

# **Canadian Space Agency**

Introduction to our Cost Modernization Initiative and Opportunities for Cooperation

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### **About the Canadian Space Agency**



- Founded in 1989
- Headquarters: John H. Chapman Space Center, Located in Saint-Hubert, Quebec, Canada
- Satellite offices: Ottawa,
   Washington, Paris, Houston
- Canada was the 3rd country in space with the launch of Alouette in 1962
- Canada will contribute
   Canadarm 3, a robotic
   manipulator to the Lunar
   Gateway endeavor.

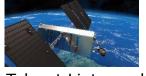
#### **Some Canadian Signature Technologies**

- Space Robotics (e.g. Canadarm)
- Synthetic Aperture Radar (e.g. RCM SAR)
- SatCom and Navigation (e.g. Telesat Lightspeed)
- High Precision Opto-Mechanical Systems
  - For Earth Observation, Astronomy, Planetary Exploration, Space Surveillance
  - E.g. JWST's Fine Guidance Sensor & Near Infrared Imager and Slitless Spectograph (NIRISS)
- Surface mobility (rovers)
- Satellite & Space Debris Monitoring (e.g. NEOSSAT or DND Sapphire)
- Life Science (Food and Health) (e.g. Astroskin)
- In Situ Resource Utilization (ISRU)



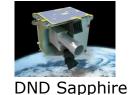
Canadarm 2













Telesat Ligtspeed **JWST** 

Lunar rover

Astroskin

### **International Partnerships**

- The United States and Canada share many commonalities which foster strong cultural and geopolitical ties
  - Canada has a long-standing partnership with NASA, dating back to the early days of the space shuttle program
  - Canada is also a Cooperating State of the European Space Agency (ESA) and participates in European programs
- CSA and NASA share common definitions for Technical Readiness Levels (TRL), Mission Phases, technical reviews, mission development and testing philosophies

#### CSA / NASA mission collaborations:

- Alouette / ISIS
- WINDII on UARS
- Fine Error Sensor on FUSE
- MOPITT on TERRA
- Radar components on Cloudsat
- THEMIS
- MET station on Phoenix lander
- APXS on Curiosity Rover
- Canadarm 1 on Shuttle
- Canadarm 2 and Dextre on ISS
- Various ISS payloads
- OLA on Osiris-Rex
- FGS and NIRISS on JWST
- Extended interaction klystrons on SWOT
- Canadarm3 on Gateway
- Future Lunar Rovers

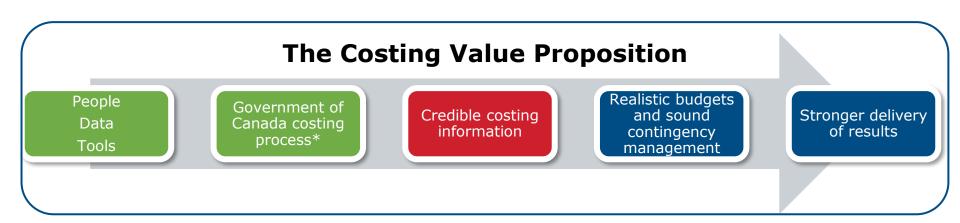
#### Improving our costing capacity & maturity

- Space Mission Costing is inherently difficult due to various factors such as technology complexity, uncertainty about variables, and evolving requirements.
- Government of Canada (GC) released a "Guide to Costing" aimed at enhancing its methods and practices to ensure more credible and transparent cost estimations.
- The Canadian Space Agency (CSA) is introducing a Cost Modernization initiative in response to the Treasury Board's directive. This is a new standalone activity within CSA, separate from regular program estimates.

### **Strategic Goals & Outcomes**

- Strategic Goals:
  - Compliance, Coherence, Quality, Control, Continuous Improvement
- Expected outcomes:
  - Better costing of projects over lifecycle of project, informed decision-making and better use of public funds.
  - Streamlined process will introduce efficiencies and a standardized approach to cost and schedule estimation
  - Evergreen process improvement will lead to culture change
  - Collaborating with partners & costing community

### 4 Pillars of Costing Modernization



Credible costing information plays an important role in enabling the Government of Canada (GC) to successfully achieve results

☐ 4 Pillars : Data, Tools, Process, People

#### **4 Axis of Intervention**

**DATA** 

**TOOLS** 

**PROCESS** 

**PEOPLE** 









Data Mining and Normalization

Develop Software Tools

Develop procedures standards and guides

Develop training and support certification

### Workplan at a glance

- Data Mining in Historical Archives
- Development of a toolkit
- Development of a CSA Costing Handbook
- Development of a costing policy framework
- Measuring progress using the Cost Capability Maturity
   Model

#### **Medium Term Plans**

Short Term Medium Term

Ops



Multiple Cost Estimating Exercises

Jata



Ongoing search through the historic archives, collecting and normalizing data

Tools



Identify Software Requirements

Excel prototype in the development environment

Gradual transition from development environment to production environment

Process



Policy Framework, Directive, Handbook, DIDs, Standards, etc.

Performance Measurement and process improvement

People



General and context specific classes

ICEAA - CEBoK cohorts
Online help

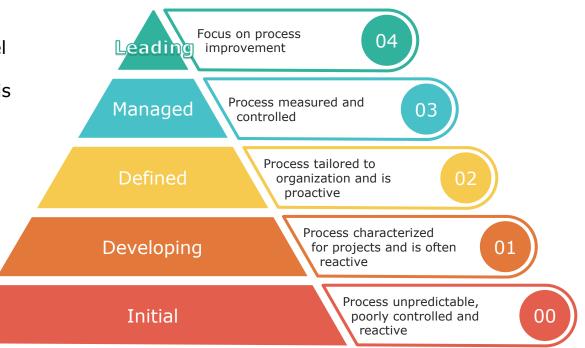
Risk based approach to certification

# Measuring our success

The Cost Capability Maturity Model (C2M2) will measure our progress across the difference phases of this initiative

The 4 axis of intervention are:

- Data
- Tools
- Process
- People



#### **Leveraging Best Practices**

- As CSA embarks on a journey of costing modernization we are inspired by the visionaries of the past and hope to build on the esteemed legacy of our peers:
  - NASA
  - Canadian Department of National Defence (DND)
  - Canada's Treasury Board Secretariat (TBS)

"If I have seen further, it is by standing on the shoulders of Giants."
-Issac Newton

# **Costing Processes are Similar**

Gov't Accountability Office	NASA	Treasury Board Secretariat	Dep't of National Defence
Define the Purpose and Scope	Receive request and understand project	Establish a purpose and a plan	Cost Planning
Develop a WBS	Build or obtain WBS	Employ a cost breakdown structure	Establish boundaries and assumptions
	Define or obtain technical Description		
Identify Ground Rules and Assumptions	Develop Ground Rules and Assumptions	Identify ground rules and assumptions	
	Select Cost Estimating Methodology		
	Select/Build Cost Model/Tool		Develop a model
Obtain Data	Gather and Normalize Data	Gather evidence and data	
Develop Point Estimates	Develop Cost Estimates	Determine uncertainty, risk and cost	Review, analyze and update
Account for Uncertainty	Develop and Incorporate the Cost Risk Assessment		
Validate and Document the Estimate	Document Cost Estimate	Assure and validate the exercise	Provide assurance
Present Results	Present the Cost Estimate Results	Communicate the results	Report results
Update the Estimate	Update the cost Estimate as Required	(Update as required)	
Conduct Sensitivity Analysis			
Conduct a Peer Review			
Use Best Practices and Tools			

## **Potential Areas of Cooperation**

Data



Data

Historical cost data for past missions, especially for joint NASA-CSA missions

Math Models

Proposed approach to adjust NASA CERs to reflect Canadian mission datasets Development of new CERs with Canadian Datasets

**Inflation Models** 

Software Tools

Dialog on database architecture (semantic model) to facilitate conversion of inputs parameters across platforms

Shared utility functions (datasheets format converter, CER selector, reporting and visualization functions)

Policies, Procedures, Supporting material

We plan on drafting handbooks, tutorials, help files (In English and French)

We also plan on providing inputs to CEBOK to give it a more international flavor

Findings, insights

Retrospective analysis to understand deltas between models

Training products

Tools



Process







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