012...



*MESR: Mars Exploration  
Science Rover Prototype*



*LELR: Lunar Exploration  
Light Rover Prototype*



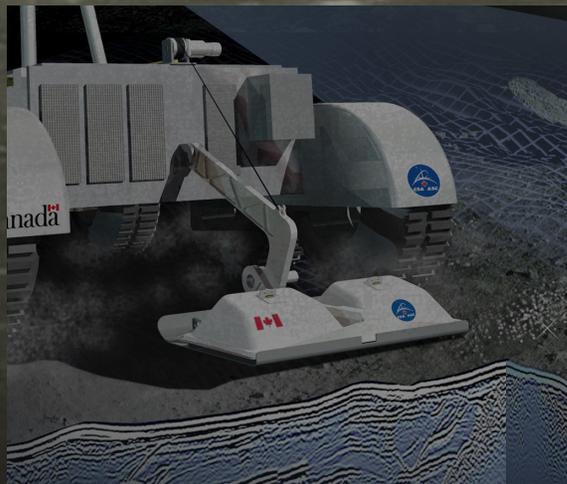
*3D Microscope (2011)*



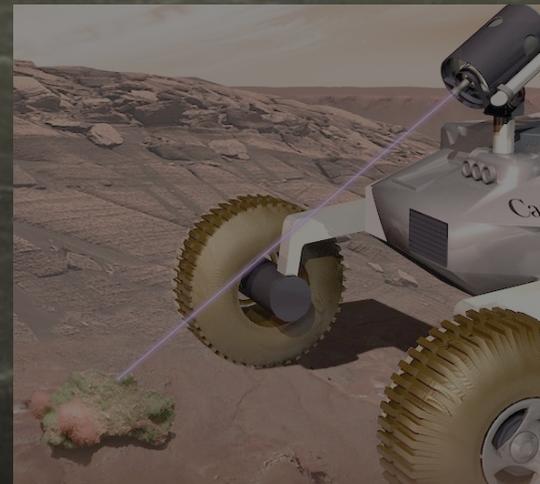
*3D Vision System (2011)*



*APXS (2009)*



*Lunar GPR (proposed 2012)*

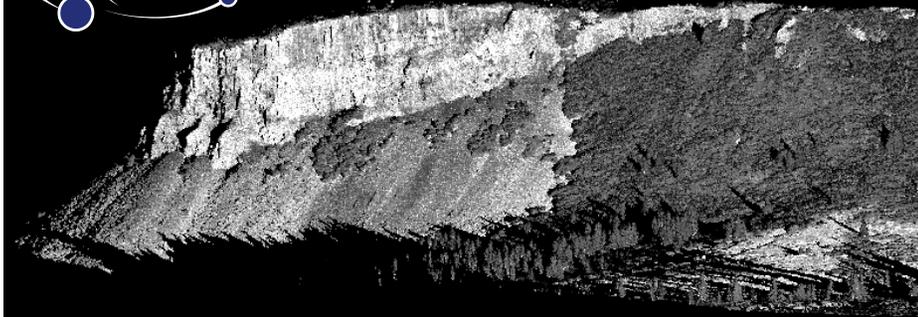


*Raman (proposed 2012)*

# Understanding Geology as a Mission Driver

## Ice & Impacts

Lunar Geology Analogue Missions  
Mistastin & Sudbury (2010, 2011)





- Testing approaches for localizing methane seeps on Mars using rover based instruments
- Various instrument approaches
- Lost Hammer, Axel Heiberg 2012
- Mars science rover
- Advanced vision
- Passive / active sensing

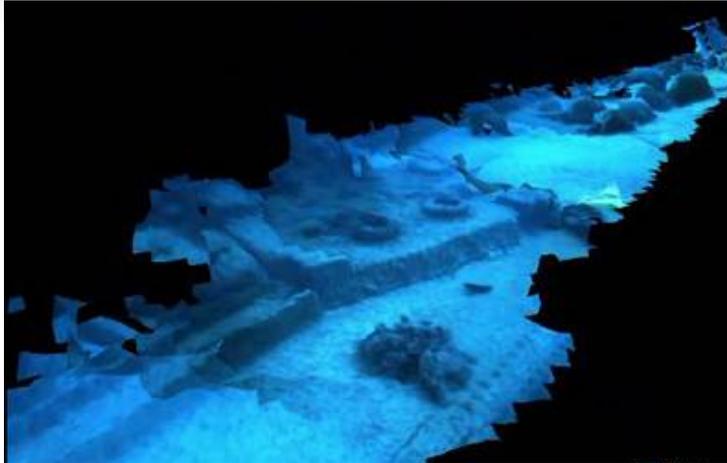




# Pavilion Lake Analogue Mission



2010/2011



# Learning to Explore, Preparing to Discover

*Mars Sample Return  
Technology Deployment  
US-CDN Mars Rover Prototype  
Deployment Flagstaff AZ, 2010*



*Science Drivers*



*Remote Operations*





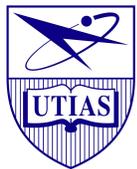
# Science cooperation opportunities



- (video)
- Payloads for Mars deployment scenarios
- Coordinated Mars sample return scenario
- Lunar scouting & prospecting
- Surface and subsurface sample acquisition



# A Growing CDN Community



- 25+ CDN co-operations in planetary science / exploration



- Science & Space Exploration (both robotic and human) are ever more intrinsically linked
- Pressing need for CDN planetary scientists (esp geologists) comfortable spanning the planetary science & exploration interface
- Cooperation between MDA and 25+ Canadian partners
- Close synergies between science and early prospecting and characterization
- Strong opportunity to strengthen links & consensus between communities – eg Hawaii 2012



*“There has never been a more exciting time for  
Planetary Science & Exploration in Canada”*

**Enjoy The Rest of  
GAC-MAC 2011!**

