

REQUEST FOR INFORMATION (RFI)

CANADIAN CAPABILITIES TO SUPPORT A FUTURE CANADIAN ROBOTIC MANIPULATOR SYSTEM

SOLICITATION DETAILS

REFERENCE NUMBER: 2018-001

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RESPONSE DUE DATE: FEB 23, 2018

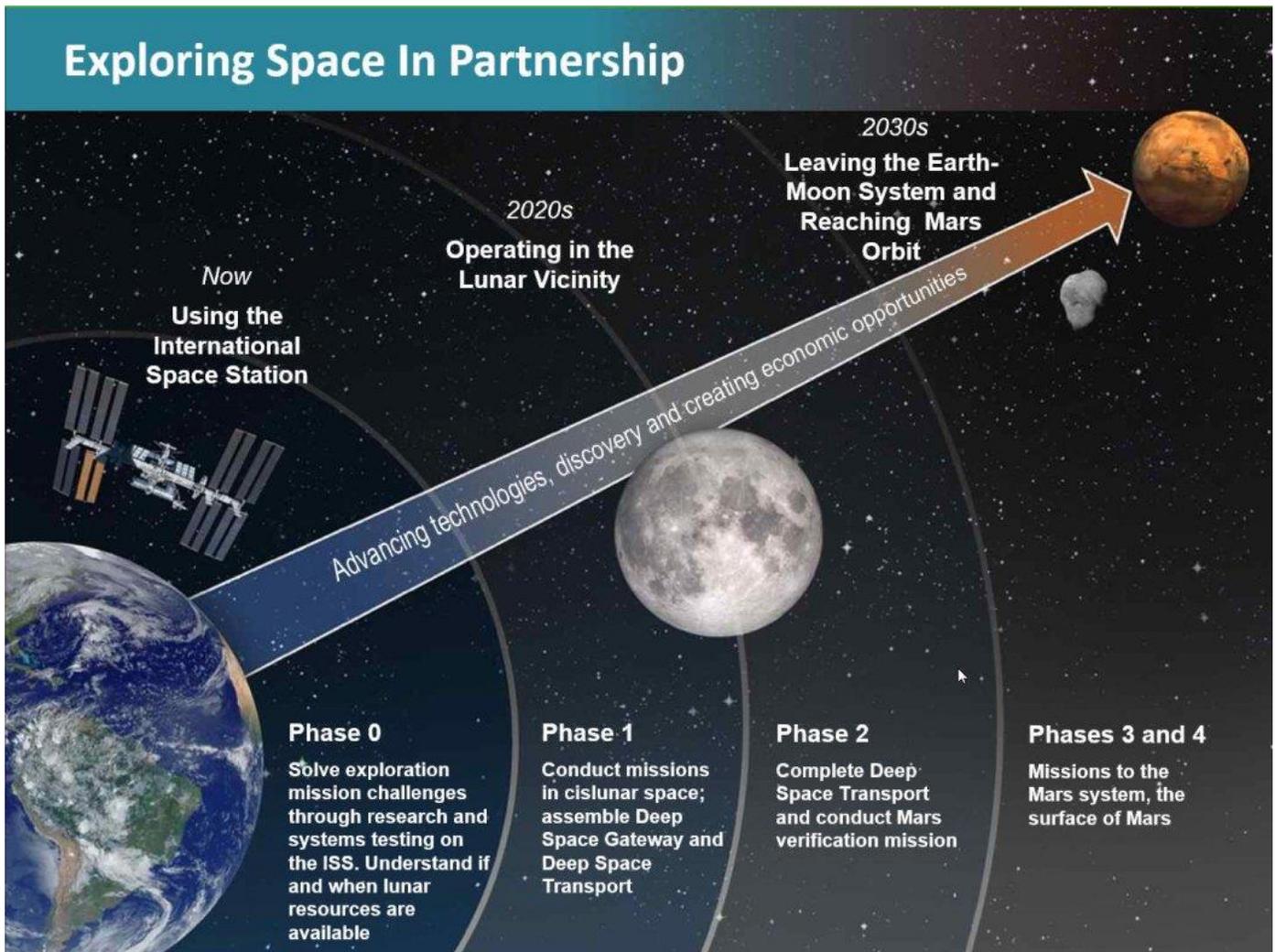
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1 Introduction

1.1 Objective

The International Space Exploration community is pursuing the long-term goal of permanent human presence beyond Low Earth Orbit. A manned station in lunar orbit, called the Deep Space Gateway, is in the planning stages and will be a proving ground for technologies that will take us to the Moon's surface, Mars and beyond. To ensure uninterrupted expansion of human presence into the solar system during the lifetime of the International Space Station (ISS), the time for action is now.



Canada is considering a robotics contribution as part of this international collaborative project. This builds on Canada's current robotic leadership position and expertise used extensively for decades on NASA's Space Shuttle Program and the International Space Station. Canada's robotics contributions helped construct the ISS itself and are used on an on-going basis for its maintenance and logistical operations. This technology is so iconic that it is depicted on our \$5 bill and is a globally recognized symbol of Canadian innovation.

For this RFI, MDA, under contract to the Canadian Space Agency, is seeking out Canadian capabilities necessary to realize a next generation robotic manipulator system for the Deep Space Gateway. These capabilities broadly cover advanced technologies, products, components, services and manufacturing technologies. MDA will compile the responses and provide CSA with an assessment of Canadian Capabilities related to developing a next-generation human-robotic system for the Deep Space Gateway.

1.2 General

This Request for Information (RFI) shall not be interpreted as a Request for Proposal (RFP). No agreement/contract will be entered into with or awarded to any vendor based on the responses to this RFI. MDA shall not be liable for, nor shall it reimburse any of the respondents, or any third-party, for any costs, fees or expenses incurred in the preparation or submission of a response to this RFI.

Response to this RFI will not create any obligation. MDA will not be bound by anything stated herein. Respondents shall not be bound by any aspect of their response to this RFI. Respondents are advised that information submitted may be used in the development of future request for quotes (RFQs) and/or RFPs.

This RFI represents the first of two proposed stages. For this stage, no NDAs will be entered into as part of this initial solicitation. The second stage may result in a request for an NDA whereby additional information can be provided specific to the foreseen needs.

This request for information (RFI) is a consultation document intended to solicit feedback from Canadian industry with respect to the matters described within this RFI. This is not a bid solicitation.

Please do not include any information that would warrant an NDA. At this stage in the RFI process MDA does not wish to engage in NDAs but will be willing to do so if required after the initial review of the response.

1.3 Background

The Canadian capabilities of interest for this RFI are applicable to the Robotics and Automation Division of MDA for commercial and civil applications. Responses to this RFI will help identify potential Canadian companies, capabilities and services that could be engaged in to develop a robotic manipulator system that could be used in future commercial opportunities or international collaborations.

The Robotics and Automation website for space based robotics can be found here:
<http://mdacorporation.com/isg/robotics-automation/space-based-robotics-solutions>

2 Requested Information

Should any of the technologies, products or services listed in Table 2-1 and Table 2-2 be relevant, respondents are invited to complete and submit the information requested below. Information can be filled out directly on this form and emailed back, or provided separately as long as the content is clear and complete.

2.1 General Respondent Information

Company Name	
Company Website	
Respondent's Address	
Contact information of Respondent Point of Contact (POC) including name, position/title, email, and phone number.	
Is the Company Canadian owned?	
Approximately what percentage of the company is located in Canada?	

Do you comply or have plans to comply with the following standards and/or certifications?

	AS 9100
	ISO 9001
	MIL-STD-1629A: Procedures for Performing a FMECA (guideline document)
	SSP 30234F: Failure Modes and Effects Analysis and Critical Items List Requirements for Space Station
	IEC 60812:2006: Analysis techniques for system reliability
	JSC 26943: Guidelines for the Preparation of Payload Flight Safety Data Packages and Hazard Reports
	SSP 30309: Safety Analysis and Risk Assessment Requirements Document
	NPRD-95: Non-electronic Parts Reliability Data
	EEE-INST-002: Instructions for EEE Parts Selection, Screening, Qualification, and Derating
	Workmanship standards to IPC Class 3
	J-STD-001ES: Requirements for Soldered Electrical and Electronic Assemblies
	ANSI/ESD S20.20-2007: For the Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment
	NASA-STD 8739.8: Standard for Software Assurance
	ISO/IEC 12207: Systems and Software Engineering – Software Life Cycle Processes
	NASA-STD-6016: Materials and Processes for Spacecraft
	CGSB LAP: Canadian General Standards Board Laboratory Acceptance Program

2.2 Products and Technologies

This section is intended for companies that are able to provide a specific product or technology resulting in an end item that would be required for the development of a robotic manipulator system. Such products or technologies would be used by MDA in the design, development or verification of the robotic manipulator system or integrated into the system as a stand-alone component or element. MDA has identified several products and/or technologies in Table 2-1 below.

If technologies have successfully demonstrated past space heritage please provide their Technology Readiness Level (TRL) achieved by past products be provided, and examples of flight heritage.

TRL definition can be found at: https://www.nasa.gov/pdf/458490main_TRL_Definitions.pdf

Please check off the products or technologies that you believe your company can provide. Note that these areas are provided for example only. This RFI is open to new technologies/game-changers for Earth-based applications that could be spun into a space system.

Table 2-1: Products and Technologies Summary List

Area	Product/Technology
<i>Robotics</i>	<input type="checkbox"/> <i>Force & Moment Sensors</i> <input type="checkbox"/> <i>Vision Systems</i> <input type="checkbox"/> <i>Optical Readers/Encoders</i> <input type="checkbox"/> <i>Transmission products (e.g. ballscrews, splines, harmonic drives)</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Rotary Joint Cable Control</i> <input type="checkbox"/> <i>Robotic Joints</i> <input type="checkbox"/> <i>Robotic Interface Connectors</i> <input type="checkbox"/> <i>Motor Drives/Resolvers</i>
<i>Materials</i>	<input type="checkbox"/> <i>Solid Lubricants</i> <input type="checkbox"/> <i>Wet Lubricants</i> <input type="checkbox"/> <i>Carbon Composites or other advanced materials</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Environment Engineering</i> <input type="checkbox"/> <i>Adhesives</i> <input type="checkbox"/> <i>Brake Materials</i>
<i>Sensors</i>	<input type="checkbox"/> <i>Optics</i> <input type="checkbox"/> <i>Lidar/Laser Distance Sensors</i> <input type="checkbox"/> <i>Inductive Sensors</i> <input type="checkbox"/> <i>Capacitive Sensors</i> <input type="checkbox"/> <i>Multi-Camera Arrays</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Imaging/Camera Sensors</i> <input type="checkbox"/> <i>Photoelectric/Infrared Sensors</i> <input type="checkbox"/> <i>Ultrasonic Sensors</i> <input type="checkbox"/> <i>Magnetic Sensors</i>
<i>Software</i>	<input type="checkbox"/> <i>Collision Detection</i> <input type="checkbox"/> <i>Collision Avoidance</i> <input type="checkbox"/> <i>Software Development/Support Environment</i> <input type="checkbox"/> <i>Automatic Task Planning</i> <input type="checkbox"/> <i>Automatic Path Planning</i> <input type="checkbox"/> <i>AI</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Software Requirements/Analysis/Capture</i> <input type="checkbox"/> <i>Software Life Cycle Management</i> <input type="checkbox"/> <i>Data Acquisition Systems</i> <input type="checkbox"/> <i>Server Integration/Control and Prioritizing</i> <input type="checkbox"/> <i>Image Processing</i>
<i>Electronics</i>	<input type="checkbox"/> <i>Data Bus Architecture</i> <input type="checkbox"/> <i>Field-Programmable Gate Arrays (FPGAs)</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Power Conditioning</i> <input type="checkbox"/> <i>Motor Drive Electronics</i> <input type="checkbox"/> <i>Advanced processors</i>

Area	Product/Technology
<i>Power</i>	<input type="checkbox"/> <i>High density batteries (Li-Ion Polymer)</i> <input type="checkbox"/> <i>Solar Arrays</i> <input type="checkbox"/> <i>Other: _____</i>
<i>Autonomy</i>	<input type="checkbox"/> <i>Supervised autonomy</i> <input type="checkbox"/> <i>Augmented Reality Space Creation</i> <input type="checkbox"/> <i>Cooperative Robotics</i> <input type="checkbox"/> <i>Decision Support Systems</i> <input type="checkbox"/> <i>Other: _____</i>
<i>Specialty Products</i>	<input type="checkbox"/> <i>Thermal Isolation (e.g. MLI)</i> <input type="checkbox"/> <i>Atomic Oxygen resistant coatings</i> <input type="checkbox"/> <i>Thermal Blankets</i> <input type="checkbox"/> <i>Circuit boards</i> <input type="checkbox"/> <i>Heat transfer (e.g. heat pipes)</i> <input type="checkbox"/> <i>Teflon impregnated coatings</i> <input type="checkbox"/> <i>Wear resistance treatment (e.g. nitriding, ion nitriding)</i> <input type="checkbox"/> <i>Separation nuts, frangi-bolts, etc.</i> <input type="checkbox"/> <i>Other: _____</i>
<i>Ground Support Equipment (GSE) / Special Test Equipment (STE)</i>	<input type="checkbox"/> <i>Structural supports</i> <input type="checkbox"/> <i>Tooling</i> <input type="checkbox"/> <i>Hoists/Lift Fixtures</i> <input type="checkbox"/> <i>Emulators (SW + HW)</i> <input type="checkbox"/> <i>Connectors</i> <input type="checkbox"/> <i>Remote workstation</i> <input type="checkbox"/> <i>Testbeds</i> <input type="checkbox"/> <i>Other: _____</i>
<i>Human-Machine Interfaces</i>	<input type="checkbox"/> <i>Input Devices</i> <input type="checkbox"/> <i>Other: _____</i>

Area	Product/Technology
<i>Other Products or Technologies / Comments</i>	

2.3 Services

The services listed in Table 2-2 below are intended for companies that can perform a specific function independently of whether or not they can provide an end product. The services listed are intended to be used to support the development, verification or build of a robotic manipulator system at component, assembly or system level.

Please check off the services that you believe your company can provide.

Table 2-2: Services Summary List

Area	Services	
<i>Analysis</i>	<input type="checkbox"/> <i>Structure</i> <i>e.g. FEM, statistical energy analysis (SEA)</i> <input type="checkbox"/> <i>Thermal</i> <i>e.g. TMM, hot/cold cases, heater duty-cycles</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Radiation</i> <i>e.g. TID, SEE, Displacement damage</i> <input type="checkbox"/> <i>EMI/EMC</i> <i>e.g. MIL-STD-461F: CE, CS, RE, RS</i> <input type="checkbox"/> <i>Electrical</i> <i>e.g. worst case analysis</i>
<i>Simulations</i>	<input type="checkbox"/> <i>Vision system simulations</i> <input type="checkbox"/> <i>Autonomy simulations</i> <input type="checkbox"/> <i>Contact Dynamic simulations</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Kinematic simulations</i> <input type="checkbox"/> <i>Operation simulations</i>
<i>Design</i>	<input type="checkbox"/> <i>Mechanical</i> <i>e.g. gear box, end effector, robotic tool, robotic interface design</i> <input type="checkbox"/> <i>Controls</i> <i>e.g. Control Algorithms and architecture design</i> <input type="checkbox"/> <i>Thermal</i> <i>e.g. Heater/radiator size/location; material selection</i> <input type="checkbox"/> <i>Human Factors</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Design</i> - <i>e.g. Dimensioning, tolerances, CAD, drawings</i> <input type="checkbox"/> <i>EMI/EMC</i> - <i>e.g. Mitigation, shielding</i> <input type="checkbox"/> <i>Radiation</i> - <i>e.g. Shielding</i> <input type="checkbox"/> <i>Electrical</i> - <i>e.g. harness, board assemblies, motor</i>
<i>Systems Support</i>	<input type="checkbox"/> <i>Failure tolerance and failure safe systems</i> <input type="checkbox"/> <i>Design for minimum risk</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Verification and Validation</i> <input type="checkbox"/> <i>Advanced User Interfaces</i> <input type="checkbox"/> <i>Concept of Operations</i>
<i>Procurements</i>	<input type="checkbox"/> <i>EEE Parts</i> <input type="checkbox"/> <i>Long lead parts</i> <input type="checkbox"/> <i>Space flight certified parts</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Inspection</i> <input type="checkbox"/> <i>Product Assurance</i>
<i>Integration</i>	<input type="checkbox"/> <i>Facilities</i> <i>e.g. clean rooms, cranes, high-bay</i> <input type="checkbox"/> <i>Assembly</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>Harness routing</i> <input type="checkbox"/> <i>Verification</i> <input type="checkbox"/> <i>Quality</i>
<i>Manufacturing</i>	<input type="checkbox"/> <i>Machine shops</i> <input type="checkbox"/> <i>Additive Manufacturing (e.g. metals such as titanium, aluminum, steel; high performance plastics such as PEEK, Ultem, Carbon Fibre reinforced plastics)</i> <input type="checkbox"/> <i>Other: _____</i>	<input type="checkbox"/> <i>High-precision capabilities</i> <input type="checkbox"/> <i>Treatments</i> <i>e.g. heat treatment, coatings, hardening</i> <input type="checkbox"/> <i>Material handling/testing</i>

Area	Services
<i>Test</i>	<input type="checkbox"/> <i>Facility Use</i> - <i>Vibration</i> - <i>Radiation</i> - <i>Thermal Chamber</i> - <i>Thermal Vacuum Chamber</i> - <i>EMI/EMC</i> - <i>Shock</i>
<i>Consulting</i>	<input type="checkbox"/> <i>Non-destructive testing</i> <input type="checkbox"/> <i>Destructive testing</i> <input type="checkbox"/> <i>Diagnostics testing</i> <input type="checkbox"/> <i>Material sample analysis</i> <input type="checkbox"/> <i>Other: _____</i>
<i>Other Services / Comments</i>	<input type="checkbox"/> <i>Specialty personnel</i> <i>e.g. magnetics specialists, radiation specialists</i> <input type="checkbox"/> <i>Other: _____</i>
	<input type="checkbox"/> <i>Specialty equipment</i> <i>e.g. laser-trackers, CMM (portable)</i>

3 Terms and Conditions

3.1 Enquiries

Enquiries are to be made by e-mail to the address indicated below. Any information provided in relation to this RFI will not be binding upon MDA under any circumstances.

Division:	MDA Robotics and Automation	Address:	9445 Airport Rd,
E-mail:	rfi@mdacorporation.com		Brampton, ON
			L6S 4J3

3.2 Costs for Responses

MDA is under no obligation and is not subject to any financial liability for the preparation and submission of a response. The response to this RFI is not to be construed as an issuance of a contract.

3.3 Response Submission

3.3.1 Due Date

Responses to this RFI must be received no later than 5PM EST on February 23, 2018.

3.3.2 How to Respond

All responses shall be submitted via e-mail to rfi@mdacorporation.com

Files may be submitted in MS Word or PDF format. Paper submissions will not be accepted.

3.3.3 Response Content

An overview of the response content is described in Section 2. Note, if the respondent has previously provided a response to RFI 2016-009, it is sufficient to provide a statement of interest with a reference to this response.