



Canadian Space Agency
Agence spatiale canadienne



CSA Proposed Future Exploration Activities

Briefing to ILEWG/LEAG
October 28, 2008



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Canada



CSA Update

- Dr. Steve MacLean named as CSA president on September 2, 2008 for a five-year term
- Minister has appointed an external advisory committee that reports to the Minister
- Canadian astronaut recruitment underway – 5000+ applications for 2 positions
- Phoenix Mars lander operations
- Two Canadian astronauts to fly in 2009 (Payette and Thirsk)
- Canadian government has made significant declarations on Science & Technology and Space in past year



Strategic Review

- Industry Canada review as mandated in S&T strategy
- Evolution to LTSP4:
 - ◆ “...as one of Steve MacLean's first acts as new President, the CSA will begin consultations with stakeholders that will lead to a new Long-Term Space Plan. I expect this plan — the fourth in the series — to be as influential for our generation of exploration and development as any plan that Canada has produced for charting our future in space. That's a tall order. I know that Steve is capable of bringing together the stakeholders. Time is of the essence, and I look forward to the plan in the coming months.”
 - ◆ -Minister of Industry, Sept 2, 2008





The Exploration Context

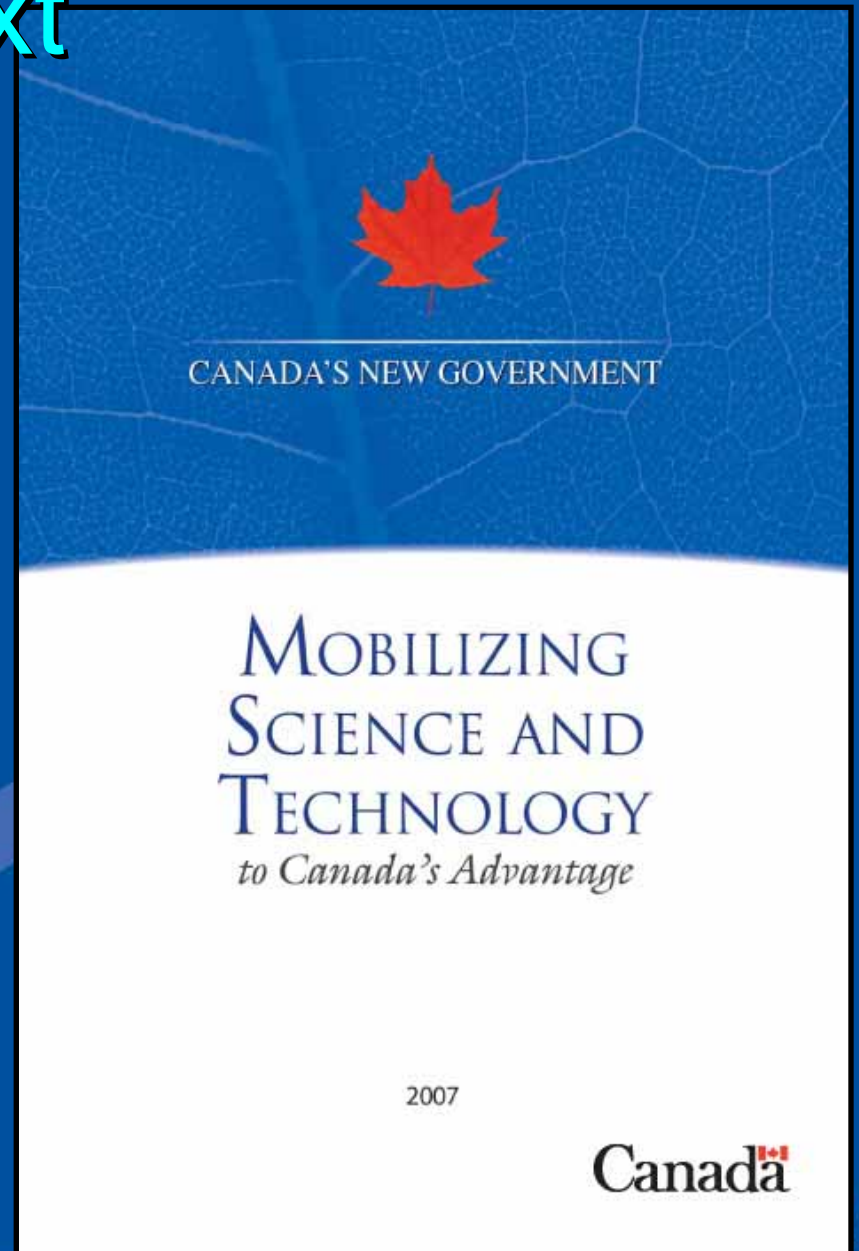
- The World is going to the Moon and Mars
 - ◆ Space faring nations are developing ambitious exploration programs
 - ◆ A time of many new opportunities
- Global Exploration Strategy (GES)
 - ◆ 14 contributing countries: Canada was strong contributor to framework document
- Int'l Space Exploration Coordination Group (ISECG)
 - ◆ First meeting in Berlin, Nov. 2007
 - ◆ Last meeting hosted by CSA
 - ◆ Next meeting in early 2009 in Japan





Canadian Context

- Government of Canada's Science and Technology Strategy
 - ◆ Released 2007





Proposed Exploration Goals

■ Participation in human Lunar exploration

- ◆ Through surface infrastructure
- ◆ Through precursor missions
- ◆ Through astronaut flights



■ Scientific Exploration of Mars

- ◆ Through robotic Mars Sample Return
- ◆ Through precursor missions



■ Supported through CSA Exploration Core

**What could be a welcome
lunar infrastructure
contribution?**





Infrastructure vs. Missions

- Canada proposes to participate in missions to the Moon and to Mars
 - ◆ Science instruments
 - ◆ Space servicing capabilities
 - ◆ Excavation and drilling technologies
 - ◆ Active vision systems
 - ◆ Manipulation and robotics
 - ◆ Communications technologies
 - ◆ Advanced life support technologies
 - ◆ Crew medical systems
 - ◆ Operational capabilities

Open Architecture

The Pieces of a Greater Mission



Human Missions to the Moon

US/NASA Developed initial capabilities

- Launch Vehicle Architecture
- Lunar Lander: ascent vehicle, descent vehicle, basic habitation
- Initial EVA system for CEV and an Initial Surface Suit
- Basic Navigation and Communication

Systems and Capabilities Environment for an Outpost including Outpost enabled sorties

- Long duration space suit
- Advanced long-duration Habitation
- Augmented Power Systems
- Basic unpressurized rover
- Pressurized rover
- Logistics rover
- Augmented, high bandwidth satellite communication/navigation
- Logistics Resupply
- ISRU Production

Open for cooperation

Time

Participatory Flexibility Strategy

- Develop parallel capabilities while seeking "open architecture" contributions
- Continue success of the Global Exploration Strategy through multilateral engagement in International Space Exploration Coordination Group (ISECG)
- Continue success of US Chamber of Commerce engagement
- Build on long-standing bilateral relationships while seeking new relationships when opportunities and conditions permit



Lunar Exploration Requirements

- Lander Design + launch
- Power Systems
- EVA (suit, support)
- Habitat
- ComNav
- ISRU
- Robotic Systems
- Science Instruments
- **Mobility Systems**

**Where could Canada
play a role in
infrastructure?**

Apply criteria



Science

- Lunar science: strategic and opportunistic
- Mars science:
 - ◆ Based on science priorities
 - ◆ Mars sample return, subsurface samples
 - ◆ Precursor missions
 - ◆ Opportunistic as well



Exploration Core

- Objective: **decrease risk and cost of future missions**
- CSA-wide
- Maintain a level of preparedness
 - ◆ to seize new opportunities as they arise
- Prepare universities and industries
 - ◆ Aligned on Proposed Exploration Program
- Resources for early payload requirements definition
- Bring systems to TRL 5-6
 - ◆ Ground prototypes in simulated-operational environment
 - ◆ Develop operation expertise
- Partnership: CSA, industry, academia & OGDs
 - ◆ CSA will act as integrator for ground prototypes

Concept Studies: 18 contracts

January to July-August, 2008

- Canadian Moon mobility system
 - ◆ Define operation concept
- Other potential infrastructure contributions
- Concepts for science contribution to Mars missions
- Science instruments for surface operation on the moon
- ISRU package
 - ◆ Drill, excavation and processing
- Vision systems
- Robotic arms for rover/lander
- On-orbit servicing systems
 - ◆ Manipulator - docking system
- Exploration communication infrastructure
- Medical autonomy





What's next?

- Exploration Core Kicked off
 - ◆ Budget ramping up
- Sharing of exploration program plans with space stakeholders
- Continued discussions with international partners for potential roles for Canada
- Preparation of Canada's next Long Term Space Plan
- Preparation of options for government



Upcoming CSA Events

- Phase 0 studies (proposals under review)
- Early prototype procurement underway
- CARN 2009 Deployments (RFP imminent)
- Data Analysis
- CSA participation to NASA analogue demos
- Prototype Development (RFP soon)
- Science Exploration Workshop (December 2008)
- DTO for TriDAR Rendezvous sensor on STS-128 (Spring 2009)



Challenges to Global Exploration Strategy

- Unsynchronised political readiness
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- Existing commitments vs new activities
- Diversity of stability of programs
- People and expertise
- Exchange of technical information



How will we make this work?

- Impact of GES and ISECG already
- Recall ISECG:
 - ◆ Works with existing groups
 - ◆ Not only for Moon
- To maximize impact of ISECG:
 - ◆ Interpreted by most international partners as the forum for coordination at the multilateral level
 - ◆ Realize the importance of ISECG to some nations, we all have different drivers