



Science Preparations for Early Exploration

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MDA

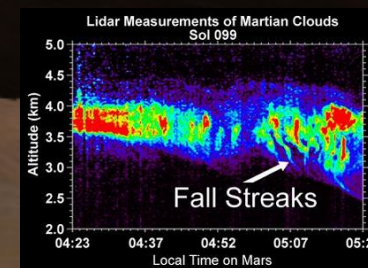
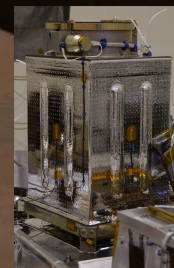
PTMSS 2011



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**



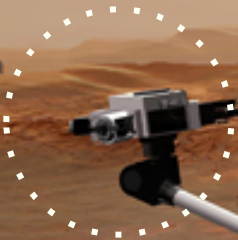
UNIVERSITY
of GUELPH

Mission Resume About to Grow...



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

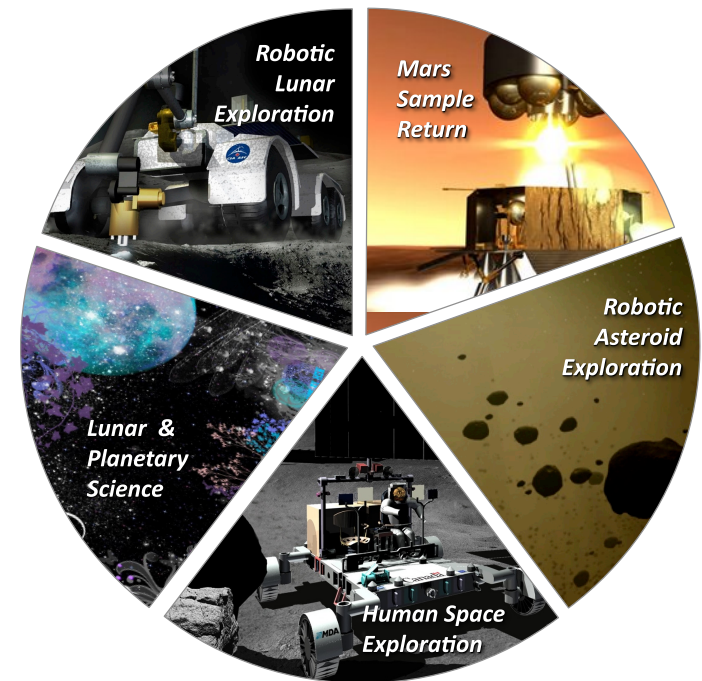




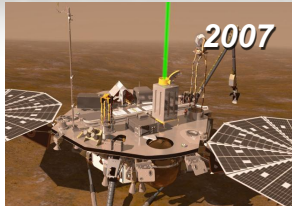
- *Science is an inextricable element of lunar & planetary exploration*
 - Especially key during early exploration (characterization phase)

- 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

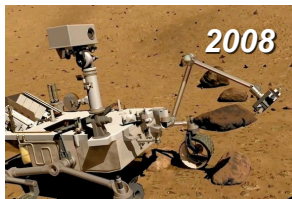
Lunar & Planetary Science & Exploration



Science Across Exploration Preparation

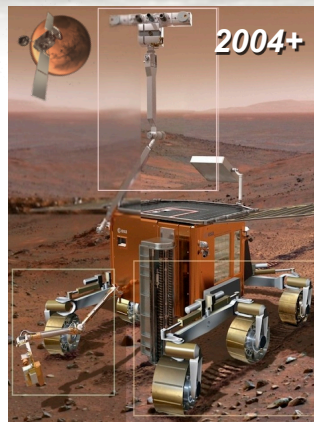


2007



2008

Mars Flight



2004+

ExoMars Ph A-B



2001+

Exploration Tech Dev

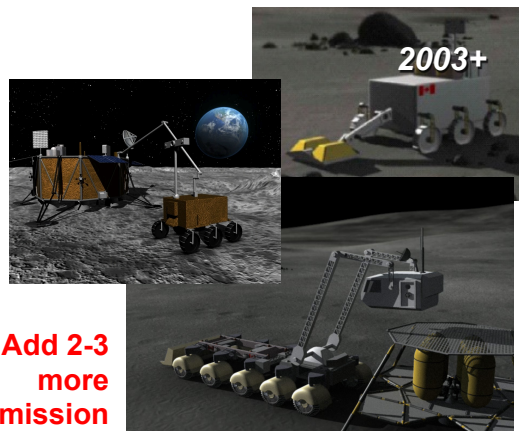


2004+

NASA & ESA Rover Collaborations



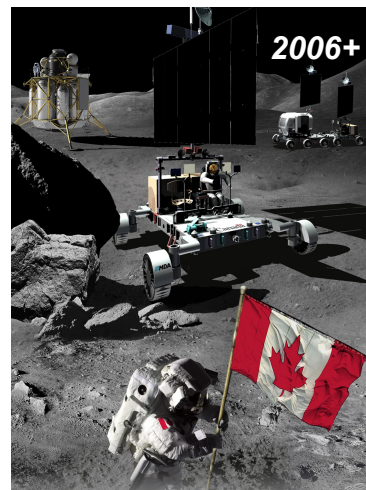
2007+



2003+

Add 2-3
more
mission
pics

Exploration Adv. Studies (20+)



2006+

Next Canadarm Preparation



2009+

NASA Space Science

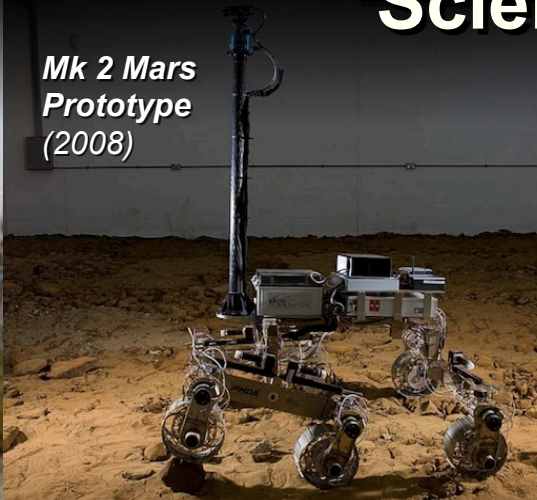
- Proud to be a part of CSA's exploration success & growth

Scientific Delivery Vehicles

*Mk 1 Mars
Prototype
(2005)*



*Mk 2 Mars
Prototype
(2008)*



*Mk 3 Mars
Prototype
(2009)*



*Lunabotics
Vehicle Sensing
(2009)*

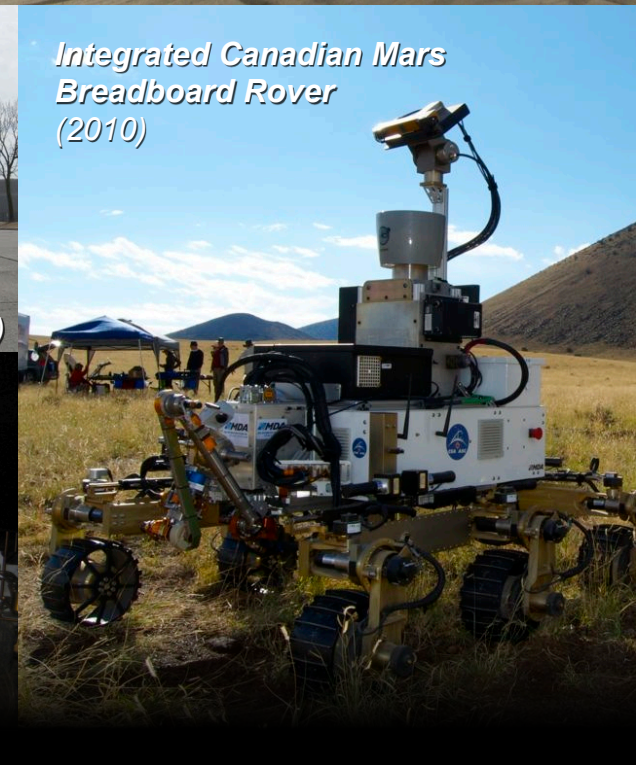


*Navigation
Testbed
(2009)*



Manned Testbed (2009)

*Integrated Canadian Mars
Breadboard Rover
(2010)*



Rover Vision (2007)



Human Rover Nav Aids (2009)



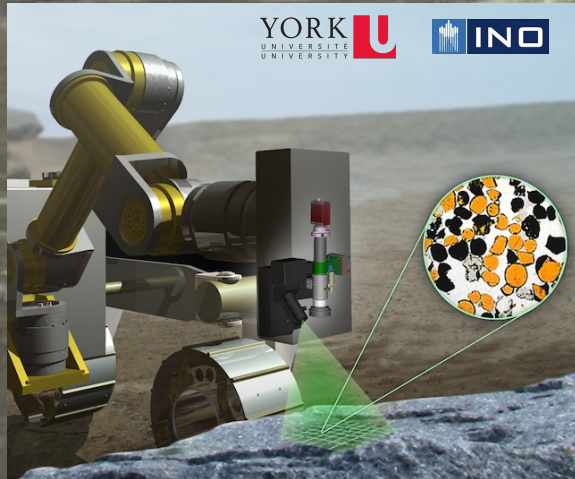
New Canadian Rovers: Coming 2012...



*MESR: Mars Exploration
Science Rover Prototype*



*LELR: Lunar Exploration
Light Rover Prototype*



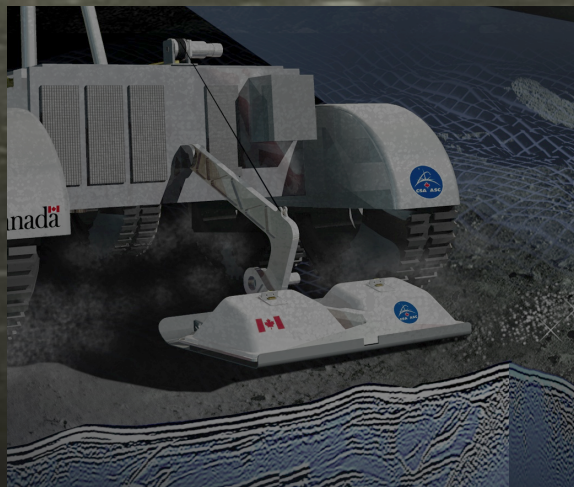
3D Microscope (2011)



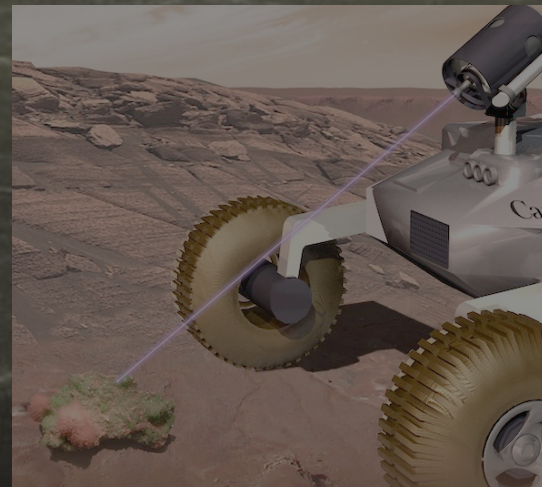
3D Vision System (2011)



APXS (2009)



Lunar GPR (proposed 2012)

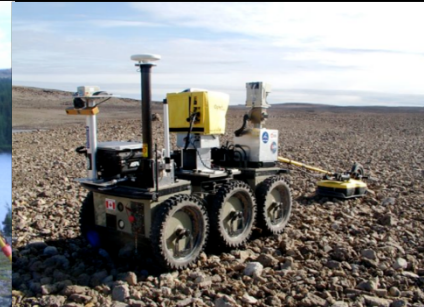
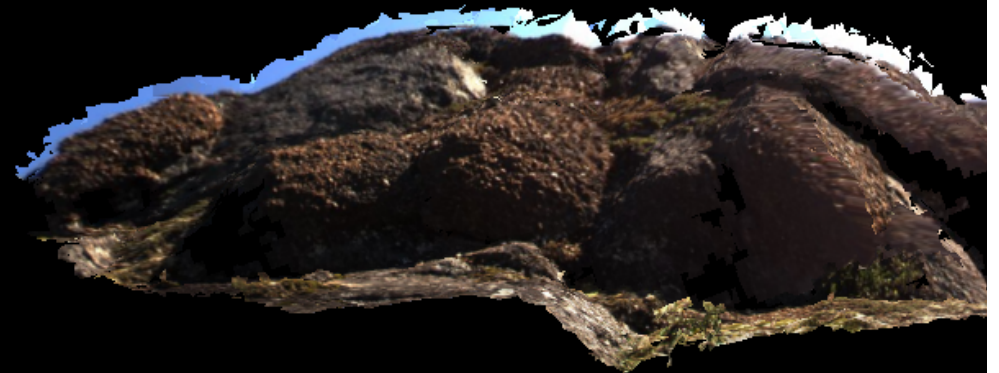
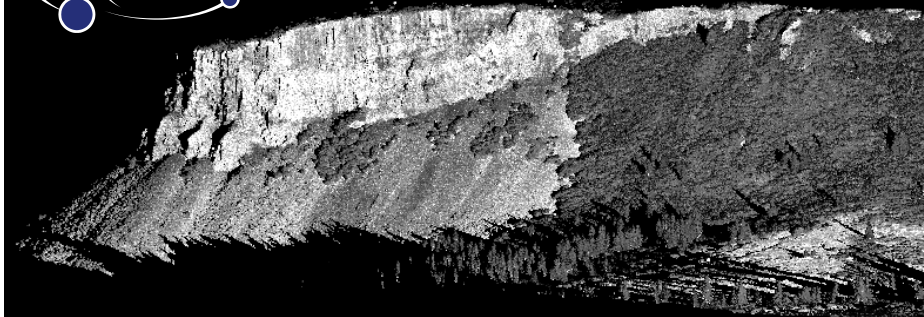


Raman (proposed 2012)

Understanding Geology as a Mission Driver

Ice & Impacts

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





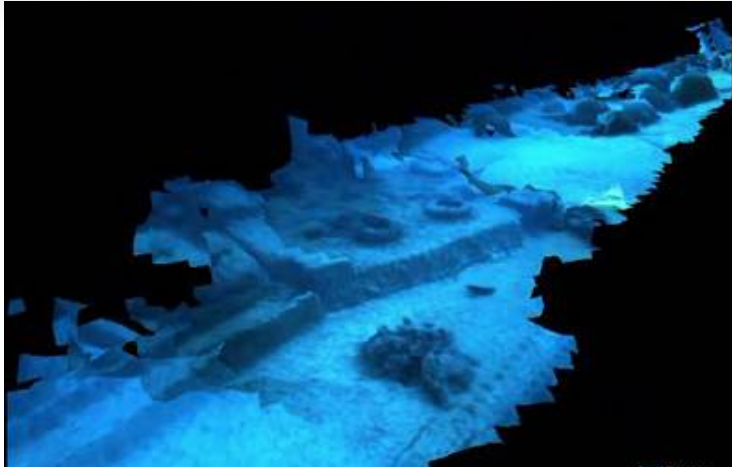
- Testing approaches for localizing methane seeps on Mars using rover based instruments
- Various instrument approaches
- Lost Hammer, Axel Heiberg 2012
- Mars science rover
- Advanced vision
- Passive / active sensing





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





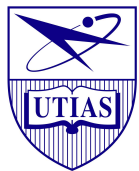
Science cooperation opportunities



- (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!**

