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PART 1 - GENERAL INFORMATION

1.1 Introduction

The bid solicitation is divided into seven parts plus attachments and annexes, as follows:

- Part 1 General Information: provides a general description of the requirement;
- Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation;
- Part 3 Bid Preparation Instructions: provides bidders with instructions on how to prepare their bid;
- Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, and the basis of selection;
- Part 5 Certifications and Additional Information: includes the certifications and additional information to be provided;
- Part 6 Security, Financial and Other Requirements: includes specific requirements that must be addressed by bidders; and
- Part 7 Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract.

List of Annexes and Attachments:

Annex A Statement of Work
Annex B Basis of Payment
Annex C Security Requirements Check List
Annex D Non-Disclosure Agreement

Attachment 1 to Part 3 Technical and Managerial Bid Preparation Instructions
Attachment 2 to Part 3 Electronic Payment Instruments
Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria
Attachment 1 to Part 5 Federal Contractors Program for Employment Equity - Certification

1.2 Summary

- 1.2.1** Public Works and Government Services Canada (PWGSC), on behalf of the Canadian Space Agency (CSA), is releasing this Request for Proposal (RFP) to acquire services to conduct work for the Lunar Rover Mission (LRM) Phase A related to the Lunar Exploration Accelerator Program (LEAP).

The objective of the LRM Phase A will be to demonstrate and confirm the feasibility, value and benefits of the proposed rover and instruments suite for validating technology and conduct opportunistic science on the Moon, and to demonstrate the validity of the mission requirements as well as the development of the system requirements and concept designs for the rover and its instrument suite. The LRM will include at least two science instruments: one from Canada and one from the United States of America (U.S.).

At the end of Phase A, the CSA expects to have all the technical and programmatic information necessary to assess the potential of the proposed rover and instruments suite to contribute to the objectives of the LEAP mission.

The intent of this RFP is to award up to two (2) Phase A contracts with a maximum funding of \$1,800,000.00 (Applicable Taxes extra) for each contract. The Phase A contract is for the development of the system requirements and concept designs for the rover and its Canadian instrument suite, and

includes the Work related to the integration of the U.S. scientific instrument described as optional goods and/or optional services that will be required to support the portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider as specified in the Bidder's bid. The portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider as specified in the Bidder's bid will be put under contract and funded directly by the National Aeronautics and Space Administration (NASA). As such, that cost is excluded from the maximum funding specified above. In the event that the total maximum funding available of \$3,600,00.00 (Applicable Taxes extra) for two contracts is not exceeded, an additional contract(s) may be awarded as specified in Part 4 - Evaluation Procedures and Basis of Selection of this bid solicitation. The planned budget for the U.S. scientific instrument(s) is \$5,000,000.00 US Dollars (USD) for Phases A, B, C and D. This disclosure does not commit NASA to pay the maximum funding available.

The period of the contract(s) for the Phase A initiative will be from date of contract award up to eight (8) months after contract award.

The procurement process for the LEAP - Lunar Rover Mission initiative is planned to be conducted in two phases. This RFP is Phase 1 in the procurement process and is for the Phase A initiative. The participation in the subsequent Phase 2 RFP of the procurement process is for the Phases B, C and D initiative. Only the successful Bidder(s) from the Phase A bid solicitation will be eligible to participate in the subsequent Phase 2 RFP process conducted by PWGSC as described in further details below. Although the procurement process remains subject to change (and even to cancellation, in accordance with 2003 Standard Instructions – Goods or Services – Competitive Requirements), Canada anticipates that the procurement process will be conducted in the following two phases:

a) Phase 1 - Request for Proposal (RFP) for Phase A

Participation in this RFP and obtaining a contract for Work under Phase A is a condition and prerequisite for the participation in the subsequent Phase 2 RFP for Phases B, C and D. Canada intends to award two contracts for the Phase A Work. The portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider as specified in the Bidder's bid will be put under contract and funded directly by NASA. However, the Contractor(s) for the Phase A Work will be required to self-organize with the Canadian and U.S. teams to provide sound and meritorious lunar science, should Canada exercise the Optional Goods and/or Optional Services, to meet the requirements as specified in the SOW.

U.S. participation as described in the solicitation is contingent upon execution of an implementing agreement between the United States (U.S.) and Canada. Bidders are cautioned that any proposal costs incurred by U.S. scientific instrument(s) providers that are contingent on U.S. involvement are at their risk until an agreement between the U.S. and Canada has been duly executed. This statement is not intended to establish any commitment or agreement by the U.S. to reimburse bid and proposal costs to U.S. instrument(s) providers.

b) Phase 2 - Request for Proposal (RFP) for Phases B, C and D

This RFP is expected to be issued during Phase A Work in Winter 2021/2022, if applicable. Canada will release the Phase 2 RFP only to the two contractors selected under the Phase 1 RFP. The Phase 2 RFP will cover the Work required under Phases B, C and D, with price for the Work being a key element of the Basis of Selection along with technical merit in order to achieve best value. Canada intends to award one contract for Phase B, C and D Work, which is defined as follows:

Phase B: Preliminary Design Definition

This phase uses the technical requirements outlined in the Phase A work to provide a preliminary (or early) engineering design of the Lunar Rover and its Science Instruments.

Upon completion of the Work under this phase, Canada will elect, at its sole discretion, if it wishes to proceed with the Work under the next phase of the project.

Phase C: Detailed Design Definition

This phase finalizes the preliminary Phase B work and locks down the design of the Lunar Rover and its Science Instruments through a detailed review process known as a "Critical Design Review" (CDR) where every single design element of the Lunar Rover and its Science Instruments are scrutinized and finalized before moving forward with the manufacturing phase.

Upon completion of the Work under this phase, Canada will elect, at its sole discretion, if it wishes to proceed with the Work under the next phase of the project.

Phase D: Manufacturing, Assembly, Integration and Test (MAIT) and Launch Preparation

This phase includes the manufacturing, assembly, integration, testing and commissioning.

1.2.2 Security requirements

There are security requirements associated with this requirement. For additional information, consult Part 6 - Security, Financial and Other Requirements, and Part 7 - Resulting Contract Clauses. For more information on personnel and organization security screening or security clauses, bidders should refer to the [Contract Security Program](http://www.tpsgc-pwgsc.gc.ca/esc-src/introduction-eng.html) of Public Works and Government Services Canada (<http://www.tpsgc-pwgsc.gc.ca/esc-src/introduction-eng.html>) website.

1.2.3 Canadian Content

The requirement, with the exception of the U.S. science instrument(s), is limited to Canadian goods and Canadian services.

1.2.4 The Federal Contractors Program (FCP)

The Federal Contractors Program (FCP) for employment equity applies to this procurement; refer to Part 5 – Certifications and Additional Information, Part 7 - Resulting Contract Clauses and the annex titled Federal Contractors Program for Employment Equity - Certification.

1.2.5 Epost Connect service

This bid solicitation requires bidders to use the epost Connect service provided by Canada Post Corporation to transmit their bid electronically. Bidders must refer to Part 2 entitled Bidder Instructions, and Part 3 entitled Bid Preparation Instructions, of the bid solicitation, for further information.

1.3 Debriefings

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days from receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

1.4 Phase Bid Compliance Process

The Phased Bid Compliance Process (PBCP) applies to this requirement.

PART 2 - BIDDER INSTRUCTIONS

2.1 Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The [2003](#) (2020-05-28) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

Subsection 5.4 of [2003](#), Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: 60 days
Insert: 180 days

2.1.1 SACC Manual Clauses

SACC *Manual* clause [A7035T](#) (2007-05-25), List of Proposed Subcontractor

2.2 Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit via epost Connect by the date, time and place indicated in the bid solicitation.

For bidders needing to register with epost Connect, the email address is:

tpsgc.dgareceptiondessoumissions-abbidreceiving.pwgsc@tpsgc-pwgsc.gc.ca

Interested bidders must register a few days prior to solicitation closing date.

Bids will not be accepted if emailed directly to this email address. This email address is to be used to open an epost Connect conversation, as detailed in Standard Instructions 2003, or to send bids through an epost Connect message if the Bidder is using its own licensing agreement for epost Connect.

Due to the nature of the bid solicitation, bids transmitted by facsimile or electronic mail to PWGSC will not be accepted.

2.3 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPSs, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions

For the purposes of this clause, "*former public servant*" is any former member of a department as defined in the [Financial Administration Act](#), R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a. an individual;
- b. an individual who has incorporated;
- c. a partnership made of former public servants; or
- d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"*lump sum payment period*" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"*pension*" means a pension or annual allowance paid under the [Public Service Superannuation Act](#) (PSSA), R.S., 1985, c. P-36, and any increases paid pursuant to the [Supplementary Retirement Benefits Act](#), R.S., 1985, c. S-24 as it affects the PSSA. It does not include pensions payable pursuant to the [Canadian Forces Superannuation Act](#), R.S., 1985, c. C-17, the [Defence Services Pension Continuation Act](#), 1970, c. D-3, the [Royal Canadian Mounted Police Pension Continuation Act](#), 1970, c. R-10, and the [Royal Canadian Mounted Police Superannuation Act](#), R.S., 1985, c. R-11, the [Members of Parliament Retiring Allowances Act](#), R.S. 1985, c. M-5, and that portion of pension payable to the [Canada Pension Plan Act](#), R.S., 1985, c. C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? **Yes () No ()**

If so, the Bidder must provide the following information, for all FPSs in receipt of a pension, as applicable:

- a. name of former public servant;
- b. date of termination of employment or retirement from the Public Service.

By providing this information, bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with [Contracting Policy Notice: 2019-01](#) and the [Guidelines on the Proactive Disclosure of Contracts](#).

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **Yes () No ()**

If so, the Bidder must provide the following information:

- a. name of former public servant;
- b. conditions of the lump sum payment incentive;
- c. date of termination of employment;
- d. amount of lump sum payment;
- e. rate of pay on which lump sum payment is based;
- f. period of lump sum payment including start date, end date and number of weeks;
- g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

2.4 Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority no later than **ten (10)** calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked

"proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated and the enquiry can be answered to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

2.5 Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario, Canada.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the bidders.

2.6 Improvement of Requirement During Solicitation Period

Should bidders consider that the specifications or Statement of Work (SOW) contained in the bid solicitation could be improved technically or technologically, bidders are invited to make suggestions, in writing, to the Contracting Authority named in the bid solicitation. Bidders must clearly outline the suggested improvement as well as the reason for the suggestion. Suggestions that do not restrict the level of competition nor favour a particular Bidder will be given consideration provided they are submitted to the Contracting Authority at least ten (10) calendar days before the bid closing date. Canada will have the right to accept or reject any or all suggestions.

2.7 Bid Challenge and Recourse Mechanisms

- (a) Several mechanisms are available to potential suppliers to challenge aspects of the procurement process up to and including contract award.
- (b) Canada encourages suppliers to first bring their concerns to the attention of the Contracting Authority. Canada's [Buy and Sell](#) website, under the heading "[Bid Challenge and Recourse Mechanisms](#)" contains information on potential complaint bodies such as:
 - Office of the Procurement Ombudsman (OPO)
 - Canadian International Trade Tribunal (CITT)
- (c) Suppliers should note that there are strict deadlines for filing complaints, and the time periods vary depending on the complaint body in question. Suppliers should therefore act quickly when they want to challenge any aspect of the procurement process.

PART 3 - BID PREPARATION INSTRUCTIONS

3.1 Bid Preparation Instructions

Epost Connect Bid Submission

Bidders must submit their bid electronically in accordance with section 08 of the 2003 Standard Instructions and Attachment 1 to Part 3 Technical and Managerial Bid Preparation Instructions of this solicitation document. The epost Connect system has a limit of 1GB per single message posted and a limit of 20GB per conversation.

The bid must be gathered per section and separated in four individual attachments as follows:

Section I: Technical and Managerial Bid

Section II: Financial Bid

Section III: Certifications

Section IV: Additional Information

Due to the impacts from the COVID-19 pandemic, the reduced business hours and limited staff available at the NCR Bid Receiving Unit, bidders must transmit their bids electronically using the epost Connect service in a searchable format such as searchable PDF format. Bids that are submitted using other methods of bid delivery usually available such as in person delivery, facsimile, hard copy, CD or USB key will be considered non-responsive and will not be evaluated.

Prices should appear in Section II of the Financial Bid only. No prices should be indicated in any other section of the bid.

Section I: Technical and Managerial Bid

In their technical and managerial bid, bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will meet these requirements. Bidders should demonstrate their capability and describe their approach in a thorough, concise and clear manner for carrying out the work.

The technical and managerial bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

Additional instructions are provided in Attachment 1 to Part 3 Technical and Managerial Bid Preparation Instructions.

Section II: Financial Bid

3.1.1 In their financial bid, bidders must submit a total firm, all-inclusive price for “(A) + (B) Total firm, all-inclusive price:” as highlighted in grey in the Basis of Payment in Annex B, customs duties included and Applicable Taxes extra.

The firm amount per milestone will be calculated by Canada based on the formula detailed in the Basis of Payment in Annex B and will be incorporated into the resultant contract.

3.1.1.1 Price Breakdown

With the exception of the proposed U.S. scientific instrument(s), bidders are requested to detail the following elements for the performance of each work package, milestone or phase of the Work under Phase A, as

applicable, and in accordance with Table 1 Work Package Description Sheet and Table 2 Resource Allocation Matrix of Attachment 1 to Part 3 Technical and Managerial Bid Preparation Instructions:

- (a) Labour: For each individual and (or) labour category to be assigned to the Work, indicate: i) the hourly rate, inclusive of overhead and profit; and ii) the estimated number of hours.
- (b) Equipment: Specify each item required to complete the Work and provide the pricing basis of each one, Canadian customs duty and excise taxes included, as applicable. These items will be deliverable to Canada upon completion of the contract.
- (c) Materials and Supplies: Identify each category of materials and supplies required to complete the Work and provide the pricing basis.
- (d) Travel and Living Expenses: Indicate the number of trips and the number of days for each trip, the cost, destination and purpose of each journey, together with the basis of these costs for each resource.
- (e) Subcontracts: Identify any proposed subcontractor and provide for each one the same price breakdown information as contained in this article.
- (f) Other Direct Charges: Identify any other direct charges anticipated, such as long distance communications and rentals, and provide the pricing basis.
- (g) Contributions: Identify industrial contributions, if applicable.
- (h) Applicable Taxes: Identify any Applicable Taxes separately.

Though participation in this RFP and obtaining a contract for Work under Phase A is a condition and prerequisite for the participation in the subsequent Phase 2 RFP for Phases B, C and D as indicated in section 1.2.1 of this bid solicitation, bidders are requested to provide the cost estimates for the Rough Order of Magnitude (ROM) Life-Cycle Costs (LCC) segregated for Phases A to E, including the U.S. science instrument(s) as a separate WBS element, in accordance with the format specified in Table 3-1 TEMPLATE FOR COST BREAKDOWN BY WBS of Annex A - Statement of Work as shown below. The LCC for the U.S. science instrument(s) should be provided in USD. All other LCC should be provided in CAD funds (Applicable Taxes extra).

TABLE 3-1 TEMPLATE FOR COST BREAKDOWN BY WBS

1	2	A	D	C	D	E	F	G	H	I	J	K	
5													
6		WBS	WBS Element		FY21	FY22	sub-Total	FY22	FY23	FY24	FY25	sub-Total	Total Proj
7		01	Project management										
8			Labour (\$)										
9			Sub-Contracts										
10			Materials/Other										
11			Travel Living										
12			Labour hours										
13		02	System Engineering										
14			Labour (\$)										
15			Sub-Contracts										
16			Materials/Other										
17			Travel Living										
18			Labour hours										
19		03	Safety & Mission Assurance										
25		04	Science / Technology										
26		04.01	Science										
32		04.08	Technology Development (prototypes, etc.)										
38		05	Payload(s)										
39		05.01	Payload # 1										
45		05.02	Payload # 2										
51		06	Spacecraft Systems										
52		06.01	Rover										
53		06.01.01	Structure										
54		06.01.02	Mobility										
55		06.01.03	C&DI										
56		06.01.04	Power and Electrical										
57		06.01.05	Thermal										
58		06.01.06	GNC										
59		06.01.07	Sensors										
60		06.01.08	Communications Subsystems										
61		06.01.09	Harness										
62		06.01.10	Software										
63		06.02	Lander										
64		06.03	Spacecraft										
65		07	Mission Operations										
66			Breakout separable services (e.g. DSN, dish time)										
67			e.g. Training										
68			e.g. Simulators										
69			Labour (\$)										
70			Sub-Contracts										
71			Materials/Other										
72			Travel Living										
73			Labour hours										
74		08	Launch Vehicle / Services										
75		09	Ground Systems										
76		10	System Integration & Testing										
77		11	Public Outreach (Public Relations)										
78			sub-Total										
79			G&A										
80			FCC										
81			Reserves										
82			Taxes										
83			- Contributions										
84			Total Mission Costs										
85													

3.1.2 Electronic Payment of Invoices – Bid

Bidders that are willing to accept payment of invoices by Electronic Payment Instruments, should complete Attachment 2 to Part 3 Electronic Payment Instruments, to identify which ones are accepted.

If Attachment 2 to Part 3 Electronic Payment Instruments is not completed, it will be considered as if Electronic Payment Instruments are not being accepted for payment of invoices.

Acceptance of Electronic Payment Instruments will not be considered as an evaluation criterion.

3.1.3 Exchange Rate Fluctuation

SACC Manual clause [C3011T](#) (2013-11-06), Exchange Rate Fluctuation

3.1.4 SACC Manual Clauses

Section III: Certifications

Bidders must submit the certifications and additional information required under Part 5.

Section IV: Additional Information

3.1.5 Bidder's Proposed Sites or Premises Requiring Safeguarding Measures

- 3.1.5.1** As indicated in Part 6 under Security Requirements, the Bidder must provide the full addresses of the Bidder's and proposed individuals' sites or premises for which safeguarding measures are required for Work Performance:

Street Number / Street Name, Unit / Suite / Apartment Number
City, Province, Territory / State
Postal Code / Zip Code
Country

- 3.1.5.2** The Company Security Officer must ensure through the [Contract Security Program](#) that the Bidder and proposed individuals hold a valid security clearance at the required level, as indicated in Part 6 – Security, Financial and Other Requirements.

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

4.1 Evaluation Procedures

- (a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the "technical and managerial" and "financial" evaluation criteria.
- (b) An evaluation team composed of representatives of Canada and NASA will evaluate the bids.
- (c) Canada will use the PBCP described below.

4.1.1 Phased Bid Compliance Process (PBCP)

4.1.1.1 General

1. Canada is conducting the PBCP described below for this requirement.
2. Notwithstanding any review by Canada at Phase I or II of the PBCP, bidders are and will remain solely responsible for the accuracy, consistency and completeness of their bids and Canada does not undertake, by reason of this review, any obligations or responsibility for identifying any or all errors or omissions in bids or in responses by a Bidder to any communication from Canada.

The Bidder acknowledges that the reviews in Phase I and II of this PBCP are preliminary and do not preclude a finding in Phase III that the bid is non-responsive, even for mandatory.

Requirements which were subject to review in Phase I or II and notwithstanding that the bid had been found responsive in such earlier Phase. Canada may deem a bid to be non-responsive to a mandatory requirement at any Phase.

The Bidder also acknowledges that its response to a notice or a compliance assessment report (CAR) (each defined below) in Phase I or II may not be successful in rendering its bid responsive to the mandatory requirements that are the subject of the notice or CAR, and may render its bid non-responsive to other mandatory requirements.

3. Canada may, in its discretion, request and accept at any time from a Bidder and consider as part of the bid, any information to correct errors or deficiencies in the bid that are clerical or administrative, such as, without limitation, failure to sign the bid or any part or to checkmark a box in a form, or other failure of format or form or failure to acknowledge; failure to provide a procurement business number or contact information such as names, addresses and telephone numbers; inadvertent errors in numbers or calculations that do not change the amount the Bidder has specified as the price or of any component thereof that is subject to evaluation. This shall not limit Canada's right to request or accept any information after the bid solicitation closing in circumstances where the bid solicitation expressly provides for this right. The Bidder will have the time period specified in writing by Canada to provide the necessary documentation. Failure to meet this deadline will result in the bid being declared non-responsive.
4. The PBCP does not limit Canada's rights under Standard Acquisition Clauses and Conditions (SACC) 2003 (2020-05-28) Standard Instructions – Goods or Services – Competitive Requirements nor Canada's right to request or accept any information during the solicitation period or after bid solicitation closing in circumstances where the bid solicitation expressly provides for this right, or in the circumstances described in subsection (c).
5. Canada will send any Notice or CAR by any method Canada chooses, in its absolute discretion. The Bidder must submit its response by the method stipulated in the Notice or CAR. Responses are deemed to be received by Canada at the date and time they are delivered to Canada by the method and at the address specified in the Notice or CAR. An email response permitted by the Notice or CAR is deemed received by Canada on the date and time it is received in Canada's email inbox at Canada's email address specified in the Notice or CAR. A Notice or CAR sent by Canada to the Bidder at any address

provided by the Bidder in or pursuant to the bid is deemed received by the Bidder on the date it is sent by Canada. Canada is not responsible for late receipt by Canada of a response, however caused.

4.1.1.2 Phase I: Financial Bid

1. After the closing date and time of this bid solicitation, Canada will examine the bid to determine whether it includes a Financial Bid and whether any Financial Bid includes all information required by the solicitation. Canada's review in Phase I will be limited to identifying whether any information that is required under the bid solicitation to be included in the Financial Bid is missing from the Financial Bid. This review will not assess whether the Financial Bid meets any standard or is responsive to all solicitation requirements.
2. Canada's review in Phase I will be performed by officials of the Department of Public Works and Government Services.
3. If Canada determines, in its absolute discretion that there is no Financial Bid or that the Financial Bid is missing all of the information required by the bid solicitation to be included in the Financial Bid, then the bid will be considered non-responsive and will be given no further consideration.
4. For bids other than those described in c), Canada will send a written notice to the Bidder ("Notice") identifying where the Financial Bid is missing information. A Bidder, whose Financial Bid has been found responsive to the requirements that are reviewed at Phase I, will not receive a Notice. Such bidders shall not be entitled to submit any additional information in respect of their Financial Bid.
5. The bidders who have been sent a Notice shall have the time period specified in the Notice (the "Remedy Period") to remedy the matters identified in the Notice by providing to Canada, in writing, additional information or clarification in response to the Notice. Responses received after the end of the Remedy Period will not be considered by Canada, except in circumstances and on terms expressly provided for in the Notice.
6. In its response to the Notice, the Bidder will be entitled to remedy only that part of its Financial Bid which is identified in the Notice. For instance, where the Notice states that a required line item has been left blank, only the missing information may be added to the Financial Bid, except that, in those instances where the addition of such information will necessarily result in a change to other calculations previously submitted in its Financial Bid, (for example, the calculation to determine a total price), such necessary adjustments shall be identified by the Bidder and only these adjustments shall be made. All submitted information must comply with the requirements of this solicitation.
7. Any other changes to the Financial Bid submitted by the Bidder will be considered to be new information and will be disregarded. There will be no change permitted to any other Section of the Bidder's bid. Information submitted in accordance with the requirements of this solicitation in response to the Notice will replace, in full, only that part of the original Financial Bid as is permitted above, and will be used for the remainder of the bid evaluation process.
8. Canada will determine whether the Financial Bid is responsive to the requirements reviewed at Phase I, considering such additional information or clarification as may have been provided by the Bidder in accordance with this Section. If the Financial Bid is not found responsive for the requirements reviewed at Phase I to the satisfaction of Canada, then the bid shall be considered non-responsive and will receive no further consideration.
9. Only bids found responsive to the requirements reviewed in Phase I to the satisfaction of Canada, will receive a Phase II review.

4.1.1.3 Phase II: Technical Bid

1. Canada's review at Phase II will be limited to a review of the Technical Bid to identify any instances where the Bidder has failed to meet any Eligible Mandatory Criterion. This review will not assess whether the Technical Bid meets any standard or is responsive to all solicitation requirements. Eligible Mandatory

Criteria are all mandatory technical criteria that are identified in this solicitation as being subject to the PBCP. Mandatory technical criteria that are not identified in the solicitation as being subject to the PBCP, will not be evaluated until Phase III.

2. Canada will send a written notice to the Bidder (Compliance Assessment Report or "CAR") identifying any Eligible Mandatory Criteria that the bid has failed to meet. A Bidder whose bid has been found responsive to the requirements that are reviewed at Phase II will receive a CAR that states that its bid has been found responsive to the requirements reviewed at Phase II. Such Bidder shall not be entitled to submit any response to the CAR.
3. The Bidder shall have the period specified in the CAR (the "Remedy Period") to remedy the failure to meet any Eligible Mandatory Criterion identified in the CAR by providing to Canada in writing additional or different information or clarification in response to the CAR. Responses received after the end of the Remedy Period will not be considered by Canada, except in circumstances and on terms expressly provided for in the CAR.
4. The Bidder's response must address only the Eligible Mandatory Criteria listed in the CAR as not having been achieved, and must include only such information as is necessary to achieve such compliance. Any additional information provided by the Bidder which is not necessary to achieve such compliance will not be considered by Canada, except that, in those instances where such a response to the Eligible Mandatory Criteria specified in the CAR will necessarily result in a consequential change to other parts of the bid, the Bidder shall identify such additional changes, provided that its response must not include any change to the Financial Bid.
5. The Bidder's response to the CAR should identify in each case the Eligible Mandatory Criterion in the CAR to which it is responding, including identifying in the corresponding section of the original bid, the wording of the proposed change to that section, and the wording and location in the bid of any other consequential changes that necessarily result from such change. In respect of any such consequential change, the Bidder must include a rationale explaining why such consequential change is a necessary result of the change proposed to meet the Eligible Mandatory Criterion. It is not up to Canada to revise the Bidder's bid, and failure of the Bidder to do so in accordance with this subparagraph is at the Bidder's own risk. All submitted information must comply with the requirements of this solicitation.
6. Any changes to the bid submitted by the Bidder other than as permitted in this solicitation, will be considered to be new information and will be disregarded. Information submitted in accordance with the requirements of this solicitation in response to the CAR will replace, in full, only that part of the original bid as is permitted in this Section.
7. Additional or different information submitted during Phase II permitted by this section will be considered as included in the bid, but will be considered by Canada in the evaluation of the bid at Phase II only for the purpose of determining whether the bid meets the Eligible Mandatory Criteria. It will not be used at any Phase of the evaluation to increase any score that the original bid would achieve without the benefit of such additional or different information. For instance, an Eligible Mandatory Criterion that requires a mandatory minimum number of points to achieve compliance will be assessed at Phase II to determine whether such mandatory minimum score would be achieved with such additional or different information submitted by the Bidder in response to the CAR. If so, the bid will be considered responsive in respect of such Eligible Mandatory Criterion, and the additional or different information submitted by the Bidder shall bind the Bidder as part of its bid, but the Bidder's original score, which was less than the mandatory minimum for such Eligible Mandatory Criterion, will not change, and it will be that original score that is used to calculate any score for the bid.
8. Canada will determine whether the bid is responsive for the requirements reviewed at Phase II, considering such additional or different information or clarification as may have been provided by the Bidder in accordance with this Section. If the bid is not found responsive for the requirements reviewed at Phase II to the satisfaction of Canada, then the bid shall be considered non-responsive and will receive no further consideration.

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9. Only bids found responsive to the requirements reviewed in Phase II to the satisfaction of Canada, will receive a Phase III evaluation.

4.1.1.4 Phase III: Final Evaluation of the Bid

1. In Phase III, Canada will complete the evaluation of all bids found responsive to the requirements reviewed at Phase II. Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.
2. A bid is non-responsive and will receive no further consideration if it does not meet all mandatory evaluation criteria of the solicitation.

4.1.2 Technical and Managerial Evaluation

Mandatory and point rated technical and managerial evaluation criteria are included in Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria.

4.1.2.1 Mandatory Technical Criteria

The PBCP will apply to the mandatory technical and managerial evaluation criterion in Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria.

4.1.2.2 Point Rated Technical Criteria

The PBCP will apply to all point rated technical and managerial evaluation criteria included in Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria.

4.1.3 Financial Evaluation

4.1.3.1 Mandatory Financial Criteria (FM)

4.1.3.1.1 FM1 - The Bidder must submit a total firm, all-inclusive price for the Work to be performed under Phase A in cells (A) and (B) of the Basis of Payment at Annex B. The portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider as specified in the Bidder's bid will be put under contract and funded directly by NASA. As such, that cost is to be excluded from the Basis of Payment at Annex B.

4.1.3.1.2 FM2 - The maximum funding available for each Contract resulting from the bid solicitation is \$1,800,000.00 (Applicable Taxes extra) for the Work under Phase A, including the optional good and/or optional services. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. The portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider as specified in the Bidder's bid will be put under contract and funded directly by NASA. As such, that cost is excluded from the maximum funding specified above.

SACC Manual Clause [A0220T](#) (2014-06-26), Evaluation of Price-Bid

4.2 Basis of Selection

4.2.1 Basis of Selection – Highest Rated Within Budget

1. To be declared responsive, a bid must:
 - a. comply with all the requirements of the bid solicitation;
 - b. meet all mandatory technical evaluation criteria;
 - c. meet all mandatory financial evaluation criteria;

- d. obtain the required minimum of 19.5 points overall for the Canada portion technical evaluation criteria "Mission Merit Criteria". The rating is performed on a scale of 30 points;
- e. obtain the required minimum of 6.5 points overall for the U.S. portion technical evaluation criteria "Mission Merit Criteria". The rating is performed on a scale of 10 points;
- f. obtain the required minimum of 32.5 points overall for the Canada portion technical evaluation criteria "Feasibility Criteria". The rating is performed on a scale of 50 points;
- g. obtain the required minimum of 6.5 points overall for the U.S. portion technical evaluation criteria "Feasibility Criteria". The rating is performed on a scale of 10 points;
- h. obtain the required minimum of 19.5 points overall for the Canada portion technical evaluation criteria "Managerial Criteria". The rating is performed on a scale of 30 points; and
- i. obtain the required minimum of 6.5 points overall for the U.S. portion technical evaluation criteria "Managerial Criteria". The rating is performed on a scale of 10 points.

2. Bids not meeting (a) or (b) or (c) or (d) or (e) or (f) or (g) or (h) and/or (i) will be declared non-responsive.

3. The bids will be ranked according to the total combined number of points obtained for both the Canada and U.S. portions point rated evaluation criteria, starting from the highest total number of points to the lowest. The two (2) responsive bids with the highest total combined number of points will be recommended for award of a contract.

4. In the event that two or more responsive bids obtain the same total number of points, the responsive bid with the highest combined number of points for criterion P4 (Scope, feasibility and risks of the engineering approach) will be ranked higher. If the responsive bids have the same number of point for criterion P4, the responsive bid with the highest combined number of points for criterion P5 (Scope, feasibility and risks of the scientific approach) will be ranked higher. If the responsive bids have the same number of point for criterion P5, the responsive bid with the highest combined number of points for the remaining criteria in the following order will be used as the final tie breaker: criterion P7 (Project Management Plan), criterion P6 (Team capability and experience,), criterion P1 (Relevance of the proposed mission and expected impact), criterion P2 (Suitability of the technology in meeting the engineering objectives), and finally criterion P3 (Suitability of the science measurements and instruments in meeting the scientific objectives).

5. In the event that all available funding has not been spent or that additional funding is made available, Canada may elect to award one or more contracts to the responsive bid(s) with the next highest total combined number of points.

6. For example, if the first two (2) responsive bids with the highest total combined number of points were each recommended for award of a contract resulting from the bid solicitation for the Work under Phase A for a cost of \$550,000.00 (Applicable Taxes extra) for the first ranked Bidder and \$650,000.00 (Applicable Taxes extra) for the second ranked Bidder, for a total cost of \$1,200,000.00 (Applicable Taxes extra), then Canada may, in its discretion, elect to award one or more contracts to the responsive bid(s) with the next highest total combined number of points, provided that the total firm, all-inclusive price proposed does not exceed the remaining funding of \$2,400,000.00 available for this requirement, or up to \$1,800,000.00 (Applicable Taxes extra) each, if additional funds were made available.

Continuing with the above example, if the third ranked Bidder proposed a total firm, all-inclusive price of \$1,800,000.00 (Applicable Taxes extra) for the Work to be performed under Phase A, but the fourth ranked Bidder proposed a total firm, all-inclusive price of \$1,000,000.00 (Applicable Taxes extra), then Canada may, in its discretion, recommend to award one more contract for the Phase A Work to the third ranked Bidder. The fourth ranked Bidder would not be recommended for award of a contract as their total firm, all-inclusive price of \$1,000,000.00 (Applicable Taxes extra) exceeds the remaining funding of \$600,000.00 (i.e. \$3,600,000.00 - \$3,000,000.00 = \$600,000.00) available for this requirement, unless additional funds were made available. However, if the third ranked Bidder proposed a total firm, all-inclusive price which exceeded the remaining budget available, then no additional contracts would be recommended for award, even if the fourth ranked Bidder proposed a total firm, all-inclusive price within the remaining budget available.

PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION

Bidders must provide the required certifications and additional information to be awarded a contract.

The certifications provided by bidders to Canada are subject to verification by Canada at all times. Unless specified otherwise, Canada will declare a bid non-responsive, or will declare a contractor in default if any certification made by the Bidder is found to be untrue, whether made knowingly or unknowingly, during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Contracting Authority will render the bid non-responsive or constitute a default under the Contract.

5.1 Certifications Required with the Bid

Bidders must submit the following duly completed certifications as part of their bid.

5.1.1 Integrity Provisions - Declaration of Convicted Offences

In accordance with the Integrity Provisions of the Standard Instructions, all bidders must provide with their bid, if applicable, the Integrity declaration form available on the [Forms for the Integrity Regime](http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html) website (<http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html>), to be given further consideration in the procurement process.

5.2 Certifications Precedent to Contract Award and Additional Information

The certifications and additional information listed below should be submitted with the bid but may be submitted afterwards. If any of these required certifications or additional information is not completed and submitted as requested, the Contracting Authority will inform the Bidder of a time frame within which to provide the information. Failure to provide the certifications or the additional information listed below within the time frame specified will render the bid non-responsive.

5.2.1 Integrity Provisions – Required Documentation

In accordance with the section titled Information to be provided when bidding, contracting or entering into a real property agreement of the [Ineligibility and Suspension Policy](http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html) (<http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html>), the Bidder must provide the required documentation, as applicable, to be given further consideration in the procurement process.

5.2.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list available at the bottom of the page of the [Employment and Social Development Canada \(ESDC\) - Labour's](https://www.canada.ca/en/employment-social-development/programs/employment-equity/federal-contractor-program.html#) website (<https://www.canada.ca/en/employment-social-development/programs/employment-equity/federal-contractor-program.html#>).

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list at the time of contract award.

Canada will also have the right to terminate the Contract for default if a Contractor, or any member of the Contractor if the Contractor is a Joint Venture, appears on the ["FCP Limited Eligibility to Bid"](#) list during the period of the Contract.

The Bidder must provide the Contracting Authority with a completed annex titled Federal Contractors Program for Employment Equity - Certification, before contract award. If the Bidder is a Joint Venture, the Bidder must

provide the Contracting Authority with a completed Attachment 1 to Part 5 Federal Contractors Program for Employment Equity - Certification, for each member of the Joint Venture.

5.2.3 Additional Certifications Precedent to Contract Award

5.2.3.1 Canadian Content Certification

This procurement is limited to Canadian goods and Canadian services.

The Bidder certifies that:

() a minimum of 80 percent of the total bid price, with the exception of the price for the U.S. science instrument(s), consist of Canadian goods and Canadian services as defined in paragraph 5 of clause [A3050T](#).

For more information on how to determine the Canadian content for a mix of goods, a mix of services or a mix of goods and services, consult [Annex 3.6](#), Example 2, of the Supply Manual.

5.2.3.1.1 SACC Manual clause [A3050T](#) (2020-07-01) Canadian Content Definition

5.2.3.2 Status and Availability of Resources

5.2.3.2.1 SACC Manual clause [A3005T](#) (2010-08-16), Status and Availability of Resources

5.2.3.3 Education and Experience

5.2.3.3.1 SACC Manual clause [A3010T](#) (2010-08-16) Education and Experience

5.2.3.4 Funding certification for Phases A, B, C and D

The Bidder certifies, acknowledges and agrees that:

() the maximum funding for Phases A, B, C and D for the LRM, excluding the U.S. scientific instrument(s), will be \$45M Canadian Dollars (CAD), Applicable Taxes extra, inclusive of the two contracts totalling \$3.6M Canadian Dollars (CAD) (maximum \$1.8M CAD for each contract), Applicable Taxes extra, subject to the provisions of Section 4.2.1 of this bid solicitation for the Phase A Work, or unless specified otherwise by the Contracting Authority at any Phase of the project. This disclosure does not commit Canada to pay the maximum funding available.

() the funding available for Phases A, B, C and D for the U.S. scientific instrument(s) will be \$ 5M U.S. Dollars (USD). Any request for funding increase at any Phase of the project must be justified by the U.S. scientific instrument(s) provider and approved by a NASA representative (to be identified). This disclosure does not commit NASA to pay the maximum funding available.

Bidder signature

Date

PART 6 - SECURITY, FINANCIAL AND OTHER REQUIREMENTS

6.1 Security Requirements

1. Before award of a contract, the following conditions must be met:

- (a) the Bidder must hold a valid organization security clearance as indicated in Part 7 - Resulting Contract Clauses;
- (b) the Bidder's proposed individuals requiring access to classified or protected information, assets or sensitive work sites must meet the security requirements as indicated in Part 7 - Resulting Contract Clauses;
- (c) the Bidder must provide the name of all individuals who will require access to classified or protected information, assets or sensitive work sites;
- (d) the Bidder's proposed location of work performance and document safeguarding must meet the security requirements as indicated in Part 7 - Resulting Contract Clauses;
- (e) the Bidder must provide the addresses of proposed sites or premises of work performance and document safeguarding as indicated in Part 3 - Section IV Additional Information.

2. Bidders are reminded to obtain the required security clearance promptly. Any delay in the award of a contract to allow the successful Bidder to obtain the required clearance will be at the entire discretion of the Contracting Authority.

3. For additional information on security requirements, bidders should refer to the [Contract Security Program](http://www.tpsgc-pwgsc.gc.ca/esc-src/introduction-eng.html) of Public Works and Government Services Canada (<http://www.tpsgc-pwgsc.gc.ca/esc-src/introduction-eng.html>) website.

6.2 Financial Capability

SACC Manual clause [A9033T](#) (2012-07-16) Financial Capability

PART 7 - RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

7.1 Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex A and the technical and management portions of the Contractor's bid entitled _____(to be inserted at contract award), dated _____(to be inserted at contract award).

7.1.1 Optional Goods and/or Optional Services

The Contractor grants to Canada the irrevocable option to acquire the goods, services or both described in the Statement of Work at Annex A of the Contract under the same conditions and at the prices and/or rates stated in the Contract. The option may only be exercised by the Contracting Authority and will be evidenced, for administrative purposes only, through a contract amendment.

The Contracting Authority may exercise the option within five months after contract award by sending written notice to the Contractor.

7.2 Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

7.2.1 General Conditions

[2040](#) (2020-05-28), General Conditions - Research & Development, apply to and form part of the Contract.

7.2.2 Supplemental General Conditions

[4002](#) (2010-08-16), Supplemental General Conditions - Software Development or Modification Services, apply to and form part of the Contract.

7.3 Security Requirements

7.3.1 The following security requirements (SRCL and related clauses provided by the Contract Security Program) apply and form part of the Contract.

1. The Contractor must, at all times during the performance of the Contract, hold a valid Facility Security Clearance at the level of SECRET, with approved Document Safeguarding at the level of PROTECTED B, issued by the Contract Security Program (CSP), Public Works and Government Services Canada (PWGSC).
2. The Contractor personnel requiring access to PROTECTED information, assets or sensitive site(s) must EACH hold a valid personnel security screening at the level of SECRET, or RELIABILITY STATUS, as required, granted or approved by the CSP, PWGSC.
3. The Contractor MUST NOT utilize its Information Technology systems to electronically process, produce or store any sensitive PROTECTED information until the CSP, PWGSC has issued written approval. After approval has been granted, these tasks may be performed at the level of PROTECTED B.
4. Subcontracts which contain security requirements are NOT to be awarded without the prior written permission of the CSP, PWGSC.
5. The Contractor must comply with the provisions of the:

- (a) Security Requirements Check List and security guide (if applicable), attached at Annex C;
- (b) *Industrial Security Manual* (Latest Edition).

7.3.2 Contractor's Sites or Premises Requiring Safeguarding Measures

7.3.2.1 Where safeguarding measures are required in the performance of the Work, the Contractor must diligently maintain up-to-date the information related to the Contractor's and proposed individuals' sites or premises for the following addresses:

(to be inserted at contract award)

Street Number / Street Name, Unit / Suite / Apartment Number
City, Province, Territory / State
Postal Code / Zip Code
Country

7.3.2.2 The Company Security Officer must ensure through the Contract Security Program that the Contractor and individuals hold a valid security clearance at the required level.

7.4 Non-disclosure Agreement

The Contractor must obtain from its employee(s) or subcontractor(s) the completed and signed non-disclosure agreement, attached at Annex "D", and provide it to the Project Authority before they are given access to information by or on behalf of Canada in connection with the Work.

7.5 Term of Contract

7.5.1 Period of the Contract

The period of the Contract is from date of Contract to _____ inclusive *(to be inserted at contract award)*.

7.6 Authorities

7.6.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Sameer Ali Abbasi
Title: Contracting Specialist
Public Works and Government Services Canada
Acquisitions Branch
Directorate: Space Programs and Procurement Directorate
Address: Terrasses de la Chaudière, 4th Floor
10 Wellington Street
Gatineau, Quebec
K1A 0S5

Telephone: 873-354-4921

E-mail address: sameerali.abbasi@tpsgc-pwgsc.gc.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

7.6.2 Project Authority *(to be inserted at contract award)*

The Project Authority for the Contract is:

Name: _____
Title: _____
Organization: _____
Address: _____

Telephone: _____
Facsimile: _____-_____-_____
E-mail address: _____

The Project Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the administrative, programmatic and technical content of the Work under the Contract. These matters may be discussed with the Project Authority; however, the Project Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

7.6.3 Contractor's Representative *(to be inserted at contract award)*

The Contractor's Representative for the Contract is:

Name: _____
Title: _____
Organization: _____
Address: _____

Telephone: _____-_____-_____
Facsimile: _____-_____-_____
E-mail address: _____

7.7 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a [Public Service Superannuation Act](#) (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with [Contracting Policy Notice: 2019-01](#) of the Treasury Board Secretariat of Canada.

7.8 Payment

7.8.1 Basis of Payment

7.8.1.1 For the work described in the Statement of Work at Annex A, excluding section 1.4. U.S. SCIENTIFIC INSTRUMENT(S) (OPTIONAL GOODS AND OPTIONAL SERVICES):

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B for a cost of \$ _____ *(to be inserted at contract award)*. Customs duties are included and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

7.8.1.2 [OPTIONAL GOODS AND OPTIONAL SERVICES] For the portion of the Work related to the U.S. scientific instrument(s) described as optional goods and optional services in the Statement of Work at Annex A, section 1.4. U.S. SCIENTIFIC INSTRUMENT(S) (OPTIONAL GOODS AND OPTIONAL SERVICES), that will be required to support the portion of the Work to be strictly

completed by the proposed U.S. scientific instrument(s) provider that will be put under contract and funded directly by NASA.

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B for a cost of \$ (UNFUNDED). Customs duties are included and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

7.8.2 Milestone Payments - Subject to Holdback

1. Canada will make milestone payments in accordance with the Schedule of Milestones detailed in Annex B, Basis of Payment and the payment provisions of the Contract, up to 90 percent of the amount claimed and approved by Canada if:
 - a. an accurate and complete claim for payment using form [PWGSC-TPSGC 1111](#), Claim for Progress Payment, and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;
 - b. the total amount for all milestone payments paid by Canada does not exceed 90 percent of the total amount to be paid under the Contract;
 - c. all the certificates appearing on form [PWGSC-TPSGC 1111](#) have been signed by the respective authorized representatives;
 - d. all work associated with the milestone and as applicable any deliverable required have been completed and accepted by Canada.
2. The balance of the amount payable will be paid in accordance with the payment provisions of the Contract upon completion and delivery of all Work required under the Contract if the Work has been accepted by Canada and a final claim for the payment is submitted.

7.8.3 SACC Manual Clauses

SACC Manual clause [A9117C](#) (2007-11-30) T1204, Direct Request by Customer Department

7.8.4 Electronic Payment of Invoices – Contract *(if accepted by the Contractor in its bid)*

The Contractor accepts to be paid using any of the following Electronic Payment Instrument(s):

- a. Visa Acquisition Card;
- b. MasterCard Acquisition Card;
- c. Direct Deposit (Domestic and International);
- d. Electronic Data Interchange (EDI);
- e. Wire Transfer (International Only);
- f. Large Value Transfer System (LVTS) (Over \$25M)

7.9 Invoicing Instructions

1. The Contractor must submit a claim for payment using form [PWGSC-TPSGC 1111](#), Claim for Progress Payment.

Each claim must show:

-
- a. all information required on form [PWGSC-TPSGC 1111](#);
 - b. all applicable information detailed under the section entitled "Invoice Submission" of the general conditions;
 - c. the description and value of the milestone claimed as detailed in the Contract.
2. Applicable Taxes must be calculated on the total amount of the claim before the holdback is applied. At the time the holdback is claimed, there will be no Applicable Taxes payable as it was claimed and payable under the previous claims for progress payments.
 3. The Contractor must:
 - i. Prepare and certify one (1) original of the claim form [PWGSC-TPSGC 1111](#) and send a PDF copy by e-mail to the Contracting, Project, and Technical Authorities as identified under sub-articles 7.5.1, 7.5.2, and 7.5.3 of the contract with copy to the following CSA e-mail address: asc.facturation-invoicing.csa@canada.ca;
 - ii. If mailed, the Contractor must prepare and certify **one (1) original and two (2) copies** of the claim form [PWGSC-TPSGC 1111](#), and forward **one (1) copy** to the Contracting Authority and **one (1) original and one (1) copy** to CSA's Financial Services using the following mailing address for appropriate certification by the Project Authority or Technical Authority identified herein after inspection and acceptance of the Work takes place:

Canadian Space Agency
Care of: Financial Services'
6767 route de l'Aéroport, Saint-Hubert, Québec, Canada
J3Y 8Y9

The Project Authority or Technical Authority will then forward the original and one (1) copy of the claim to the Contracting Authority for certification and onward submission to the Payment Office for the remaining certification and payment action.
 4. The Contractor must not submit claims until all work identified in the claim is completed.

7.10 Certifications and Additional Information

7.10.1 Compliance

Unless specified otherwise, the continuous compliance with the certifications provided by the Contractor in its bid or precedent to contract award, and the ongoing cooperation in providing additional information are conditions of the Contract and failure to comply will constitute the Contractor in default. Certifications are subject to verification by Canada during the entire period of the Contract.

7.10.2 Federal Contractors Program for Employment Equity - Default by the Contractor

The Contractor understands and agrees that, when an Agreement to Implement Employment Equity (AIEE) exists between the Contractor and Employment and Social Development Canada (ESDC)-Labour, the AIEE must remain valid during the entire period of the Contract. If the AIEE becomes invalid, the name of the Contractor will be added to the "[FCP Limited Eligibility to Bid](#)" list. The imposition of such a sanction by ESDC will constitute the Contractor in default as per the terms of the Contract.

7.10.3 SACC Manual Clauses

SACC Manual clause [A3060C](#) (2008-05-12), Canadian Content Certification

7.11 Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in _____ (to be inserted at contract award).

7.12 Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

- (a) the Articles of Agreement;
- (b) the general conditions 2040 (2020-05-28), General Conditions - Research & Development;
- (c) the supplemental general conditions 4002 (2010-08-16) - Software Development or Modification Services;
- (d) Annex A, Statement of Work;
- (e) Annex B, Basis of Payment;
- (f) Annex C, Security Requirements Check List;
- (g) Annex D, Non-Disclosure Agreement;
- (h) the Contractor's bid dated _____ (to be inserted at contract award).

7.13 Foreign Nationals (Canadian Contractor)

SACC Manual clause A2000C (2006-06-16) Foreign Nationals (Canadian Contractor)

7.14 Insurance

SACC Manual clause G1005C (2016-01-28) Insurance - No Specific Requirement

7.15 Dispute Resolution

- (a) The parties agree to maintain open and honest communication about the Work throughout and after the performance of the contract.
- (b) The parties agree to consult and co-operate with each other in the furtherance of the contract and promptly notify the other party or parties and attempt to resolve problems or differences that may arise.
- (c) If the parties cannot resolve a dispute through consultation and cooperation, the parties agree to consult a neutral third party offering alternative dispute resolution services to attempt to address the dispute.
- (d) Options of alternative dispute resolution services can be found on Canada's Buy and Sell website under the heading "Dispute Resolution".

7.16 Canadian Space Agency's Directive on Communications with the Media

1. Definitions

"Communication Activity(ies)" includes: public information and recognition, the planning, development, production and delivery or publication, and any other type or form of dissemination of marketing, promotional or information activities, initiatives, reports, summaries or other products or materials, whether in print or electronic format that pertain to the present agreement, all communications, public relations events, press releases, social media releases, or any other communication directed to the general public in whatever form or media it may be in, including but without limiting the generality of the preceding done through any company web site.

2. Communication Activities Format

The Contractor must coordinate early on with the Canadian Space Agency (CSA) all Communication Activities that pertain to the present contract.

Subject to review and approval by the CSA, the Contractor may mention and/or indicate visually, without any additional costs to the CSA, the CSA's participation in the contract through at least one of the following methods at the complete discretion of the CSA:

a. By clearly and prominently labelling publications, advertising and promotional products and any form of material and products sponsored or funded by the CSA, as follows, in the appropriate official language: "This program/project/activity is undertaken with the financial support of the Canadian Space Agency." "Ce programme/projet/activité est réalisé(e) avec l'appui financier de l'Agence spatiale canadienne."

b. By affixing CSA's corporate logo on print or electronic publications, advertising and promotional products and on any other form of material, products or displays sponsored or funded by the Canadian Space Agency.

Any and all mention or reference to the Canadian Space Agency in addition to those specified above in (a) and (b) must be specifically accepted by the CSA prior to publication.

The Contractor must obtain and use a high resolution printed or electronic copy of the CSA's corporate identity logo and seek advice on its application, by contacting the Project Authority as mentioned in Paragraph 7.6.2 of this contract.

3. Communication Activity Coordination Process

The Contractor must coordinate with the CSA's Directorate of Communications and Public Affairs all Communication Activities pertaining to the Contract. To this end, the Contractor must:

a. As soon as the Contractor intends to organize a Communication Activity, send a Notice to the CSA's Directorate of Communications and Public Affairs. The communications notice must include a complete description of the proposed Communication Activity. The notice must be in writing in accordance with the clause notice included in the general conditions applicable to the contract. The communications notice must include a copy or example of the proposed Communication Activity.

b. The contractor must provide to the CSA any and all additional document in any appropriate format, example or information that the CSA deems necessary, at its entire discretion to correctly and efficiently coordinate the proposed Communication Activity. The Contractor agrees to only proceed with the proposed Communication Activity after receiving a written confirmation of coordination of the Communication Activity from the CSA's Directorate of Communications and Public Affairs.

c. The contractor must receive beforehand the authorization, approval and written confirmation from the CSA's Directorate of Communications and Public Affairs before organizing, proceeding or hosting a communication activity.

7.17 Conditions and Prerequisite for Subsequent Project Phases

Further to the award of this Contract, should Canada elect to proceed with Phases B, C, and D of the project, Canada will release a Request for Proposal (RFP) only to the contractors selected under the Phase 1 RFP for the Work required under Phases B, C and D. Canada intends to award one contract for Phase B, C and D Work, which is defined as follows:

Phase B: Preliminary Design Definition

This phase uses the technical requirements outlined in the Phase A work to provide a preliminary (or early) engineering design of the Lunar Rover and its Science Instruments.

Upon completion of the Work under this phase, Canada will elect, at its sole discretion, if it wishes to proceed with the Work under the next phase of the project.

Phase C: Detailed Design Definition

This phase finalizes the preliminary Phase B work and locks down the design of the Lunar Rover and its Science Instruments through a detailed review process known as a "*Critical Design Review*" (CDR) where every single design element of the Lunar Rover and its Science Instruments are scrutinized and finalized before moving forward with the manufacturing phase.

Upon completion of the Work under this phase, Canada will elect, at its sole discretion, if it wishes to proceed with the Work under the next phase of the project.

Phase D: Manufacturing, Assembly, Integration and Test (MAIT) and Launch Preparation

This phase includes the manufacturing, assembly, integration, testing and commissioning.

The Basis of Selection, details of the Work required under Phases B, C and D as well as the applicable terms and conditions for this portion of the Work will be specified in the corresponding RFP. The Phase 2 RFP will be issued by Public Services and Procurement Canada (PSPC) and the bid preparation activities for Phases B, C and D are outside the scope of work of this Contract.

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ANNEX A

STATEMENT OF WORK

The Statement of Work (SOW) for Lunar Exploration Accelerator Program (LEAP) Lunar Rover - Phase A, initial release, dated March 31, 2021 is to be inserted at this point and forms part of the document.

ANNEX B

BASIS OF PAYMENT

A – Work, Excluding Optional Goods and Optional Services

For the work described in the Statement of Work at Annex A, excluding section 1.4. U.S. SCIENTIFIC INSTRUMENT (OPTIONAL GOODS AND Optional SERVICES), the schedule of milestones for which payments will be made in accordance with the Contract is as follows:

SCHEDULE OF MILESTONES

Milestone No.	Description	Firm Amount	Due Date
1	Conceptual Design Review (CoDR)	55 % OF (A) +(B) (to be inserted at contract award)	(4) months after contract award (date to be inserted at contract award)
2	Systems Requirements Review (SRR)	18 % OF (A) + (B) (to be inserted at contract award)	(7) months after contract award (date to be inserted at contract award)
3	Performance Indicator Reporting in accordance with Section 3.2.10 of the Statement of Work.	12 % OF (A) + (B) (to be inserted at contract award)	(8) months after contract award (date to be inserted at contract award)

(A) Firm, all-inclusive price:	\$_____ (Applicable Taxes Extra) * (to be inserted at contract award)
--------------------------------	--

B – Optional Goods and/or Optional Services

For the portion of the Work related to the U.S. scientific instrument(s) described as optional goods and optional services in the Statement of Work at Annex A, section 1.4. U.S. SCIENTIFIC INSTRUMENT(S) (OPTIONAL GOODS AND OPTIONAL SERVICES), that will be required to support the portion of the Work to be strictly completed by the proposed U.S. scientific instrument(s) provider that will be put under contract and funded directly by NASA.

The schedule of milestones for which payments will be made in accordance with the Contract is as follows:

SCHEDULE OF MILESTONES

Milestone No.	Description	Firm Amount	Due Date
4	Systems Requirements Review (SRR) Work related to the integration of the U.S. Scientific Instrument.	15 % OF (A) + (B) (to be inserted at contract award)	(7) months after contract award (date to be inserted at contract award)

(B) Firm, all-inclusive price:	\$_____ (Applicable Taxes Extra) * (to be inserted at contract award)
--------------------------------	--

(A) + (B) Total firm, all-inclusive price:	\$_____ (Applicable Taxes Extra) * (to be inserted at contract award)
--	--

* (to be deleted at contract award):

The total firm, all-inclusive price must be provided by the Bidder in their Financial bid and should include the price breakdown as requested in Section 3.1.1.1 of this bid solicitation. The firm amount per milestone will be calculated by Canada based on the formula detailed in the table above and will be incorporated into the resultant contract.

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ANNEX C

SECURITY REQUIREMENTS CHECK LIST

ANNEX/Annexe C



Government of Canada
Gouvernement du Canada

Contract Number / Numéro du contrat 20200303
Security Classification / Classification de sécurité Sans Classification

SECURITY REQUIREMENTS CHECK LIST (SRCL)

LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE		
1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine Canadian Space Agency		2. Branch or Directorate / Direction générale ou Direction Space Exploration
3. a) Subcontract Number / Numéro du contrat de sous-traitance		3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant To be determined
4. Brief Description of Work / Brève description du travail Eventual contract for the development of a lunar rover including a Canadian science payload as well as an American science payload. This SRCL is for the initial project phase - Phase A - where the contractor will be doing analysis and refining the technical requirements for the mission as a whole.		
5. a) Will the supplier require access to Controlled Goods? Le fournisseur aura-t-il accès à des marchandises contrôlées?		<input checked="" type="checkbox"/> No Non <input type="checkbox"/> Yes Oui
5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?		<input type="checkbox"/> No Non <input checked="" type="checkbox"/> Yes Oui
6. Indicate the type of access required / Indiquer le type d'accès requis		
6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)		<input type="checkbox"/> No Non <input checked="" type="checkbox"/> Yes Oui
6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.		<input checked="" type="checkbox"/> No Non <input type="checkbox"/> Yes Oui
6. c) Is this a commercial courier or delivery requirement with no overnight storage? S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?		<input checked="" type="checkbox"/> No Non <input type="checkbox"/> Yes Oui
7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès		
Canada <input checked="" type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	Foreign / Étranger <input checked="" type="checkbox"/>
7. b) Release restrictions / Restrictions relatives à la diffusion		
No release restrictions Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>
Not releasable A ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>
Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:
7. c) Level of information / Niveau d'information		
PROTECTED A PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A PROTÉGÉ A <input type="checkbox"/>
PROTECTED B PROTÉGÉ B <input checked="" type="checkbox"/>	NATO RESTRICTED NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B PROTÉGÉ B <input type="checkbox"/>
PROTECTED C PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL CONFIDENTIEL <input type="checkbox"/>	NATO SECRET NATO SECRET <input type="checkbox"/>	CONFIDENTIAL CONFIDENTIEL <input type="checkbox"/>
SECRET SECRET <input type="checkbox"/>	COSMIC TOP SECRET COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET SECRET <input type="checkbox"/>
TOP SECRET TRÈS SECRET <input type="checkbox"/>		TOP SECRET TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) TRÈS SECRET (SIGINT) <input type="checkbox"/>

TBS/SCT 350-103(2004/12)

Security Classification / Classification de sécurité
Sans Classification

Canada



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PART A (continued) / PARTIE A (suite)

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS? ☒ No ☐ Yes
Non Oui

If Yes, indicate the level of sensitivity:

Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate? ☒ No ☐ Yes
Non Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :

Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

<input checked="" type="checkbox"/> RELIABILITY STATUS COTE DE FIABILITÉ	<input type="checkbox"/> CONFIDENTIAL CONFIDENTIEL	<input checked="" type="checkbox"/> SECRET SECRET	<input type="checkbox"/> TOP SECRET TRÈS SECRET
<input type="checkbox"/> TOP SECRET - SIGINT TRÈS SECRET - SIGINT	<input type="checkbox"/> NATO CONFIDENTIAL NATO CONFIDENTIEL	<input type="checkbox"/> NATO SECRET NATO SECRET	<input type="checkbox"/> COSMIC TOP SECRET COSMIC TRÈS SECRET
<input type="checkbox"/> SITE ACCESS ACCÈS AUX EMPLACEMENTS			

Special comments:

Commentaires spéciaux :

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.

REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail? ☒ No ☐ Yes
Non Oui

If Yes, will unscreened personnel be escorted?
Dans l'affirmative, le personnel en question sera-t-il escorté? ☐ No ☐ Yes
Non Oui

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS? ☐ No ☒ Yes
Non Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC? ☒ No ☐ Yes
Non Oui

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ? ☒ No ☐ Yes
Non Oui

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS? ☐ No ☒ Yes
Non Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale? ☒ No ☐ Yes
Non Oui

TBS/SCT 350-103(2004/12)

Security Classification / Classification de sécurité

Sans Classification

Canada



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of Canada

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du Canada

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Sans Classification

PART C - (continued) / PARTIE C - (suite)

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.

Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the Internet), the summary chart is automatically populated by your responses to previous questions.

Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED PROTÉGÉ			CLASSIFIED CLASSIFIÉ			NATO				COMSEC						
	A	B	C	CONFIDENTIAL CONFIDENTIEL	SECRET	TOP SECRET TRÈS SECRET	NATO RESTRICTED NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET COSMIC TRÈS SECRET	PROTECTED PROTÉGÉ			CONFIDENTIAL	SECRET	TOP SECRET	
											A	B	C				CONFIDENTIAL
Information / Assets Renseignements / Biens		✓															
Production																	
IT Media / Support TI		✓															
IT Link / Lien électronique																	

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?

La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

☒ No ☐ Yes
Non Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?

La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

☒ No ☐ Yes
Non Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).

ANNEX D

NON-DISCLOSURE AGREEMENT

I, _____, recognize that in the course of my work as an employee or subcontractor of _____, I may be given access to information by or on behalf of Canada in connection with the Work, pursuant to Contract Serial No. _____ between Her Majesty the Queen in right of Canada, represented by the Minister of Public Works and Government Services and _____, including any information that is confidential or proprietary to third parties, and information conceived, developed or produced by the Contractor as part of the Work. For the purposes of this agreement, information includes but not limited to: any documents, instructions, guidelines, data, material, advice or any other information whether received orally, in printed form, recorded electronically, or otherwise and whether or not labeled as proprietary or sensitive, that is disclosed to a person or that a person becomes aware of during the performance of the Contract.

I agree that I will not reproduce, copy, use, divulge, release or disclose, in whole or in part, in whatever way or form any information described above to any person other than a person employed by Canada on a need to know basis. I undertake to safeguard the same and take all necessary and appropriate measures, including those set out in any written or oral instructions issued by Canada, to prevent the disclosure of or access to such information in contravention of this agreement.

I also acknowledge that any information provided to the Contractor by or on behalf of Canada must be used solely for the purpose of the Contract and must remain the property of Canada or a third party, as the case may be.

I agree that the obligation of this agreement will survive the completion of the Contract Serial No.: _____

Signature

Date

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ATTACHMENT 1 TO PART 3: TECHNICAL AND MANAGERIAL BID PREPARATION INSTRUCTIONS

The document Technical and Managerial Bid Preparation Instructions (Attachment 1 to Part 3) appended to the bid solicitation is to be inserted at this point and forms part of this document.

ATTACHMENT 2 TO PART 3: ELECTRONIC PAYMENT INSTRUMENTS

ELECTRONIC PAYMENT INSTRUMENTS

The Bidder accepts to be paid by any of the following Electronic Payment Instrument(s):

- ☐ () VISA Acquisition Card;
- ☐ () MasterCard Acquisition Card;
- ☐ () Direct Deposit (Domestic and International);
- ☐ () Electronic Data Interchange (EDI);
- ☐ () Wire Transfer (International Only);
- ☐ () Large Value Transfer System (LVTS) (Over \$25M)

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ATTACHMENT 1 TO PART 4: MANDATORY AND POINT RATED EVALUATION CRITERIA

The document Mandatory and Point Rated Evaluation Criteria (Attachment 1 to Part 4) appended to the bid solicitation is to be inserted at this point and forms part of this document.

ATTACHMENT 1 TO PART 5: FEDERAL CONTRACTORS PROGRAM FOR EMPLOYMENT EQUITY – CERTIFICATION

I, the Bidder, by submitting the present information to the Contracting Authority, certify that the information provided is true as of the date indicated below. The certifications provided to Canada are subject to verification at all times. I understand that Canada will declare a bid non-responsive, or will declare a contractor in default, if a certification is found to be untrue, whether during the bid evaluation period or during the contract period. Canada will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply with any request or requirement imposed by Canada may render the bid non-responsive or constitute a default under the Contract.

For further information on the Federal Contractors Program for Employment Equity visit [Employment and Social Development Canada \(ESDC\) – Labour's](#) website.

Date: _____ (YYYY/MM/DD) (If left blank, the date will be deemed to be the bid solicitation closing date.)

Complete both A and B.

A. Check only one of the following:

- ☐ A1. The Bidder certifies having no work force in Canada.
- ☐ A2. The Bidder certifies being a public sector employer.
- ☐ A3. The Bidder certifies being a [federally regulated employer](#) being subject to the [Employment Equity Act](#).
- ☐ A4. The Bidder certifies having a combined work force in Canada of less than 100 permanent full-time and/or permanent part-time employees.

A5. The Bidder has a combined workforce in Canada of 100 or more employees; and

- ☐ A5.1. The Bidder certifies already having a valid and current [Agreement to Implement Employment Equity](#) (AIEE) in place with ESDC-Labour.

OR

- ☐ A5.2. The Bidder certifies having submitted the [Agreement to Implement Employment Equity \(LAB1168\)](#) to ESDC-Labour. As this is a condition to contract award, proceed to completing the form Agreement to Implement Employment Equity (LAB1168), duly signing it, and transmit it to ESDC-Labour.

B. Check only one of the following:

- ☐ B1. The Bidder is not a Joint Venture.

OR

- ☐ B2. The Bidder is a Joint venture and each member of the Joint Venture must provide the Contracting Authority with a completed annex Federal Contractors Program for Employment Equity - Certification. (Refer to the Joint Venture section of the Standard Instructions)

Canadian Space Agency

ANNEX “A”

Lunar Exploration Accelerator Program (LEAP) - Lunar Rover - Phase A

Statement of Work (SOW)

**rev. IR
March 31, 2021**

NCAGE Code: L0889

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1. INTRODUCTION

A key aspect of the Space Policy Framework of Canada is: ensuring that Canada is a sought-after partner in the international space exploration Missions that serve Canada's national interests; and continuing to invest in the development of Canadian contributions in the form of advanced systems and scientific instruments as part of major international endeavours. As a member of the International Space Exploration Coordination Group (ISECG), one particular aspect of Canada's interest is Lunar Surface Mobility (LSM) related activities.

On February 28, 2019, the Government of Canada announced a new Lunar Exploration Accelerator Program (LEAP) with an investment of \$150M over five years. Its aim is to expand and prepare Canada's space sector, particularly small and medium sized enterprises, for future exploration missions by offering technology development, science and mission opportunities in lunar orbit, on the Moon's surface, or further into deep space.

The LEAP portfolio is a forward-looking initiative; it is intended to generate technologies and science needed by Canada and its international partners for future international deep space missions, positioning Canada well for possible participation in them and is aligned with the Global Exploration Roadmap (GER) supplement priorities [RD-05].

The Work to be performed under this Statement of Work (SOW) includes the development of space technologies related to lunar mobility systems and science investigations on the lunar surface in support of an initiative referred to as the LEAP Lunar Rover Mission (LRM).

Proposed rover missions with integrated investigations will be evaluated, selected, and down-selected through a two-step competitive process. Please refer Section 1.3 for further information.

The primary focus of LRM will largely be used as a feed-forward demonstrator of Canadian industry's and academia capabilities for future Canadian rover missions in addition to performing opportunistic science investigations and promoting public engagement. This implies missions such as scouting, science investigations in unexplored areas, as well as prospecting for resources and support to larger rovers or human missions. The Canadian Space Agency (CSA) will partner with the National Aeronautics and Space Administration (NASA) to acquire an opportunity with the Science Mission Directorate under the Commercial Lunar Payload Services (CLPS) Program for cargo transportation services to the lunar surface.

1.1 MISSION CONTEXT

This Statement of Work (SOW) applies the lessons learned from the previous rover technology developments, science studies, as well as previously conducted Lunar Surface Mobility (LSM) Phase 0 studies, and the latest Space Technology Development Program (STDP)-sponsored studies and technology development. The mission will consist of landing a 30-kg class rover (including payloads) in a polar region of the Moon within the next 5 years to demonstrate key technologies and accomplish meaningful lunar science. The rover will communicate with Earth via a lander relay, an orbiter relay, or Directly-To-Earth (DTE), which will be negotiated with NASA and explored as part of this Phase A SOW. Figure 1-1 illustrates a notional concept for the proposed rover standing beside a 1.75m human figure for scale and Figure 1-2 illustrates a notional overview of the rover sub-systems.

NASA will furnish transportation on a lunar lander and a commercial launcher through the NASA CLPS Program. The notional high level interfaces are illustrated in Figure 1-3. The CSA will negotiate an Implementing Agreement with NASA during the Phase A.

As part of the Work under this SOW, the Contractor must develop the system requirements and interface definition with the spacecraft and lander provider, NASA, and the CSA. The Contractor should develop a conceptual design in which the rover has the flexibility to be installed on different landers and launchers with the least amount of modifications between missions. The Contractor should also develop a conceptual architecture that is modular in nature to allow upgrades to the rover to either grow to a larger mass capability or have their sub-systems be used on a larger class rovers.

The Contractor's team must include a science team composed of Canadian and American scientists. American scientists and the Work to be completed by the U.S. instrument(s) provider will, however, be funded through NASA on a no-exchange-of-fund basis, contingent upon execution of an Implementing Agreement between the U.S. and Canada. The science team should fulfill all scientific aspects of the mission starting with the work required for the Phase A. The Contractor's team will be required to participate in the selection of landing site locations options in the future in concert with NASA and CLPS teams. This selection process might include wider inputs from the community through consultative workshops.

The proposed science objectives must be aligned with a subset of the Canadian priorities established in the Canadian Space Exploration Science and Space Health Priorities for Next Decade and Beyond document [RD-06] as defined in section 7.1 and the Concept Of Operations Document (ConOps) [AD-06]. As a minimum, the mission must include at least two scientific instruments or payloads: one American and one Canadian. The American instruments, also referred to as U.S. scientific instruments, and Canadian instruments must share a payload mass of 6.0 kg combined as needed to maximize science return.

The LRM scope includes the development of the Canadian scientific instrument(s), its integration and testing, as well as, the integration of the U.S. scientific instrument(s), to the rover as a complete package. This assembly will then be delivered for integration to the lander and the launcher as illustrated in Figure 1-3. The Contractor must self-organize and coordinate the Work with the Canadian and U.S. scientific teams to meet the requirements as specified in this SOW.

Radioactive sources such as Radioisotope Heater Unit (RHU) or Radioisotope Thermoelectric Generator (RTG), for the purposes of heating or electrical generation, are not permitted on this mission.

Utility Task	Mobility, scouting, science
PL Capacity	6 kg (min two payloads)
Element Mass	24 kg (excl. payload)
Dimensions	700 L X 700 W X 600 H (mm) (+/- 100 mm on all dimensions)
Total Travel Distance	Min 500 m from lander
Max. Velocity	20 cm/s (nominal 10 cm/s)
Max. Slope	25 degrees
Max. Overclimb	At least 10 cm
Max. Night Survival Period	14.75 lunar synodic days
Power Generation	Solar, 60 W
Autonomy level	Semi-autonomous
Ground Clearance	At least 12 cm
wheels	20-30 cm diam.
Communications Band	1 - 250 kbps S / X (DTE) 1 - 1000 kbps UHF/S/X(Relay)
Available Period / Life	NET 2024, 2 to 7 lunar days

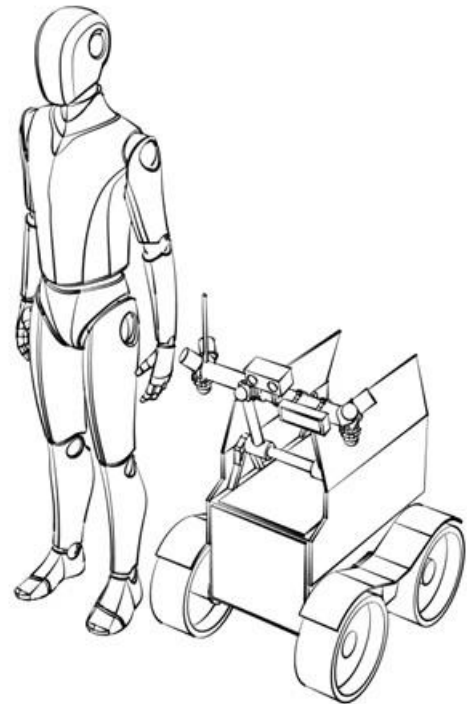


FIGURE 1-1 NOTIONAL LUNAR ROVER CHARACTERISTICS

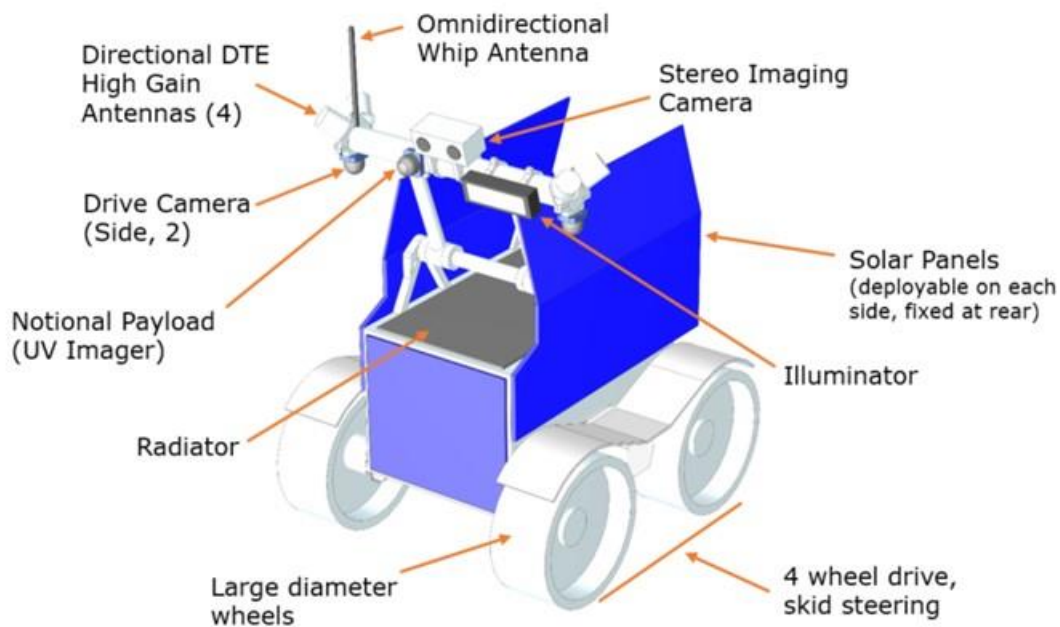


FIGURE 1-2 NOTIONAL ROVER

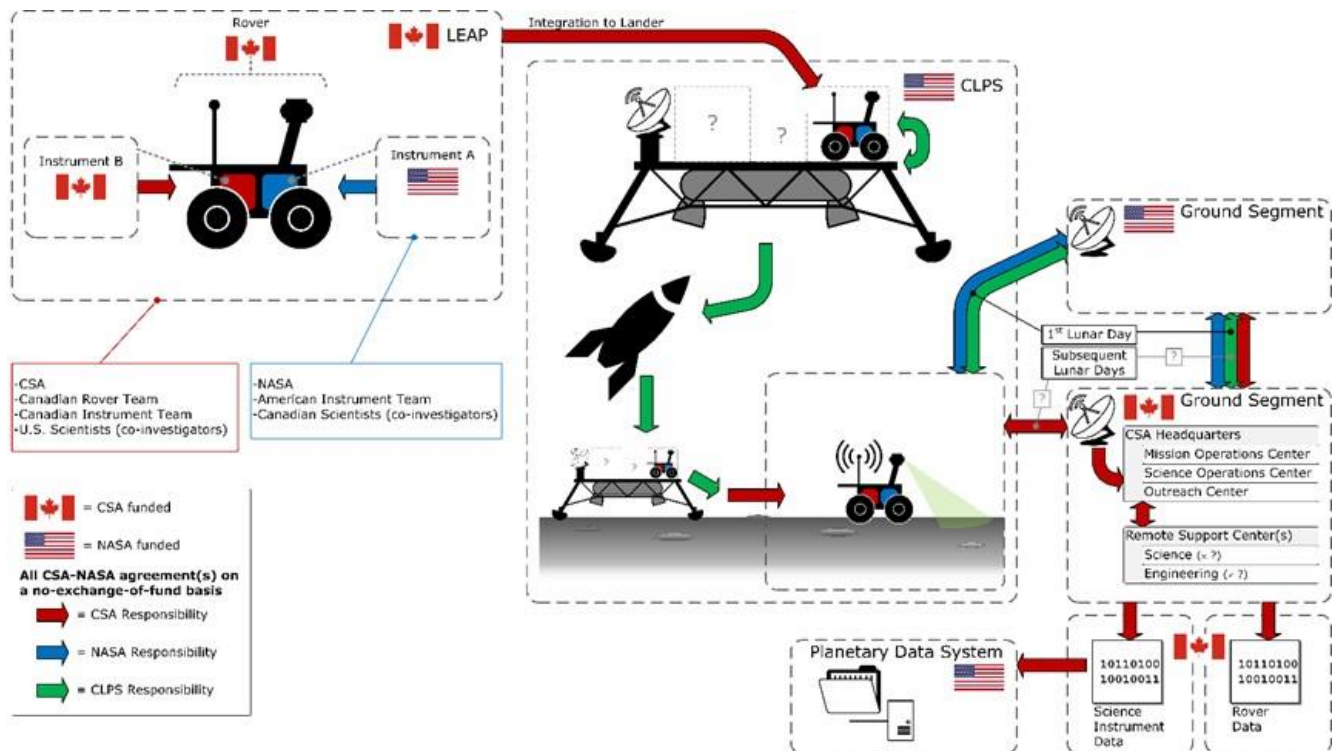


FIGURE 1-3 NOTIONAL LRM INTERNATIONAL CONTEXT

1.2 MISSION OBJECTIVE AND MEASUREMENT REQUIREMENTS

As previously introduced, the mission will provide the opportunities to:

- Demonstrate and characterize Canadian technology on the surface of the Moon;
- Perform meaningful science;
- Support the CSA in engaging with the public through outreach; and
- Increase the Canadian Space Sector readiness for future lunar missions.

The objectives of the Lunar Rover Mission will be:

- to rove the surface of the Moon to access, explore and discover remote polar areas of interest utilizing the Canadian and American scientific payloads¹, and;
- to demonstrate its capacity to endure and overcome the harsh lunar environment, including the extreme temperatures, the lunar regolith and the lunar nights in a polar region of the Moon all the while acquiring engineering measurements, imaging, and data.

The technological aspect of the mission is to accomplish traverses at the surface of the Moon to demonstrate and assess data to characterize key aspects of the rover and payloads technologies such as: mobility, remote semi-autonomous control, rover telecommunications, dust mitigation techniques, operate and survive in the harsh lunar environment.

¹ A scientific payload implies an scientific instrument, a camera, or other apparatuses that gathers data.

Hence, the Contractor will develop a sensor suite to measure the various engineering data to permit the technical evaluation and assessment of those technologies while in operation on the Moon. The intent is to develop and demonstrate building blocks and complete systems for the LRM, as well as hardware and software that can be re-applied and further advance the LEAP-beyond missions.

In addition to these aspects, scientific objectives will be further developed as part of Phase A in order to have a complete mission including meaningful science at the surface of the Moon. As indicated in the LRM MRD [AD-08] and put in context in the ConOps [AD-06], science goals must be developed in concert with a subset of the Canadian science priorities established by the community [RD-06] (see section 7). CSA will put in place an agreement with NASA in which CSA has committed to provide allocation for one American payload to the mission that shares in the 6.0 kg payload mass limit.

Another key element for the mission is the public outreach. The concept of outreach is to maximize the dissemination of the mission information during the mission to engage the public and have an enhanced experience and interaction of Canadians in the mission.

The mission objectives are summarized in Figure 1-4. A Mission Requirement Document (MRD) [AD-08] has been developed and provided to orient the scope of the mission and the high level mission requirements. During the Phase A work, the Contractor may reorganize and prioritize the MR as level 1 and 2's; with level 1 requirements being the engineering or scientific determinations or results required for successful completion of the mission objectives. All requirements which are deemed by the Contractor as having the greatest impact on cost or that belong in another level must be identified and justified, along with any opportunities for cost savings. The MRD is supported by the Mission Concept Document [AD-07] and the Concept of Operations [AD-06]. The Contractor must develop the mission concept and requirements based upon these applicable documents.



FIGURE 1-4 LUNAR ROVER DUTY

1.3 SCOPE

This SOW defines the tasks to be performed, and the associated deliverables to be produced, by the Contractor for the Lunar Rover Mission (LRM) Phase A work, including the rover and its payload(s). The Phase A scope of work defines the tasks required to develop a set of systems requirements, including the ones derived from the science objectives and the CSA approved selected instruments. Also, included is a detailed conceptual design based on the review of the CSA provided LRM Concept of Operations Document (ConOps) [AD-06], LRM Mission Concept Document (MCD) [AD-07] and the LRM Mission Requirements Document (MRD) [AD-08] together with the appropriate CAD models.

Additional tasks include an update to the operations concept document with a detailed reference mission scenario and systems operations concept, where science instrument operations are comprised, conduct a Technology Readiness and Risk Assessment (TRRA), prepare a Verification Compliance Matrix (VCM), accomplish studies and related activities to reduce risks, deliver Structural/Thermal/Mechanical/Electrical models, software conceptual design, engineering budgets (e.g. mass, power, volumes), a Phase BCD Development & Manufacturing Plan, and a Science Development Plan. The Project substantive LCC (costing), detailed schedule, and management plans must also be provided as part of Phase A during the Conceptual Design Review milestone.

At the end of this phase, the final baselined system requirements and the advanced concept must be completely developed and delivered. An “advanced concept” implies that the engineering models encapsulate a design capable of being built, tested and qualified in time for the predetermined launch window. The initial timeline is presented in Figure 1-5 and will be updated at the contract kick-off meeting and during the course of the Phase A work.



FIGURE 1-5 NOTIONAL MISSION SCHEDULE

The procurement approach selected is having up to two parallel Phase A contracts (Phase 1 - Request For Proposal (RFP) for Phase A) and then a subsequent selection process that will lead to one contract for Phase B, C and D at the end of Phase A through another competitive process (Phase 2 – RFP for Phases B, C and D). To implement this approach, the Contractor(s) must provide all the required deliverables as detailed in this SOW for Phase A, but then also be prepared to submit another proposal for the design and implementation work in parallel. The Phase 2 RFP will be issued by Public Services and Procurement Canada (PSPC) and the bid preparation

activities for Phases B, C and D are outside the scope of work of this SOW. The CSA will provide more details during the Phase A in the form of a SOW for Phases B, C and D to the Phase A Contractor(s) in order to scope and fulfill the needs for the Phases B, C and D proposal. As a starting point, the project schedule should fit within the proposed timeline presented in Figure 1-5. The Contractor can provide a shorter timeline as appropriate for the LRM, but it must fulfill all the requirements of the mission. Also, as part of its Phase B, C, and D proposal in the Phase 2 RFP, the contractor(s) from Phase A will be required to provide project costing for the Threshold mission and the Baseline mission. Additionally, if they can perform the Augmented mission or can target various elements of the Augmented mission and still be under the budget cap, then those should be identified and costed. Obviously, the more that can be accomplished with the fixed budget cap, the higher the ROI, and hence the more attractive it is for Canada to pursue.

In order for the CSA to obtain approval and authority to continue into the next phases, the Contractor must provide the following elements as part of the Phase A work to the CSA:

- a) Detailed costing for Phase B, C and D.
- b) Indicative Costing for Phase E
- c) Project Management Plan for Phase B, C and D
- d) Project Development Plan for Phase B, C and D.

As part of Phase A, and in consideration for the following phases, the Contractor must also provide a risk assessment associated with the elements specified in Table 1-1 and a scope management approach to maximize the outcomes for the mission in accordance with the Table 1-1 extracted from the MRD [AD-08]. In consonance with these, the CSA has subdivided the mission success criteria in three main categories:

- a) Threshold
- b) Baseline
- c) Augmented

The Baseline mission is seen as the required nominal mission. The Augmented column describes target requirements to achieve supplementary outcomes for the mission, and the Threshold is the minimum success criteria for the mission objectives. These objectives must be considered during the Phase A and can also be augmented and adjusted, subject to CSA approval, in accordance with the requirements that will be developed as part of Phase A in order to maximize the outcomes of the mission.

TABLE 1-1 LEAP ROVER MISSION OBJECTIVES/SUCCESS CRITERIA

Goals	Criteria / Objectives	Mission Success Level		
		Threshold	Baseline	Augmented
Rove - Gather - Overcome - Inspire	Traverse	Drive to a point at least 50 meters away from lander.	Drive to a point at least 500 meters away from lander.	Drive to a point at least 1.6 km away from lander.
	Permanently Shadowed Regions (PSR)	Drive and gather data in a shadowed area (not necessarily permanent).	PSR edge exploration, "toe dip" into PSR.	Operation inside a PSR for at least 1 hr.
	2D Imagery	Acquire imagery of: -rover tracks, straight; -rover tracks, point-turn; -1 x 120° partial color panorama at landing site; -area under lander;	include "Threshold" plus: -Earth in background; -lander in background; -1 x 360° color panorama of landing site from at least 50 meters away from lander; -Time-lapse of motion over 30 meters traverse;	include "Baseline" plus: -1 x 360° panorama of moonscape from at least 1.6 km away from lander; -Time-lapse of motion over 100 meters traverse;
	3D Imagery	None.	Acquire 3D imagery: -of one selected target; -to create a composite 3D map of a 30 m segment traverse;	include "Baseline" plus: -to create a composite 3D map of a 100 m segment traverse; -to create a composite 3D 360° panorama of the rover surroundings;
	Science	Address one LEAP S&T theme: "Know your Environment" or "Prospect for Resources".	Address two LEAP S&T themes: "Know your Environment" and "Prospect for Resources".	include "Baseline" plus either: -increase scope of "Know your Environment" and "Prospect for Resources" or -address the third LEAP S&T theme "Safe and Healthy Astronauts"
	Lunar Night Survival	None.	Survive one lunar night (i.e. the rover will hibernate and needs to be able to get back to operational at the end of the night) and demonstrate operations on the second lunar day.	Survive six lunar nights and demonstrate operations on the seventh lunar day.
	Outreach	Have imagery available to CSA's Communication department within 24 hours of its reception on the ground with the desire to have it released by CSA to the general Canadian public soon after its reception.	Have imagery in its 3D context available to Canadians within 24 hours of its reception on the ground.	Have imagery and rover telemetry in its 3D context available live to Canadians during the first lunar day, at least 75% of the rover's operation time.

1.4 U.S. SCIENTIFIC INSTRUMENT(S) (OPTIONAL GOODS AND/OR OPTIONAL SERVICES)

The Contractor must complete all work related to the U.S. scientific instrument(s) as specified in this SOW only if Canada exercises the Optional Goods and Optional Services. The exercise of the optional goods and/or optional services are contingent upon execution of an Implementing Agreement between the U.S. and Canada and the implementation of a contract between NASA and the U.S. instrument(s) provider.

1.5 DOCUMENT CONVENTIONS

A number of the sections in this document describe controlled requirements and specifications and therefore the following verbs are used in the specific sense indicated below:

- a) “Must” is used to indicate a mandatory requirement;
- b) “Should” indicates a goal or preferred alternative. Such goals or alternatives must be treated as requirements on a best efforts basis, and verified as for other requirements. The actual performance achieved must be included in the appropriate verification report, whether or not the goal performance is achieved;
- c) “May” indicates an option;
- d) “Will” indicates a statement of intention or fact, as does the use of present indicative active verbs.

2. DOCUMENTS

This section lists documents of significance to this Phase A SOW. These documents are divided into two categories: Applicable Documents and Reference Documents. Unless otherwise specified, the current revision of these documents applies.

2.1 APPLICABLE DOCUMENTS (AD)

This section lists the documents that are required for the Contractor to carry out the work requirements.

The following documents of the exact issue date and revision level shown are applicable and form an integral part of this document to the extent specified herein and can be obtained (in both official languages) from the following File Transfer Protocol (FTP) site: <ftp://ftp.asc-csa.gc.ca/users/TRP/pub/leap>

TABLE 2-1 APPLICABLE DOCUMENTS

AD No.	Document No.	Document Title	Rev. No.	Date
AD-01	CSA-ST-GDL-0001	CSA Technology Readiness and Risk Assessment Guidelines	D	March 2019
AD-02	CSA-ST-FORM-0003	Critical Technology Element (CTE) Identification Workbook	B	March 2019
AD-03	CSA-ST-FORM-0004	Technology Readiness and Risk Assessment Summary Report	2	February 2019
AD-04	CSA-RPT-0003	Technology Roadmap Worksheet	A	March 2019
AD-05	CSA-SPEX-GDL-0001	CSA SE Scientific Readiness Level Guidelines	Draft 2.0	June 2017
AD-06	CSA-LEAP-CO-0001	LEAP Rover Mission (LRM) Concept of Operations Document	IR	July 2020
AD-07	CSA-LEAP-CD-0001	LEAP Rover Mission (LRM) Mission Concept Document	IR	July 2020
AD-08	CSA-LEAP-RD-0001	LEAP Rover Mission (LRM) Mission Requirements Document	IR	August 2020
AD-09	CSA-LEAP-RD-0002	LEAP Micro Rover Product Assurance Requirements	P3	March 2021

2.2 REFERENCE DOCUMENTS (RD)

The following documents provide additional information or guidelines that either may clarify the contents or are pertinent to the history of this document.

TABLE 2-2 REFERENCE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
RD-01	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6 th Edition	2017
RD-02	CSA-SE-PR-0001	CSA Systems Engineering Methods and Practices ftp://ftp.asc-csa.gc.ca/users/TRP/pub/leap/	Rev. C	June 2020
RD-03	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard ftp://ftp.asc-csa.gc.ca/users/TRP/pub/leap/	Rev. B	June, 2020
RD-04	N/A	Guidelines on Costing (Treasury Board) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32600		2019
RD-05	N/A	Global Exploration Roadmap (GER) and supplement https://www.globalspaceexploration.org/wordpress/	3rd edition	Feb. 2018 and Aug. 2020
RD-06	N/A	Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond ftp://ftp.asc-csa.gc.ca/users/Exp/pub/Publications/Science%20Priority%20Reports/	N/A	2017
RD-07	N/A	NASA Project Cost Estimating Capability (PCEC) https://software.nasa.gov/featuredsoftware/pcec	N/A	
RD-08	Apogee Website	https://projects.eclipse.org/proposals/apogee		
RD-09	N/A	Xcore documentation (Eclipse Foundation)		
RD-10	N/A	Core Flight System Documentation and Open Source Code (NASA Goddard) https://cfs.gsfc.nasa.gov/		
RD-11	ANSI/AIAA G-043-2012	Guide to the Preparation of Operational Concept Documents https://arc.aiaa.org/doi/10.2514/4.105487.001		2012
RD-12	NPR 7120.5E	NASA Space Flight Program and Project Management Requirements https://nodis3.gsfc.nasa.gov/npg_img/N_PR_7120_005E/N_PR_7120_005E_.pdf	Rev E	August 2012
RD-13	CSA-LEAP-FORM-0001	PAR Assessment and Compliance Matrix Template ftp://ftp.asc-csa.gc.ca/users/TRP/pub/leap	IR	December 2020
RD-14	GSFC-STD-7000	General Environments Verification Standard	Rev A	2018
RD-15	NASA-STD-5017	NASA Space Mechanisms Handbook	rev A	
RD-16	AIAA S-114-2005	AIAA Moving Mechanical Assemblies		

3. WORK REQUIREMENTS

3.1 GENERAL TASKS

The Contractor must provide the management, technical leadership and subject matter experts in all applicable disciplines, and the support necessary to ensure effective and efficient performance of all project efforts and activities. The Contractor must approach Phase A with the objective of producing a conceptual design, schedule and a life-cycle cost (LCC) estimate for the mission.

The Phase A work requirements that must be accomplished by the Contractor are detailed in the subsequent sections and encompass all work related to the LRM and the Canadian and American scientific payload(s). The Deliverables and the Contract Data Requirements List (CDRL), as well as their Data Item Descriptions (DIDs) can be found in the Appendices A and B.

- 1) Project Management (Section 3.2)
- 2) Systems Engineering and Reviews (Section 3.3)
- 3) Safety and Mission Assurance (Section 4)
- 4) Operations (Section 5)
- 5) Engineering (Section 6)
- 6) Science (Section 7)

The CSA will make available the appropriate applicable documents through the FTP site.

3.2 PROJECT MANAGEMENT

The Contractor must establish and maintain a project management control system necessary to integrate the approved scope of work and ensure that the technical and programmatic requirements of this SOW are met, properly tracked, and reported. Refer to the Appendix A, for the minimum required CDRLs.

3.2.1 Project Management Plan (PMP)

The Contractor must develop and implement the Project Management Plan (PMP) as per CDRL [PM5].

The Project Management Plan [PM5] is used to:

- a) Guide the overall project execution;
- b) Document phase planning assumptions;
- c) Document phase planning decisions regarding alternatives (trade-offs, options) chosen;
- d) Facilitate communications amongst stakeholders;
- e) Define key management reviews as to the content, extent and timing;
- f) Provide a baseline for progress measurement and control; and
- g) Provide the tools and mechanisms to ensure integration of project information from the different sub-contractors as applicable, including but not limited to: integrated management schedule, integrated WBS, integrated cost estimate, integrated risk assessment.

As required by CSA, the Contractor must support the CSA in the development of a Joint Project Implementation Plan (JPIP) with NASA, (or similar document), between all parties involved. The JPIP will describe at a minimum but not limited to:

- a) Main deliverables of each parties and their due date
- b) Meeting schedule between the parties
- c) Communications channels

3.2.2 Team Organization

The Contractor must set up and maintain a project organization. The Contractor must provide and maintain a current Project Organizational Chart, showing personnel assignments by name and function and showing subcontractor reporting relationships.

The Contractor must nominate a Project Manager, who will be responsible for all aspects of the work carried out by the Contractor. The Project Manager must possess all the qualifications and experience needed to lead the Contractor's work throughout the duration of the contract. The Contractor's Project Manager must have full access to the Contractor's senior management for timely resolution of all issues affecting the project.

The Contractor must also nominate a Rover Science Principal Investigator (PI), who will be responsible for leading the mission science team in delivering the overall science mission goals and leading the science instrument teams. The PI will be the main point of contact with the CSA Project Scientist. The PI, in coordination with the CSA Project Scientist, could also represent the rover science team in discussions on the overall operational delivery logistics with representatives from other payloads on the CLPS lander. A Rover Science Deputy PI must also be identified, who will assist the PI in overall science team leadership, and would assume the role of PI should he or she be unable to complete his or her duties. It should be noted that Co-Investigator positions on the science team of each nation science instrument will be offered to the other nation scientists.

The Contractor must also identify other key personnel who are considered essential to the performance of the contract. The Contractor must assign personnel with appropriate qualifications and experience to all posts within the project organization.

3.2.2.1 Division of Responsibilities

The LRM will be a partnership of domestic and international industrial partners, universities, NASA, and the CSA. The Contractor will be responsible for the overall execution of the work described in this SOW. The CSA will review the deliverables identified in Appendix A and provide an essential degree of insight into the mission development to ensure the implementation is responsive to CSA's requirements and constraints partly spelled out in the Product Assurance Requirements (section 4) and to the Treasury Board's Directive on the Management of Projects and Programmes. Disposition will be provided as per the approval category for each CDRL. The CSA Project Authority, hereinafter referred to as CSA Project Manager, will be responsible for the management of the project on behalf of the CSA, and will be the official representative of the CSA to the Contractor and our International Partners (IPs) throughout this project. The Contracting Authority (CA) is responsible for authorizing any changes to the proposed scope of work and contract.

NASA, amongst other responsibilities, will manage the U.S. payload development, and provide the payload(s) to CSA as NASA-owned government furnished equipment for integration into the rover by the Contractor. NASA will also coordinate the technical interfaces, schedule, and deliverable needs between CSA, the selected Canadian rover team, and the U.S. instrument(s) provider. NASA will also select a CLPS Provider who can provide spacecraft interface compatibility with the selected Canadian rover interface specifications and through that CLPS Provider provide delivery of the selected Canadian rover, and its payloads, to the lunar surface.

3.2.2.2 Subcontract Management

The Contractor must be fully responsible for implementation and execution of all tasks, including those subcontracted to others. Whenever this is the case, the Contractor must prepare and maintain subcontract Statements of Work, technical requirements documents, etc., necessary to effectively manage the subcontractors' work.

At the request of Canada, copies of subcontractor documentation must be delivered to the CSA.

The Contractor must ensure that all of the relevant requirements of this SOW are flowed down to the subcontract Statements of Work. The Contractor must ensure that the relevant Quality Assurance criteria for spaceflight assets are flowed down to the subcontractor's Product Assurance Requirements.

3.2.3 Work Breakdown Structure and WBS Dictionary

The Contractor must plan, control and direct the project using a Work Breakdown Structure (WBS) that is product-oriented and that organises and defines the total work scope of the project to an adequate level of detail to provide for effective resource planning, management insight, and performance measurement. The Contractor must update and maintain the WBS provided with the bid for the Phase A throughout the course of the work as per CDRL [PM7].

The Contractor must establish and maintain a Work Package Description (WPD) defining the work to be done against each element identified in the WBS for Phase A. Also, subcontractor

contributions must be clearly separable to allow monitoring and control of the subcontracted work. Updates of the WPD must be provided along with the WBS updates during the course of Phase A work.

A properly formulated Contractor WBS (CWBS) provides a consistent and visible framework that facilitates uniform planning, assignment of responsibilities, data summarization, and status reporting. Both WBS and WPD for the Phase A and then for Phase B, C, D are to be further developed as part of the Phase A SOW are required as per CDRLs [PM7] and [PM8].

Included here are the WBS level 1, however the bid must include at least a product based level 2 WBS with some rover elements at level 3 (i.e. 6.3.1), see Appendix F as a guide:

- 1.0 Project Management
- 2.0 Systems Engineering
- 3.0 Quality, Safety and Mission Assurance
- 4.0 Science/Technology
- 5.0 Payloads
- 6.0 Spacecraft (or Flight System - Contractor preference)
- 7.0 Mission Operations
- 8.0 Launch Vehicle & Services
- 9.0 Ground Systems & Equipment
- 10.0 Systems Integration and Testing
- 11.0 Public Outreach (Public Relations)

The WBS must be in a chart format showing element relationships, arranged in the same order as the WBS provided in Appendix F.

3.2.4 Project Cost Estimate

During the early part of Phase A, an indicative-level (i.e. being better than ROM) life cycle cost (LCC) cost estimate must be developed using the template shown in Table 3-1 and delivered to CSA no later than 2 months after the Phase A contract award date for the Threshold and Baseline missions as a minimum, with Augmented or any parts thereof if so proposed in the initial proposal.

The bottom-up substantive LCC cost estimate (phases BCDE) must be developed using the template shown in Table 3-1 and delivered no later than 4 months after the Phase A contract award date (or at the Conceptual Design Review) for the Threshold and Baseline missions as a minimum, with Augmented or any parts thereof if so proposed in the initial proposal; and will be based on the CDRL [PM11] (i.e.: broken down per WBS) and take into account the deliverables specified at Section 8 of this SOW for future phases, noting that the Contractor may propose supplemental hardware as needed (i.e. fit check models, prototypes, 3-D printed models, mock-ups, Flight Spares, etc.).

During Phase A work, a parsing of the mission requirements and objectives defined in [AD-07] and [AD-08] into refined mission requirements and systems requirements will be done together with the CSA to streamline the Project and achieve further cost savings all within the parameters of the Baseline (nominal) Mission. These estimates will be used to obtain cost approvals for the next phases.

Risk reduction that has been accomplished during Phase A will be closely reviewed. CSA may request presentations and site visits to review the final concept study results with the Contractors and sub-contractors.

Any software revisions or refurbishment of testbeds to be used in Phase E should be considered as deferred Phase D work.

The Phase A to D Project Cost for the LRM, excluding the U.S. instrument(s), will be budget-capped at \$ **45M** Canadian Dollars (CAD) maximum, Applicable Taxes extra, inclusive of the two contracts totalling \$3.6M Canadian Dollars (CAD) (maximum \$1.8M CAD for each contract), Applicable Taxes extra, for the Phase A Work.

The planned budget for the U.S. scientific instrument(s) is \$5,000,000.00 US Dollars (USD), for Phases A, B, C and D.

TABLE 3-1 TEMPLATE FOR COST BREAKDOWN BY WBS

1	2	A	B	C	D	E	F	G	H	I	J	K	
5													
6			WBS	WBS Element	FY21	FY22	sub-Total	Phase A	Phase B	Phase C	Phase D	sub-Total	Total Proj
7			U1	Project management									
8				Labour (\$)									
9				Sub-Contracts									
10				Materials/Other									
11				Travel Living									
12				Labour hours									
13			U2	System Engineering									
14				Labour (\$)									
15				Sub-Contracts									
16				Materials/Other									
17				Travel Living									
18				Labour hours									
19			U3	Safety & Mission Assurance									
25			U4	Science / Technology									
26			U4.01	Science									
32			U4.08	Technology Development (prototypes, etc.)									
38			U5	Payload(s)									
39			U5.01	Payload # 1									
45			U5.02	Payload # 2									
51			U6	Spacecraft Systems									
52			U6.01	Rover									
53			U6.01.01	Structure									
54			U6.01.02	Mobility									
55			U6.01.03	C&DI									
56			U6.01.04	Power and Electrical									
57			U6.01.05	Thermal									
58			U6.01.06	GNC									
59			U6.01.07	Sensors									
60			U6.01.08	Communications Subsystems									
61			U6.01.09	Harness									
62			U6.01.10	Software									
63			U6.02	Lander									
64			U6.03	Spacecraft									
65			U7	Mission Operations									
66				Breakout separable services (e.g. USN, dish time)									
67				e.g. Training									
68				e.g. Simulators									
69				Labour (\$)									
70				Sub-Contracts									
71				Materials/Other									
72				Travel Living									
73				Labour hours									
74			U8	Launch Vehicle / Services									
75			U9	Ground Systems									
76			U10	System Integration & Testing									
77			U11	Public Outreach (Public Relations)									
78				sub-Total									
79				G&A									
80				FCC									
81				Reserves									
82				Taxes									
83				- Contributions									
84				Total Mission Costs									
85													

A table similar to the above, prepared by CSA Finance for generic projects, can be provided to the Contractor in the native EXCEL, if required.

The Contractor must specify the cost reserves forecasted in the LCC of the project and what strategy will be used to successfully mitigate or complete each stage of the project. This includes the identified and funded schedule reserves.

The Contractor must identify and justify during this Phase A any long-lead procurements that may be needed before the end of the detailed design. The procurement of any long-lead items is outside the scope of this SOW.

A cost sensitivity analysis should also be provided identifying the key driving requirements and their impact on the cost of the project.

3.2.5 Overall Project Schedule

During the Phase A work, the Contractor must prepare a detailed resource loaded schedule for all the work to be performed under this Contract. If the Contractor does not perform resource loading (work effort) within the schedule, then the Contractor must show how the Contractor ensures the proper resources are used in a timely fashion, how the task are assigned, and how resource-leveling is done during the project, especially on the critical path. The initial schedule must be included with the Project Management Plan deliverable and then updates must be provided monthly [PM-5] and at review meetings.

A lunar landing date between September 1st, 2025 and December 1st, 2025 must be used in the preliminary schedule, unless an alternative is identified and approved by CSA. These dates correspond to the Lunar Southern Hemisphere spring and provide beneficial communication access and lighting conditions for south polar missions over several lunar days.

The Contractor must maintain and deliver the Project Schedule [PM9] each month to reflect Phase A activity progress and must be updated during progress reviews, and at each formal milestones (i.e. formal technical reviews).

The Contractor must produce a project schedule for the subsequent phases (BCDE) of the project until project completion as per CDRL [PM10].

3.2.6 Integrated Management Schedule

The Contractor must demonstrate the link between the rover project schedule, the payload/instruments schedule, the CLPS Lander schedule, the launcher schedule, and the NASA and CSA milestones as an integrated program and how it would address risks, and prepare for the overall mission and be compatible with this international Lunar mission timeline.

As per NASA's definition, *the Integrated Management Schedule (IMS) constitutes the basis for time phasing (network) and coordinating all program/project effort to ensure that objectives are accomplished within approved commitments.*¹ *An IMS may be made up of several individual schedules that represent portions of effort within a program. The IMS constitutes a program schedule of the entire required scope of effort, including the effort necessary from all government, Contractor, and other key parties for a program's successful execution from start to finish.*² *The use of "integrated" here implies the schedule's incorporation of all activities—those of the Contractor and their subcontractor's major events - necessary to complete a program.*

The schedule must be at a level sufficient to control and report on the work required by this SOW. The schedule must show dependencies between tasks (preceding/superseding), durations, baseline dates, actual dates, and critical path, as a minimum. The schedule must be provided in the original native project management software format used by the Contractor to generate it. If applicable, the

¹ NASA Schedule Mgmt Handbook, NASA/SP-2010-3403, section 2.1

² GAO Schedule Assessment Guide, GAO-16-89G, Dec. 2015.

schedule must integrate the sub-contractor schedules to create an IMS. Once the baseline IMS with the sub-contractor schedules is created, any changes must be carefully updated, analysed, and reported to CSA [PM5].

For Phase A, the Contractor may combine the IMS with the Overall Project Schedule in section 3.2.5.

3.2.7 Risk Management – Preliminary Mission Risk Assessment

The Contractor must outline management approaches to mitigate risks to ensure successful achievement of the investigation objectives within the committed cost and schedule. The Contractor must provide a preliminary technical (engineering and scientific) and programmatic risk assessment for the entire mission lifecycle, starting with Phase A through to Phase F, as part of the Project Management Plan [PM5].

For each risk, the Contractor must identify the phase to which the risk applies, the likelihood of occurrence, the quantitative assessment of the impact if the risk occurs (i.e. costs, schedule and performance) and any possible mitigation strategies that may be taken in the near term to decrease either the likelihood or the impact. Specific mitigation actions must be identified for medium and high risks. Contingency plans (i.e. identifying alternative strategies if the mitigation fails) must also be developed for high risks, or when it is uncertain that mitigation plans will be effective.

Stating simply a ‘schedule risk’ is not an acceptable consideration. Schedule slippage is a symptom of something happening and not a risk. Rather, it is expected that the Contractor must provide;

1. what risk factor causes the schedule slippage; and
2. what mitigation or contingency does the Contractor propose

The Contractor must hold a fully funded schedule slack (reserve) and must be identified in the schedule and accounted for in the progress reports. The Contractor must integrate all risks when producing risk-related information, and document it in a Risk Assessment Matrix, included in the Project Management Plan [PM5] as per CDRL [PM12].

The Contractor must seek to provide cost containing options for the whole project. The proposed risk management approach must include a discussion of the robustness of the design, which includes recognition of the risks and mitigation plans for retiring those risks, the likelihood of success in developing new technology in advancing the state of the art, the maturity of the interfaces, the appropriateness of the proposed mission architecture, the ability of the development team, the importance of margins in the plans, and the approach of descoping in order to stay below the mission budget cap.

The Contractor must identify and qualify and track risks for the upcoming phases of the project as per CDRL [PM12].

3.2.8 Communication and Access

3.2.8.1 Access to facilities

The Contractor must establish and maintain a close management and technical interface with CSA to assure a coordinated program effort and monitoring of the total program cost, schedule and performance. The Contractor must provide access to its or its sub-contractors' plant and personnel, at mutually agreeable dates, by representatives of CSA or other organizations nominated by the CSA, for review of program status. The Contractor must provide temporary office accommodation space with the necessary furnishings (i.e. desk, chair, etc.) and other facilities for the use of the CSA representatives (and the nominated attendees) visiting the Contractor's premises for reviews, meetings, audits, liaison, etc. The accommodation must be adequate for the purposes of the visit and the facilities provided must include telephone, photocopying or scanning and Internet access.

3.2.8.2 Public Engagement

CSA is required to communicate the discoveries and results of its investigations to the Canadian public. These efforts are intended to promote interest and foster participation in CSA's endeavours, and to develop exposure to and appreciations for Science, Technology, Engineering, and Mathematics (STEM). Therefore, the Contractor must support the CSA to communicate mission updates, science, and new discoveries when requested. The Contractor must also support the publishing and archiving of the data and results from the Canadian Payload(s) aboard the Lunar Rover into the Canadian Government "Open Data" and the NASA Planetary Science Archives (Data System).

The Contractor must also coordinate with the CSA and NASA any public announcements concerning the rover mission or its payloads. The Contractor must contact the CSA Project Manager upon any requests received for communications to or with the public.

As part of this work, the Contractor must produce a Public Outreach Animation showing some of the typical operations planned to be performed during the deployment (CDRL PM-21). This animation will be used for public outreach purposes, as well as at the next CSA key decision points to illustrate the proposed design and planned operations.

3.2.9 Progress Reporting and Technical Interchanges

The Contractor must provide Progress Reports [PM13] and conduct monthly project status meetings with the CSA as required to review the project status (scope (WBS), cost, schedule, risk and performance) and to resolve unforeseen and urgent issues. As a minimum, the CSA Technical Lead and Project Manager, together with the Contractor Project Manager, will participate. Additional participants will be selected on an as-needed-basis, depending on the agenda.

The Contractor must also support Technical Interchange Meetings (TIM), scheduled as required, to discuss technical topics and issues requiring resolution. The Contractor and required subcontractors and science team members (determined jointly by CSA and the Contractor on a case-by-case basis) must attend each TIM. CSA representatives and external partners will attend as appropriate. The agenda of each TIM will be determined during the course of the contract.

The Contractor and its sub-contractor(s) must support the bi-weekly project teleconference meetings with the CSA. Support includes any activities associated with the preparation, attendance

and response to any action items resulting from the teleconference meetings. The Contractor and CSA will determine the sub-contractor(s) required to attend the bi-weekly meetings.

The Contractor must attend and support the CSA in any mission level International Partners related teleconference meetings as required.

All documentation and data generated by the Contractor for the project must be accessible to the CSA for review.

3.2.9.1 Action Item Log

The Contractor must maintain a detailed Action Item Log (AIL) [PM3] throughout the project to track actions resulting from all reviews and meetings, including teleconferences and Contractor internal meetings, using the following red-yellow-green spotlight method:

- a) 'Green' implying that the action item will be completed on-time.
- b) 'Yellow' implying that there exist an issue which will prevent meeting the deadline, and
- c) 'Red' implying that the action is past due.

Also, a chart indicating how many action items are open and how many are closed since the beginning of the project must be produced for the monthly progress report and at the meetings. The AIL (CDRL PM3) must be delivered with the Monthly Progress Report CDRL [PM13].

3.2.10 Performance Indicator Reporting

The Contractor must supply information for CSA's Performance Information Profile (PIP), used to measure and evaluate the outputs and outcomes of CSA-funded initiatives. The CSA will provide a digital link to the Contractor one month before contract expiry and at the end of each government Fiscal Year (FY) for the duration of the project, where the relevant information must be entered. Sample questions are provided in Appendix D, and may be subject to minor modifications or additions. Such changes will also include questions on equity, inclusion and diversity and for which the scope will also cover the Contractor's subcontractors.

The goal of the questions is to provide data to the CSA in order to document the results achieved in one fiscal year. The report will provide the CSA's Space Exploration Program with validated, reliable, complete and timely information to support decision-making and program evaluation. Such data allows evidence-based decision to be made within the Space Exploration Program.

3.2.11 Intellectual Property

The Contractor must complete the CSA Contractor Disclosure of Intellectual Property Form in Appendix C [PM19], identifying the Background and Foreground Intellectual Property (BIP and FIP) that will be generated in this Phase A contract, the owners of the BIP and how it will be managed and coordinated among the various collaborators and entities involved.

3.2.12 Export Permits

The Contractor must obtain all necessary permits to allow the import of materials and components into Canada and the export of the Engineering, Qualification, and Flight Models and technical documentation to the United States (US).

3.2.13 International Traffic in Arms Regulations

If so required, the Contractor must support the effort to obtain the necessary approvals required by the US State Department Directorate of Defense Trade Controls (DDTC) relating to the International Traffic in Arms Regulations (ITAR) Regulation 22 C.F.R. Chapter 1, Subchapter M Parts 120-130.

3.3 SYSTEMS ENGINEERING - REVIEWS AND REPORTING

3.3.1 Systems Engineering Phases

LRM is notionally divided in the following systems engineering Phases:

- a) Phase A, System Definition;
- b) Phase B, Preliminary Design;
- c) Phase C, Detailed Design;
- d) Phase D, Manufacturing, Assembly, Integration and Test (MAIT), Launch Preparation and Commissioning;
- e) Phase E, Operations, including post-Demonstration activities addressing mission goals;
- f) Phase F, Decommissioning and disposal (if applicable).

3.3.2 System Requirements

The Contractor must develop a complete set of system requirements documented in the System Requirements Document (SRD) as per (CDRL [EN1]) and delivered as per Table A-1. These requirements must be derived from the mission requirements provided by the CSA [AD-08] and cover all functional requirements derived from the Science Objectives and User Needs Definition Document (see section 7.1). The SRD must be approved and baselined as part of the Phase A.

The SRD must include a traceability matrix showing the relationship between the system requirements, mission requirements per [AD-08], and any other origins (e.g. PAR, regulatory requirements, etc.).

3.3.3 General Instruction for Reviews

For all meetings led by the Contractor, an agenda [PM-1] must be prepared by the Contractor and submitted to the CSA prior to the meeting date. The Contractor must record the minutes [PM-2] of all meetings and submit them to the CSA within 5 working days of the meeting, for approval. Meeting minutes must summarize actions to be taken and decisions made regarding items on the agenda. Hence, the minutes are not necessarily an extensive transcription of the discussions that may have taken place.

3.3.4 Systems Meetings and Reviews

The Contractor must hold the systems meetings described in Table 3-2. All of these meetings will be attended by representatives of the CSA, and other organizations nominated by the CSA.

All meetings between the Contractor and CSA will be held at a mutually agreeable time and location. The Contractor must provide formal notification of the proposed meeting date to the CSA no less than 10 working days before the meeting (with the exception of the Kick-Off Meeting (KOM) where the Contractor must coordinate with the CSA for an appropriate date.).

For meetings held at government venues, the Contractor must inform the CSA of the names of Contractor and subcontractor attendees, their citizenship, passport numbers, and date of births, no less than 20 working days before each meeting. Additional teleconferences and face-to-face review meetings must be held, if necessary, when mutually agreed to by the Contractor and the CSA.

Meetings can be alternatively replaced by videoconference or teleconferences for cost and/or time savings and when appropriate to support the scope of the meeting.

All Systems review meetings will be chaired by the CSA PM and led by the CSA Technical Lead (TL). In order to pass the reviews included in Table 3-2 successfully, all criteria related to the reviews included in the CSA SE review standard [RD-03] must be demonstrated and that all Review Item Discrepancies (RIDs) (if any) and Action Items raised during the review must be dispositioned to CSA's satisfaction or have a forward plan agreed to by the CSA. The Contractors must present the information in the software applications that was used to produce the CAD models, or other computer models or analyses, and not necessarily in PowerPoint format. In other words, at a sufficient engineering level to provide enough information for CSA to evaluate the capability of the systems to pass the review (i.e. no engineering by PowerPoint).

3.3.4.1 System Review Meetings

This section summarizes the System Reviews for the Phase A activities. The Contractor must adhere to the review dates and schedule at least two days per review.

Each System Review requires that a Review Data Package be delivered to CSA as per CDRL [PM4]. The data package needs to have the concurrence of the CSA engineering team before the review can be held. The CSA may invite the International Partners (e.g. NASA), or others to the Reviews.

TABLE 3-2 PLANNED MEETINGS

Meeting and System Reviews	Month After Contract Award	Venue
Kick-Off Meeting (KOM)	≤ 0.5	CSA
Conceptual Design Review (CoDR) (with elements of OpRR & TRRA)	≤ 4	Contractor
Systems Requirements Review (SRR)	≤ 7	CSA
Technical Interchange Meetings	ad hoc	TBD

The Contractor must support the CSA during international discussions and meetings with our partners with respect to technical aspects of the rover and prepare, review, and update presentations and perhaps perform analyses to satisfy the International Partner integration issues.

Also, if requested by CSA, the Contractor must also participate in the concept, safety, and mission review meetings at international partner locations. For planning purposes, one, week-long meeting in Houston, TX, USA should be assumed, supported on-site by three members of the Contractor team.

3.3.4.2 Kick Off Meeting (KOM)

The Contractor must support a KOM within two weeks after Contract award as coordinated with CSA. The Work must start at contract award. The purpose of the KOM is to introduce the Contractor and CSA teams, review the scope of work, the schedule, the basis of payment, update the concept provided with the bid, and discuss any other topics as required. All key participants under the contract, including representatives from each major subcontractor including the science team members, must attend.

The Contractor must produce a presentation and other necessary material in support of the KOM (CDRL [PM14]). Also, all other CDRLs relevant to the KOM as per Table A-1 need to be delivered, accepted and reviewed.

3.3.4.3 Conceptual Design Review (CoDR)

The Contractor must prepare and conduct a CoDR. The purpose of this review being to present the preliminary system conceptual design proposed to meet the mission requirements. The CoDR must meet the objectives, entry and exit criteria detailed in the Systems Engineering Technical Reviews Standard [RD-03] including the ones of the OpRR and TRRA review. The CoDR deliverables must include the CoDR Data Package as per CDRL [PM4], the presentation as per CDRL [PM15] and the specific applicable deliverables as per Table A-1. As part of the Table A-1 deliverables, the review will particularly focus on the following:

1. Preliminary Phase A Conceptual Design Document (CDRL [EN3]);
2. TRRA and roadmap deliverables including identification of the Critical Technologies from the Technology Readiness Risk Assessment and present a plan for qualification of these items;
3. Initial Assessment and Compliance Matrix (CDRL [PA1]) using the standard template provided at [RD-13];
4. Initial version of the Project Development Plan – Phase BCD (CDRL [PM6]);
5. Initial version of the Concept of Operations (CDRL [OP1]); and
6. Initial version of the Operations Requirements (CDRL [OP2]) and Systems Requirements (CDRL[EN1])

3.3.4.4 Systems Requirements Review (SRR)

The Contractor must prepare and conduct an SRR meeting. The purpose of this review being to demonstrate the validity of the system requirements and the project readiness to proceed with the preliminary design.

The SRR must meet the objectives, entry and exit criteria detailed in the Systems Engineering Technical Reviews Standard [RD-03]. The SRR deliverables must include the SRR Data Package as per CDRL [PM4], the presentation as per CDRL [PM16] and the specific applicable deliverables as per Table A-1.

3.3.4.5 Bi-Weekly Teleconference Meetings

The Contractor must hold Bi-Weekly teleconference meetings with CSA when requested by the CSA or Contractor to address the monthly report. The teleconference is mainly to address programmatic and technical issues and to discuss progress, refer to section 3.2.9.

3.3.5 Project Reporting

3.3.5.1 Monthly Progress Reports

The Contractor must submit monthly Progress Reports (CDRL [PM13]).

The Monthly Progress Reports must be delivered no later than five working days after the end of the month. As all deliverables, it must be submitted via CSA CM Library for the project, and a copy must also be sent by email to the PSPC Contracting Authority.

3.3.6 Document Deliverables

The Contractor must deliver all documentation content listed in the CDRL tables (Appendix A) as a minimum. Documents may be combined or divided by mutual agreement to optimize production and avoid unnecessary duplication of information. The format and content of the deliverables must be in accordance with the requirements specified in the Data Item Descriptions (DIDs) (Appendix B), both the specific DID identified in the CDRL and the DID-100 “General Preparation Instructions”.

As part of this process, the CSA will encourage its engineers to be in constant communication with their Contractor engineering counterparts in order to prepare the deliverables with the least number of discrepancies that would, on a larger project, be dealt with using RIDs. The goal will be for the Contractor to deliver documents previously agreed upon by both parties, Contractor and CSA engineering staff, in order to prevent alterations or comments which would cause delays, implying costs. Even the review presentations should be agreed upon between both engineering organizations before presenting to the project manager at each system review. The goal of the system reviews will be to demonstrate that the work thus far is correct and has the concurrence of the CSA Project Management.

In order to aid in this process, the CSA may request to have a CSA engineer embedded at the Contractor’s facilities for an extended period to facilitate the communication of CSA’s intent on the various aspects of the mission. If this were to be requested, it will be discussed and coordinated with the Contractor.

Subject to CSA’s approval, the Contractor may propose documents in the Contractor’s format provided the purpose, scope and content equal or exceed the DID requirements. The content of the Contractor’s document will then replace the content of the document specified in the DID.

All documents must be delivered via the CSA CM Library for the current project. Login credentials will be provided for the KOM. If the file is very large, S-Filer must be used to transmit the document to the CSA.

SI units must be used and supplied by the Contractor. Conversion factors must be supplied for all non-SI units used in the deliverable documents (including dates as YYYY-MM-DD).

The Contractor must obtain approval from the CSA for all CDRL Documents as indicated in the CDRL table.

3.3.6.1 Documents Delivered for Approval

The term “Approval” as used in this document and in other documents referred to herein, means written approval by CSA TL and CSA PM, of documents submitted by the Contractor. Once approved, the document is authorized for further use by CSA. The CSA does not take responsibility

for the validity of the data, or statements, and the Contractor is fully responsible for the content and secondary effects derived there from.

The document may not be changed without the CSA TL or CSA PM approval. No request or document for which approval is required must be acted upon or implemented by the Contractor until such approval is provided. Such requests and documents will be reviewed promptly by the CSA TL or CSA PM and the necessary written approval or disapproval will be provided after their receipt by CSA.

In the event that a request or document is disapproved, the CSA TL or CSA PM will advise the Contractor in writing as to the reasons for such disapproval and will define the additions, deletions or corrections that the CSA TL or CSA PM deems necessary to render the request or document acceptable. Disapproved requests or documents that are subsequently amended by the Contractor and resubmitted for approval will be either approved or disapproved by the CSA. Approval or disapproval of resubmitted requests or documents will be based solely on those points that were not previously deemed to be acceptable.

3.3.6.2 Documents Delivered for Review

The term “Review” as used in this document and in all other documents referred to herein, means, unless specifically stated otherwise, a CSA review of the documents submitted for that purpose by the Contractor. The term implies that the CSA has reviewed the document, provided comments, and the Contractor has revised the document as needed to meet the requirements of the CSA as determined by the CSA TL or PM. This process should be prompt if the CSA engineers and the Contractor’s engineers are in full and constant communications with each other.

The CSA does not take responsibility for the validity of the data, or statements, and therefore the Contractor is fully responsible for the content and secondary effects derived there from. Secondary effects are those which are subsequent or less predictable.

In the event that the CSA TL or CSA PM do not approve a document submitted for review, the CSA will so notify the Contractor. Such notification will include a full explanation of the reasons for the lack of concurrence and will recommend the additions, deletions or corrections that are beneficial to the needs of the project.

The Contractor must notify the CSA of the rationale to not implement the changes suggested by CSA insofar as the changes are in accordance with the relevant DID in Appendix B and this SOW.

3.3.6.3 Engineering Coordination Memos and Technical Notes

The Contractor may prepare engineering reports or documents in the form of informal Technical Notes (TNs) or Engineering Coordination Memos (ECMs) that are required for information or to address and resolve individual technical problems that occur during the contract. The purpose of the TNs is to document and exchange technical information on the progress of the work. Copies of all TNs must be delivered to the CSA. TNs or ECMs dealing with significant technical or performance issues must be delivered to the CSA for review. ECMs or TNs must not alter the terms of the contract in any way.

3.3.7 Overall Project Development Plan

The Contractor must breakdown the system into sub-systems (i.e. Product Breakdown Structure (PBS), see CDRL [EN8]) at a level sufficient to estimate required developments, schedule, cost,

risk and performance. The PBS must be the basis of the TRRA and System Design and Development Plan for the project. The Contractor must use the CSA PBS available as part of the MCD as a starting point [AD-07].

The Project Development Plans (CDRL [PM6] (for Phases B, C, D, and E)) must include all the project Life-Cycle Cost (LCC), together with the information required by sections 3.3.7.1 through 3.3.7.3, and scientific preparation for future mission phases as outlined in section 7.2 below.

3.3.7.1 Development, Manufacturing, Verification and Validation Approach

The Contractor must provide an overview of the development, manufacturing, and testing approach, specifying the major tasks required in the development and manufacturing cycles and the general strategy best suited for this approach. The Contractor must identify the potential long-lead parts required, the timeframe and rationale supporting the statements. The Contractor must also provide the methodologies and approaches to be used for verification and validation as well as describe the model philosophy (i.e. EM, QM, FM, or PFM, etc.) with definitions of these in CSA-SE-PR-0001 [RD-02]. Also, please refer to the CSA Systems Engineering Standards [RD-03] as guideline to implement these.

In addition and during Phase A, since this is a rover, the CSA expects to see an explanation of the mobility tests to verify the handling of the rover under conditions specified in the requirements document, as well as the condition when the undercarriage bottoms-out against the regolith and takes the weight off the traction wheels and impedes movement, how will the rover extricate from that difficult situation and how will that be demonstrated or tested.

3.3.7.2 Verification Compliance Matrices

The Contractor must provide a Verification Compliance Matrix to the applicable Requirements as per CDRL [EN4].

3.3.7.3 Canadian Capabilities Development

While the interests of Canada reside in creating innovation and jobs within Canada, the Contractor may propose using foreign technology if this would save considerable costs for the mission. The Contractor should expose this opportunity during the Phase A work for CSA's evaluation, noting the Contractor's obligation to meet Canadian Content requirements that will be applicable for Phases B, C, and D.

4. SAFETY & MISSION ASSURANCE

4.1 PRODUCT ASSURANCE REQUIREMENTS (PAR)

During Phase A, the Mission Product Assurance Requirements (PAR) will be reviewed and finalized for the purpose of Phases B, C and D planning and cost estimates. CSA will provide a baseline PAR document [AD-09] for the Contractor to review and be able to perform an initial LCC cost estimate. At the end of Phase A, the final CSA PAR must be accounted for in the Contractor Project Management Plan [PM1] or the System Development Plan (i.e. TRM) [EN11] and the Payload Design Document [EN7]. Coordination with NASA and the CLPS Lander Contractor will also be required to ensure the do-no-harm requirements can be met.

The Contractor must assign a Product Assurance Representative, or Quality Assurance Representative responsible to lead the Phase A work described in the following sub-sections.

4.2 INITIAL ASSESSMENT

The Contractor must review the PAR [AD-09], plan regular PA TIMs to hold associated discussions, and present an initial Assessment and Compliance Matrix (CDRL [PA1]) using the standard template provided in [RD-13] at the CoDR. Note that CSA will have provided examples and additional details on how to complete this assessment at the KOM.

This initial assessment must include the following listed elements as a minimum (it will be left to the Contractor to assess whether more substantiations are required for the sake of clarity).

Note: simply stating that a requirement is not aligned with mission costs, schedule, PA approach or philosophy, subcontractor or supplier capability, etc. will not be deemed acceptable. Specifically, in the case of subcontractor or supplier capability gaps or issues, the Contractor must propose options to fill those gaps or address the issues.

1. A compliance statement for each requirement;
2. For each non-compliant or partially compliant statement, the Contractor must provide an alternative (a change), with the rationale and the impact of the change on the mission risk, cost and schedule;
3. Identification of requirements that the Contractor recommends for modification or removal, with justification (the rationale and impact of the change on the mission risk, cost and schedule);
4. Proposed alternatives to all requirements recommended for modification or removal;
5. Proposed parameters for a reduced Worst Case Analysis approach reflective of mission duration and environment;
6. Identification of requirements that are significant cost or schedule drivers and proposed alternatives. An estimate of the cost and schedule impact must be provided for these cases, with assumptions stated;
7. An assessment of mission risks associated with any recommended modification or removals;
8. An assessment of the overall impact to system reliability due to proposed changes, modification, or removals; and,

9. Detailed review of the Electronic, Electrical and Electromechanical (EEE) parts requirements to address the following:
 - a) Review the CSA PAR EEE parts requirements and based on the mission duration and environment recommend a parts assurance level.
 - b) For a non-standard part (standard space qualified part is defined in the CSA PAR), the Contractor must consider and recommend the EEE part program requirements and the applicable screening and qualification requirements by part package or type. The screening and qualification requirements should be based on Military, NASA, or European Space Agency (ESA) standards.
 - c) Provide the justification, rationale, quantify the impact to reliability and failure rates and associated mission risks for each EEE part requirement.

4.3 PRODUCT ASSURANCE REQUIREMENTS UPDATE

Shortly after the CoDR, CSA will release a PAR update to be considered as baselined for Phase B, C, and D planning and cost estimates. Minor updates may be made up to the SRR, and will be communicated promptly to the Contractor.

The Contractor must update the PAR Assessment and Compliance Matrix (CDRL [PA1]) against the newly-issued version of the PAR and provide a final version of CDRL [PA1] at the SRR.

4.4 FINAL PAR FOR PHASE B, C, AND D; PROPOSED CDRLS, AND GOVERNMENT DUE DILIGENCE

At the SRR, the Contractor must recommend a minimum list of PA CDRL documents with their respective DID (data items descriptions) for Phases B, C and D, which will enable CSA to verify, review and approve the design, product assurance, assembly, integration, testing and safety activities (per CDRL [PA2]).

The mission context explained in section 1.1 must be taken in account in CDRL [PA2]. That is to say, the list of recommended CDRLs for Phases B, C, and D must enable CSA to establish a level of confidence that the objectives of the integrated Canadian mission (including American payload should Canada exercise the Optional Goods and Optional Services), and the specified performance requirements will be achieved.

5. OPERATIONS

5.1 CONCEPT OF OPERATIONS

The Contractor must develop a Concept of Operations Document (ConOps) as per CDRL [OP1] and delivered as per Table A-1. A preliminary ConOps [AD-06] is provided by the CSA along with user's needs and objectives [AD-07] as a starting point. The ConOps must cover the rover operations and as well as the integrated suite of instruments operations (Canadian and American).

The rover operations will be controlled and managed from the CSA Headquarters, most likely from its Exploration Development & Operations Center (ExDOC) supported by appropriate science and engineering backroom(s). The Canadian ground segment will also be put in contact with the American control rooms or organization(s) as required to operate the payloads during lunar transit, landing, and surface operations on the Moon.

The concept as mentioned in the preliminary ConOps is to minimize the number of facilities required and enable an efficient distribution of the data from the Moon down to the CSA and its participants. It must also be considered that the operations will be conducted by a mix of CSA employees and Contractor staff; the details of which will be determined as part of the upcoming phases.

5.2 OPERATIONS REQUIREMENTS

The Contractor must develop an Operations Requirements Document (ORD) as per CDRL [OP2] and delivered as per Table A-1. Along with the preliminary ConOps, the Mission Requirements Document [AD-08] will be provided as a starting point. The ORD content can be combined with the Systems Requirements Document.

The ORD must include a traceability matrix showing the relationship between the operations requirements, mission requirements per [AD-08], and any other origins (e.g. PAR, regulatory requirements, etc.).

6. ENGINEERING

6.1 INTERFACE DEFINITION

The Contractor must develop, during the Phase A work, a Preliminary Interface Control Document (ICD) including the requirements of the interface and a preliminary implementation concept of these interfaces as per CDRL [EN2] and delivered as per Table A-1. The ICD should cover both the interfaces with the CLPS lander, as well as, the interfaces between the scientific instruments and the rover.

The CSA will be providing some further information based on the NASA CLPS guidance that will be available at the kick-off meeting (KOM). For the purpose of estimating the work and level of interfaces, it should be considered that the CLPS lander is responsible at this point to develop the actual interfacing hardware to host and deliver the rover (egress) to the Moon. However the Contractor must clearly document the interfaces (ICD) in order to facilitate the interface definition with the lander. The Contractor will need to specify its interface requirements and definitions in a clear and explicit manner in order for NASA to issue a proper Task Order to the CLPS Lander providers. Interface requirements would need to be given to NASA approximately 32 months prior to launch in order to facilitate CLPS Task Order development. It is important to provide the complete interface requirements to NASA for their CLPS procurement competitions. As part of the interface definition exercise, the Contractor must work closely with the stakeholders (including both science payloads) in order to establish clear interfaces definitions and document these properly during the Phase A contract. This also implies the establishment of Interface Working Groups and meetings with the stakeholders as required.

For the purpose of planning and initiating the work for the ICD, the following guidelines must be considered for building or specifying the interfaces with the CLPS Lander team:

- Use common and contemporary standards as well as standard practices for safety;
- Reduce operational complexity (number of modes, number of mode transitions);
- Reduce demand on resources, especially at critical times;
- Maintain appropriate, but not excessive margins;
- It is acceptable to require heater power and minimal telemetry during transit, but should avoid any resource requests beyond survival during launch and descent phases;
- Manage your own data storage, buffering, and flow to the extent practical. Be tolerant of lost communications;
 - Minimize the rate of data transmission to Earth with an average bandwidth of less than 200 kbps;
 - Be compliant with a baud rate of 115.2 kbps;
- Minimize risk to other payloads or the CLPS lander. There will be provider-dependent do-no-harm requirements levied, which will require payload testing for verification;
- Design to GSFC-STD-7000 General Environments Verification Standard (GEVS);
- Candidate mobility payloads should try to be flexible to the degree practicable (e.g. accommodate several egress options if reasonable to do so);

- Clearly document the egress requirements including unobstructed path to the lunar surface, available “lift points”, etc.
- Actuation: Avoid pyrotechnics;
- Consider fault tolerant approach to any dynamic events (e.g. bolt cutters, spring actuations, etc.);
- a) Payloads should avoid hazardous materials, designs, and operations, and must provide hazard analyses, mitigations and document support as needed.
- b) Power interfaces to the lander using 28 V DC unregulated via two channels are encouraged (e.g. separate channel for power & thermal);
- c) On-board payload energy storage should be avoided as much as possible; except for rover batteries.
- d) Thermal systems like heaters, thermostats and sensors integral to the payload are favoured, with an adiabatic interface to the lander (specify any radiation view factor requirements)
- e) Preferred data protocol is RS-422. Ethernet is TBD as this point;
- f) Regarding structural guidance on acoustic, random, sine and shock utilize the GEVS as reference;
 - If possible, design the payload to not have any fundamental frequencies below 100 Hz;
 - Induced vibrations should be eliminated. If episodic events are expected, be sure to document them;
- g) Mobility payloads should provide very clear and complete requirements to the CLPS Provider; e.g. ramp angles, surface roughness, step-off distance, etc.
- h) There will be normal analyses and assessments (on issues such as loads, thermal, environments) to support landing analysis and integration that will be requested by the CLPS provider, in coordination with the NASA Payload Integration Manager, that the LRM will need to support

6.2 CONCEPTUAL DESIGN

The Contractor must develop a Phase A Conceptual Design Document (CDRL [EN3]) that meets the LRM Systems and Operations Requirements. This design must be substantiated by analysis.

As part of the conceptual design development and previous or on-going TRRA, the Contractor must identify critical elements for risk reduction and propose methods to address them as part of the Phase A during the proposal phase in order to mitigate these risks early. Standard methods to be performed such as: analysis, demonstration, testing, etc. must clearly identify how they will reduce the risk(s) during the Phase A. Deliverables associated to these analyses must be delivered to the CSA (e.g. [EN5], [EN6], [EN7], [EN8], [EN9]). The risks to be mitigated during the Phase A must be identified as part of the TRRA and risk identification exercise. These should include elements related to CTE, identification of long lead items, and alternate solutions to inform the preliminary design.

6.3 MODELS AND ANALYSIS

As mentioned as part of the systems conceptual design tasks, analyses are required in order to support the understanding of different design choices, to predict the performance of the proposed system, including its different subsystems, interfaces and science instruments, as well as to support risk reduction activities to the program. Analyses must demonstrate that the system concept can feasibly meet the requirements, and must support data provided in the engineering budgets and margins (section 6.4).

The Phase A Conceptual Design Document (CDRL [EN3]) must present a summary of the analyses performed, results, trade-offs and problems encountered. Analyses as well as all supporting models developed must be provided per CDRL [EN5]. Analyses may be provided as Technical Notes or ECMs or integrated into other formalized documentation (e.g. Phase A Conceptual Design Document).

The analyses and models must evaluate the end-to-end LRM system, including its subsystems, interfaces and science instruments. The analyses and models provided must include, but are not limited to:

- a) 3D CAD Models of the integrated rover with all major physical elements
- b) Electrical architecture and schematics
- c) Software architecture
- d) preliminary Structural analysis
- e) preliminary Thermal analysis
- f) Communication link analysis
- g) Guidance, Navigation and Control (GN&C) diagrams (e.g., flowcharts, state and control diagrams)
- h) Performance analyses

Additional analysis subjects may include reliability, life, hazards, operational timelines and constraints, and other subjects as required.

6.4 ENGINEERING BUDGETS & TECHNICAL PERFORMANCE MEASURES

The Contractor must establish and maintain engineering budgets (CDRL [EN6]) defining the performance and functional requirements and constraints for the LRM, including all subsystems and science instruments.

The engineering budgets presented must include at minimum:

- a) Mass Budget
- b) Power Budget
- c) Link Budget(s) – Each link to be used, i.e. Uplink, TTC & Payload Downlinks
- d) Data Budget
- e) Additional budgets must be presented where necessary to demonstrate compliance to the requirements.

The Margin Philosophy proposed for use in Phase A of the LRM is described in Appendix E. The Contractor must respect the proposed margin philosophy or establish and justify an alternative. The system conceptual design must respect the SRR Margins for the final margin philosophy used.

The Contractor must inform CSA as early as possible during Phase A of any available payload margin. In order to fully utilize the allocation, the Contractor or the CSA may propose a technology demonstrator to be installed on the rover in order to gain space heritage for another Canadian technology.

The Contractor must report the status of these budgets at every milestone as a minimum and as requested by the CSA if required between milestones to monitor the progression.

In collaboration with CSA and the Science Team, the Contractor must identify and track Technical Performance Measures (TPM's, CDRL [EN7]). These will be used to track the evolution of parameters that are critical to the achievement of mission success. (TPM's are described in section 4.2.9 of [RD-02].) The Contractor must report the status of these TPM's at technical reviews, or as requested.

6.5 TECHNOLOGY READINESS AND RISK ASSESSMENT (TRRA)

The Contractor must conduct a Technology Readiness and Risk Assessment (TRRA) in accordance with the requirements of the CSA TRRA guidelines [AD-01] for all elements: rover and science instrument(s).

The main steps of the TRRA are:

- a) Logically break down the system into technology elements (PBS CDRL [EN8]);
- b) Classify technology elements as critical or non-critical using the criteria defined in the Critical Technology Elements (CTE) Identification Workbook [AD-02] and provide sufficient rationale for that classification in the Workbook (CDRL [EN9]) and the TRRA Report.(CDRL [EN10]); In completing the Workbook, the Contractor must use a Target TRL of TRL-6 by CDR at the latest, unless otherwise specified by CSA.
- c) Prepare a report according to CDRL [EN10].

For purposes of technology development, the Contractor should also provide, in the TRRA report and the Project Development Plan [PM6], the driving requirements, required technology development, cost estimate, and schedule to reach the required TRL for the CTEs in line with the LRM timeline

As the maturity of the technology grows and requirements are better defined, the TRRA may need to be updated to reflect this progress.

The Contractor must update the final Technology Readiness and Risk Assessment to reflect the change in maturity of the system as a result of the work performed in Phase A.

6.6 TECHNOLOGY ROADMAP

The Contractor must prepare a Technology Development Plan, also known as Technology Roadmap (TRM), as in [AD-04], including the recommended timeline and sequence of required technology developments to reach TRL-6 and TRL-8 (CDRL [EN11]) for all the elements to be developed: rover and scientific instrument(s). The TRM will also provide a notional budget providing estimated costing for the proposed technology development steps.

The TRM must show how the technology development plan fits within the Project Development Plan to ensure that the technology to be used on the mission can reached TRL-6 by CDR (for a tech. demo. mission); and associated TRL progression aligns with the system's mission phases and milestones versus the NASA mission phases and milestones.

6.7 LAUNCH ENGINEERING

The Contractor must design the Lunar Rover, its systems, and its integrated payloads to survive the launch and landing environments.

The Contractor must consider and survive the deep space environment during the transit to the lunar surface in which the duration may vary from 4 to 6 months. Discussions with the launch provider and NASA will be required to determine the actual duration.

7. SCIENCE

7.1 SCIENCE OBJECTIVES AND USER NEEDS DEFINITION

The Contractor must produce inputs in the form of Science Objectives and User Needs Definition Document (CDRL [SC1]) for what would be the science contribution to the defined mission. The Science Objectives must be aligned with the scientific priorities identified in Table 7-1 [also see AD-06] and are derived from the Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond [RD-06]. An alignment with the international exploration goals as expressed in the Global Exploration Roadmap (GER, [RD-05]) is also desirable.

TABLE 7-1 OBJECTIVES FROM [RD-06] THAT COULD BE ADRESSED BY LEAP INITIATIVES

Topic	Objective Number	Objective Title
Planetary Atmospheres	PAT-04	Understand atmospheric and exospheric aerosols
Planetary Geology, Geophysics and Prospecting	PGGP-01	Document the geological record and processes that have shaped the surface of the terrestrial planets, their moons, icy satellites and asteroids
	PGGP-02	Determine the Resource Potential of the Moon, Mars and asteroids
	PGGP-03	Understand the origin and distribution of volatiles on the terrestrial planets and their moons, asteroids and comets
	PGGP-04	Determine the interior structure and properties of the terrestrial planets and their moons, icy satellites and asteroids
	PGGP-06	Understand surface modification processes on airless bodies
Planetary Space Environment	PSE-01	To understand the role of magnetic fields, plasma and atmosphere-ionosphere dynamics on the history and evolution of planets and other solar-system bodies
	PSE-02	To understand and characterize the plasma processes that shape the heliosphere and drive planetary and interplanetary space weather and related which create hazards to space exploration

The CDRL [SC1] document will capture and summarize the pertinent scientific instrument goals, assumptions and scientific objectives, identify the stakeholders and provide a clear articulation of observation requirements, data and applications needs, processing and distribution requirements, calibration, validation and characterization requirements, as expressed by the user community.

A science traceability matrix must be completed as part of this work. An example is provided in Table 7-2. This matrix must be reviewed, updated and included in the CDRL [SC1] document, accompanied by a narrative description that explains the rationale for the establishment of the instrument functional requirements to meet the science measurement requirements. This matrix provides systems engineers with fundamental requirements needed to design the mission, and can be used to show clearly the effects of any de-scoping or loss of elements on the achievement of the science objectives. It should be noted that there are three level of mission success criteria that have been defined in section 1.3 and [AD-08]. If the instrument functional requirements change as a function of these levels, it should be clearly explained in the CDRL [SC1] and documented in the science traceability matrix.

TABLE 7-2 SCIENCE TRACEABILITY MATRIX

Science Goals	Science Objectives	Science Measurement Requirements		Instrument Functional Requirements*			Mission Functional Requirements (top level)
		Observables	Physical Parameters	Mandatory		Target	
Goal 1	Objective 1	Absorption line	% abundance of absorber	Vertical resolution	XX km	ZZ km	Observing strategies: requires traverse and instrument positioning
Goal 2		Morphological feature	Size of feature	Horizontal resolution	XX deg x XX lat x XX long.	ZZ deg x ZZ lat x ZZ long.	
				Temporal resolution	XX min	ZZ min	
				Etc.	Rate of change of observable phenomenon	Duration of event	Precision
Accuracy		XX K	ZZ K				
	Objective 2 to N			Repeat above categories			

* Note that in section 1.3 and AD-08, there are three levels of mission success criteria, if these have an impact on the Instrument Functional Requirements, it must be reflected in the science traceability matrix.

7.2 SCIENCE INSTRUMENTS OPERATIONS AND REQUIREMENTS DEFINITION

As indicated in sections 5 and 1.1, the operations and the system requirements must include all the needed operational constraints and requirements derived from the Sciences Objectives and User Needs Definition Document (CDRL [SC1]).

7.3 PREPARATION FOR FUTURE MISSION PHASES

7.3.1 *Science Development Plan*

The Contractor must provide a Science Development Plan for Phases B, C and D as part of the Project Development Plan (CDRL [PM6]) in order to define all scientific activities that need to be conducted in order to meet the science objectives elaborated under section 7. The science team roles and responsibilities, the description and methodology for the instrument support activities and science investigations for Phases B, C, and D and the milestones must be presented in the Science Development Plan.

Potential science collaborations and Canadian science capabilities development strategies must be identified. All identified milestones must be integrated in the overall mission schedule. All cost related to the defined activities must be included in the mission cost estimate. For cost evaluation, it can be assumed that instrument support activities will be carried out as part of the rover contract and science investigation will be pursued under grants support.

7.3.2 *Science Road-mapping Activities*

The Contractor must prepare a Science Roadmap for Phases B, C and D as part of the Project Development Plan (CDRL [PM6]), demonstrating how the Science Readiness Level (SRL) will be achieved through Phases B, C, and D. The SRL scale is described in [AD-05] and summarized in Table 7-3. Road-mapping activities may include laboratory analysis, numerical modeling, or fieldwork in a relevant environment. These activities must be documented by the Contractor, linked through a verification matrix to the appropriate mission requirements they are addressing.

TABLE 7-3 THE CSA SCIENCE READINESS LEVEL SCALE

(See details in AD-05)

Science Readiness Level Description	SRL No	Program or Mission Phase
Basic scientific principles observed and reported	SRL 1	Fundamental research
Science investigation defined	SRL 2	SE R&D programs (preparatory phases including: Science Definition, Concept Studies, Science Maturation); SST FAST program;
Science investigation proof of concept	SRL 3	
Science investigation validated using simulated and/or instrument breadboard data	SRL 4	
Science investigation validated using analogue and instrument prototype data	SRL 5	SST STDP and FAST, Phases 0 and A
Science investigation validated using (ground) calibrated instrument Engineering Model data products	SRL 6	Phases B, C, D
Science investigation validated using (ground) calibrated instrument Flight Model data products, and analogue science operations, where relevant	SRL 7	
Science investigation data production validated through successful mission operations	SRL 8	Phase E Operations
Science investigation outcomes generated through publication of results	SRL 9	Phase E Data Analysis

8. CONTRACTOR DELIVERABLES

8.1 HARDWARE

The Contractor must deliver any physical models and ground support equipment developed or purchased as part of the Phase A Work that was paid in whole or in part by the Government of Canada.

The set of hardware needed for the subsequent Phases of the project and for the overall mission is included in this list as a starting point. This is expected to be refined further during the Phase A planning stages. Also, some of these items will need to be shipped to the Lander Provider facility as Delivered at Place (DAP):

- a) 1 Flight certified Rover
- b) At least 1 certified Canadian Flight science instrument integrated onto the rover
- c) 1 non-Flight Qualification Model (QM) Rover, 1 non-Flight CDN scientific payload qualification unit (more may be required if destructively tested)
- d) 1 non-Flight rover Engineering Model (EM) or Engineering Mobility Model
- e) Electrical GSE
- f) Mechanical GSE

8.1.1 **HARDWARE (OPTIONAL GOODS AND OPTIONAL SERVICES)**

The Contractor must deliver the hardware listed below in a subsequent Phase of the project if Canada exercises the Optional Goods and Optional Services:

- i) 1 US payload integrated and tested on the rover, as defined in the AIT plan, with participation from the US payload team.

8.2 SOFTWARE

The Contractor must deliver all source code of the software developed as part of the Phase A Work, including background code, libraries and/or executables required to make the source code functional. The Version Description Document (VDD) will provide the instructions and prerequisites to build, compile and execute the developed software. The Contractor must deliver the Flight Software either to the CSA, and/or to the US Integration facility, on behalf of the CSA.

The forecasted software required for Flight is the following, as a minimum:

- a) Flight certified software, including source code and Manuals
- b) Supporting software, configuration files, data files, and Firmware updates
- c) Simulation models
- d) EGSE software
- e) Ground Control software and Ground station (operators) software

8.3 DOCUMENTATION

The Contractor must deliver all documentation requested in Appendix A.

The Contractor may propose to combine documents called by more than one CDRL into one document, but this is subject to prior approval from the CSA. Where this approval is granted, the document cover page must list all the CDRL numbers that are covered by this document (see DID-100 – General Preparation Instructions).

Documentation, reporting and other deliverables must be according to instructions provided in Appendix B of this SOW, which also provides naming convention. Presentation material should be in Power Point format. Documents provided in Adobe PDF format must not be protected against copy of text and figures.

Documents must be delivered in the original software application format. One electronic copy of each deliverable document must be transferred to the CSA to the address and in the format specified in DID-100 – General Preparation Instruction. No paper copy is to be delivered.

All documents must be provided as soon as completed but no less than 10 working days prior to the specified Review Meeting unless otherwise indicated.

9. GOVERNMENT FURNISHED EQUIPMENT

9.1 U.S. SCIENCE INSTRUMENT(S) OR PAYLOAD(S)

As part of the different phases of the project, CSA will be obtaining information, various computer models, qualification and flight hardware/software from NASA for the U.S. instrument(s)/payload(s). These will be provided to the Contractor in addition to the U.S. instrument(s)/payload(s), as a NASA contribution for integration onto the rover, testing, and delivery purposes. The details of this process will be refined as part of Phase A to be further documented for the next phases.

9.2 ACCESS TO FACILITIES

Government Furnished Equipment (GFE) is available for access by the Contractors to its facilities including the Rover Integration Facility (RIF), Analogue Terrain (AT), Rover Indoor Workspace (RIW), and its David Florida Laboratory (DFL) testing facilities for performing testing.

It is the Contractors responsibility to assess the suitability of these facilities for their purposes as early as possible during Phase A. As the DFL labs are very busy, it is important not to put them in the critical path for the project. Hence, the Contractor must indicate its intention to use these facilities during Phase A. Also, the Contractor must reserve and cover any associated fees for the conduct of testing using the government facilities.

The Exploration Development Centre (ExDOC) at CSA St-Hubert, will be used as the Mission Operations Center during the rover operations on the Moon.

CSA is also in the process of taking ownership of a 1-m³ Dusty TVAC (DTVAC) chamber that will be available for testing at DFL.

9.3 ACCESS TO SOFTWARE

CSA is also offering access to its Apogy software environment (<https://www.asc-csa.gc.ca/eng/blog/2016/11/08/apogy-the-one-stop-shop-solution-for-operating-robots-satellites-and-beyond.asp>) as GFE to facilitate development and integration of the ground segment. This is provided as open source software and CSA does not assume any liability from said use.

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APPENDICES

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A CONTRACT DATA REQUIREMENTS LIST (CDRL)

This Appendix defines the documentation to be delivered by the Contractor.

LEGEND:

- j) D = Draft (under Version Control, up to 50% complete and correct)
- k) P = Preliminary (under Version Control, 70% complete and correct)
- l) IR = Initial Release (under Configuration Control, 95-100% complete and correct)
- m) F = Final (under Configuration Control, 100% complete and correct)
- n) U = Update (expected revision, but not final; under Configuration Control, previous versions remain unchanged under Configuration Control)
- o) CF = Contractor's format
- p) KoM = Kick-off Meeting.
- q) X = Ad-hoc, as and when required
- r) M = Monthly

TABLE A-1 CONTRACT DATA REQUIREMENTS LIST

CDRL No.	Title	SOW Sect. No.	DID No.	KOM	CoDR	SRR	Acceptance Category
A.1 PROJECT MANAGEMENT							
PM1	Meeting Agenda	3.3.3	CF	F	F	F	Review
PM2	Minutes of Meetings	3.3.4	CF	F	F	F	Review
PM3	Action Items Log (AIL)	3.2.9.1	CF	F	F	F	Review
PM4	Review Data Packages	3.3.4.1	113	F	F	F	Review
PM5	Project Management Plan – Phase A	3.2.1, 3.2.7	101	P	F	U	Approval
PM6	Project Development Plan – Phase B, C, D	3.3.7, 9.1	109	D	P	F	Approval
PM7	CWBS and WP Descriptions – Phase A	3.2.3	102	F	-	-	Approval
PM8	CWBS and WP Descriptions – Phase B, C, D, E	3.2.3	102	D	IR	F	Approval
PM9	Project Schedule – Phase A	3.2.5, 3.2.6	105	F	U	U	Approval
PM10	Project Schedule – Phase B, C, D, E	3.2.5, 3.2.6	104	D	F	U	Approval
PM11	Project Cost Estimates – Phase B, C, D, E	3.2.4	103	D	F	U	Approval
PM12	Project Risk Assessment – Phase B, C, D	3.2.7	CF	D	P	F	Review
PM13	Progress Report	3.2.9	107	M	M	M	Review
PM14	Kick-Off Meeting Presentation	3.3.4.2	108	F	-	-	Review
PM15	Conceptual Design Review Presentation	3.3.4.3	CF	-	F	-	Review
PM16	System Requirements Review Presentation	3.3.4.4	CF	-	-	F	Review
PM17	Technical Interchange Meetings (TIM)	3.3.4.4	CF	X	X	X	Review
PM18	Final Review (Reserved)						
PM19	Contractor Disclosure of IP	3.2.11	App. C	D	P	F	Approval
PM20	Phase Closure / Final Report	3.3.4.5	114	-	-	F	Approval
PM21	Animation or Video	3.2.8	115	-	-	F	Review
A.2 SAFETY & MISSION ASSURANCE							
PA1.	PAR Assessment and Compliance Matrix	4.2,4.3	0011	-	IR	F	Approval

CDRL No.	Title	SOW Sect. No.	DID No.	KOM	CoDR	SRR	Acceptance Category
PA2.	List of PA CDRL documents with respective DIDs recommended for Phases B, C and D	4.4	CF	-	IR	F	Approval
A.3 OPERATIONS							
OP1.	Concept of Operations	5.1	825	-	F	U	Approval
OP2.	Operations Requirements Document	5.2	800	-	IR	F	Approval
A.4 ENGINEERING							
EN1.	System Requirements Document (SRD)	3.3.2	400	-	IR	F	Approval
EN2.	Interface Control Document (ICD) (Preliminary)	6.1	501	-	IR	F	Review
EN3.	Phase A Systems Conceptual Design Document	6.2	700	-	IR	F	Approval
EN4.	Requirements Verification Compliance Matrix	3.3.7.2	531	-	IR	F	Review
EN5.	Models & Analyses	6.3	600	-	IR	F	Review
EN6.	Engineering Budgets	6.3	530	-	IR	F	Approval
EN7.	Technical Performance Measures	6.3	530	-	IR	F	Approval
EN8.	Product Breakdown Structure (PBS)	6.5	CF	P	IR	F	Approval
EN9.	Criticality Technology Element (CTE) Selection Workbook	6.5	AD-02	-	IR	F	Approval
EN10.	TRRA Stand Alone Report	6.5	0013	-	IR	F	Approval
EN11.	Technology Roadmap (TRM)	6.5	CF	P	IR	F	Approval
A.5 SCIENCE							
SC1	Science Objectives and User Needs Definition Doc.	7.1	000	-	IR	F	Approval

B DATA ITEMS DESCRIPTIONS (DIDS)

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DID-100 – General Preparation Instructions

PURPOSE:

This DID specifies:

- a) format requirements for the preparation and formatting of deliverable project documentation;
- b) document and data delivery methods, notifications and identification requirements;
- c) document and data structure requirements;
- d) metadata requirements for all document and data submissions.

When documentation is prepared in the Contractor's format, it must still meet the requirements of this DID.

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. Preparation

All documentation must be written in English and must be delivered in electronic format. Documents must be prepared using the most appropriate software (Microsoft Word, Excel, etc.). Schedules must be submitted in Microsoft Project format. Documents whose native format is not a common office program must be delivered in PDF in addition to the native format.

The electronic file name and the identification number written on the document itself must have the following format:

CDRL-NUM WXYZ CIE document title (ABCD)_rev # sentYYYY-MM-DD

where:

CDRL-NUM:	The CDRL Identifier (e.g. PM-01); if CDRL# is not pertinent then write the document type (eg. TN, ECN, NCR, RFW, etc.)
WXYZ:	3-5 letter acronym of the project (eg.: LRM)
CIE:	Company Name or Agency center originating document
Document Title	Short descriptive text (max 24 characters)
(ABCD)	Contractor's document number, in brackets, this is optional
_rev # or letter	1st release can be revIR, rev0, or revNC (no spaces)
sentYEAR-MONTH-DAY	Date Tracking Number

For example: PM-01 LEAP NASA Ames Test Report on TVAC (4310056)_rev0 sent2018-03-31

Note the absence of underscores or hyphens, except for the rev #. Failure to observe the file naming convention will be cause for rejection of the deliverable and incur delays in the payment of the claim.

1.2. Electronic Documents Format

Electronic copies of text documents must be formatted for printing on 8.5" x 11" paper.

1.2.1. Page Numbering

General format of documents should include page numbers and be formatted according to the Contractor's normal standard. If the document is divided into volumes, each such volume must restart the page numbering sequence.

1.2.2. Document Numbers

All pages must contain the Document Number at the top of the page. Document Numbers must include revision status and volume identification as applicable.

1.3. Delivery, Notifications and Identification Requirements

Data must be submitted with a Letter of Transmittal (or an electronic equivalent as mutually agreed by the CSA and the Contractor), and acknowledged. The Letter of Transmittal must be forwarded by the Contractor in two copies; one copy of acknowledgement to be signed and returned to the Contractor by the recipient. The Letter of Transmittal will contain as a minimum, the Contract Serial Number, the CDRL Number and the Title.

Documents may be delivered via e-mail, or direct transfer (FTP), or on optical disks.

CSA will provide a secure FTP site (CSA PIE-ISEP portal) for delivery and sharing of documents.

Login credentials will be provided after the Kick-Off Meeting.

The CSA PIE-ISEP portal offers automatic email notification when a new document is added or removed. This notification can be personalized with a message from the sender. These notifications will be treated as a Letter of Transmittal and acknowledgement of receipt.

1.3.1. E-mailed documents

E-mailed documents must be sent to:

asc.bibliothequegc-cmlibrary.csa@canada.ca

Covering e-mails must contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted.

1.3.2. Direct Transferred Documents

For direct transfer, a notification of the document's availability and location on a Contractor repository must be sent to:

asc.bibliothequegc-cmlibrary.csa@canada.ca

If deliverables contain ITAR content, notifications of their availability on Contractor repositories must be sent to: the CSA CM ITAR Receipt Desk:

CSA-CM-ITAR@canada.ca

The notification must include the project/program acronym or equivalent identifier and the CDRL identifier under which deliverable documents are being submitted.

1.3.3. Documents Delivered on optical disks

Hard copy and media deliverables are to be addressed to:

CM Library, 6A-100
Attention: Franco Moroso, Project Manager
Canadian Space Agency
6767 Route de Aeroport
Longueuil, QC, J3Y 8Y9
CANADA

The optical disk's label must show the following information:

- a) Company Name
- b) Document Title
- c) Document Number and Revision Status
- d) CSA SOW Number
- e) CDRL Number and Title
- f) Contract Number

1.4. DOCUMENT STRUCTURE AND CONTENT Except as otherwise specified, all documents must have the overall structure as follows:

- a) Cover or Title Page;
- b) Table of Contents;
- c) Introduction;
- d) Applicable and Reference Documents;
- e) Body of Document; and
- f) Appendices

1.5. Cover or Title Page : The title page must contain the following information:

- a) Document Number and date: Volume x of y (if multi-volume)
- b) Rev. indicator or date of Rev.
- c) Document Title
- d) Project Name
- e) Contract No.
- f) CDRL Item No. or Nos., if one document responds to more than one CDRL, subject to prior approval from the PA.
- g) Prepared for: Canadian Space Agency
- h) Prepared by: Contractor name, CAGE Code, address, and phone number
- i) Product tree identifier, if applicable
- j) © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR].
- k) The following proprietary notice: This document is a deliverable under contract no. _____. It contains information proprietary to the Crown, or to a third party to which the Crown may have legal obligation to protect such information from unauthorized disclosure, use or duplication. Any disclosure, use or duplication of this document or of any of the information contained herein for other than the specific purpose for which it was disclosed is expressly prohibited outside the Government of Canada except as the Crown may otherwise agree to in writing.

1.6. Table of Contents

The table of contents must list the title and page number of each titled paragraph and subparagraph, at least down to the third level inclusive. The table of contents must then list the title and page number of each appendix, figure and table, in that order.

1.7. Introduction

This section must be identified as section 1 and must, as a minimum, provide the following information:

- a) Project description and background;
- b) Identification (number, title) and a brief overview of the system, hardware, or software to which the document applies;
- c) Purpose of the document;
- d) Scope of the document (what it includes and what it does not include);
- e) Document conventions; and
- f) Roles and responsibilities of the participants and stakeholders.

The requirements specified in the following DIDs are the minimum expected. The Contractor must include in all documents all additional information required in order to ensure that the document provided will achieve its purpose as stated in the DID.

1.8. Applicable and Reference Documents

This section must list by Document Number and title, all applicable and reference documents. This section must also identify the source of all applicable and reference documents and the revision indicator.

1.9. Body of Document

The body of the document must be prepared in accordance with the content and format requirements defined in the specific Data Item Description.

1.10. Appendices

Appendices may be used to provide information published separately for convenience of document maintenance. Acronyms must be included in the last appendix.

2. METADATA ON DELIVERABLES

This section is optional at the discretion of the CSA Project Manager.

In order for CSA to be able to properly manage deliverables and the system configuration as well as to process Contractor's deliverables in an efficient manner, the Contractor must, for each deliverable, provide metadata as described in the following table.

Provided by Supplier	Metadata Description	Comments
Yes	CSA Project Identifier	Project Acronym
Yes	Contract Identifier	PSPC identifier
Yes	Contract Revision Identifier	PSPC identifier
Optional	Contract Revision Date	PSPC identifier
Yes	Document Title	
Yes	Document Maturity	Draft, Preliminary, Initial Release, Updated Revision, etc.
Yes	Document Release Date	
Yes	Document Effective Date	Applicable to document changes, deviations, waivers,
Yes	Document Type	Dwg, Doc, RFD, RFW, ECR, ECN, IP CR, IP CN/CD, QN, etc.
Yes	CDRL Identifier	Per CSA SOW (e.g. EN-006)
Yes	CDRL Identifier Sub-category	If multiple, separate subject documents per CDRL item (e.g. EN-006.03) (can be Contractor defined)
Yes	Originator's Organization Identifier	CAGE code, company name, short name, etc.
Yes	Deliverable Transmittal Date	
When applicable	Class	If deliverable is a change, deviation, waiver, etc. to a released item. (Class I, Class II)
Yes	Security Classification of Deliverable	Per Government of Canada definitions for Classified and Protected data (C,S,TS,PA,PB,PC)
Yes	Sensitivity of Document contents	Company Proprietary, Trade Secret, etc.
Yes	ITAR Content Indicator	Yes or No
Yes	Export Controlled Content Indicator	Yes or No
Yes	Filename of Deliverable	Filename and file type (for all representations submitted - .doc, .pdf, etc.). Original, revisable format to be delivered before contract completion.

DID-000 – Science Objectives and Users’ Needs Definition

PURPOSE:

The purpose of this document is to provide all the science justification, as well as scientific objectives, the identification of the users and the definition of their needs. This document acts as a source for the System Requirements Document (SRD) and the Project Development Plan.

PREPARATION INSTRUCTIONS:

The document must contain the following information, as a minimum:

- 1) Introduction
 - a) Document purpose,
 - b) Document scope;
- 2) Applicable and Reference Documents;
- 3) Science Objectives:
 - a) Introduction, background, scope,
 - b) Mission goals,
 - c) Science goals,
 - d) Space community priorities,
 - e) Traceability between space community priorities and mission goals;
- 4) Users’ Needs:
 - a) Measurement needs,
 - b) Measurements assessment analysis,
 - c) Data needs,
 - d) Canadian data needs;
- 5) Implementation and Operations Concept:
 - a) Instrument sections,
 - b) Platforms,
 - c) Data Production,
 - d) Applications,
 - e) Data Exploitation;

Appendix A: Nomenclature

Appendix B: Acronyms

DID-0011 - PAR Assessment and Compliance Matrix

PURPOSE

The primary purpose of the PAR compliance matrix is to evaluate the Contractor's capability to implement well-established requirements and best practices for space solutions, in order to maximize the likelihood of achieving project performance requirements and outcomes. The secondary purpose is to seek Contractor inputs and alternatives concerning the implementation of PA Requirements of [AD-09], and evaluate the Contractor's associated risks and mitigations.

PREPARATION INSTRUCTIONS:

The following elements must be provided using RD-13 format:

- 1) A compliance statement for each requirement;
- 2) For each non-compliant or partially compliant statement, the Contractor must provide an alternative (a change), with the rationale and the impact of the change on the mission risk, cost and schedule;
- 3) Identification of requirements that the Contractor recommends for modification or removal, with justification (the rationale and impact of the change on the mission risk, cost and schedule);
- 4) Proposed alternatives to all requirements recommended for modification or removal;
- 5) Identification of requirements that are significant cost or schedule drivers and proposed alternatives. An estimate of the cost and schedule impact must be provided for these cases, with assumptions stated;
- 6) An assessment of mission risks associated with any recommended modification or removals; and,
- 7) An assessment of the overall impact to system reliability due to proposed changes or modification or removals.
- 8) Detailed review of the Electronic, Electrical and Electromechanical (EEE) parts requirements to address the following:
 - a) Review the CSA PAR EEE parts requirements and based on the mission duration and orbit recommend a parts assurance level.
 - b) For a non-standard part (standard space qualified part is defined in the CSA PAR), the Contractor must consider and recommend the EEE part program requirements and the applicable screening and qualification requirements by part package or type. The screening and qualification requirements should be based on Military, NASA, or European Space Agency (ESA) standards.
 - c) Provide the justification, rationale, quantified impact to reliability and failure rates and associated mission risks for each EEE part requirement.

Note: only for item 8, if the Contractor deems necessary, a Word format is acceptable.

DID-013 – Technology Readiness and Risk Assessment with Stand Alone Report

PURPOSE:

The Technology Readiness and Risk Assessment (TRRA) Report is used to describe in a systematic and objective fashion, at a specific point in time (milestone) in the development process, the technological readiness of a system for a particular spaceflight mission, the criticality of the constituent technologies, and the expected degree of difficulty in achieving the remaining technology development steps.

The TRRA provides for all the Critical Technology Elements (CTEs) of the proposed concept, as per the Product Breakdown Structure (PBS), a high-level summary of the maturity of the technologies and the technology development risks.

The TRRA Report is used to assess project status and technical risks, and to guide definition of risk reduction work in following phases.

Agreement on the appropriate PBS level and identification of the CTEs is required prior to the TRRA leading to the elaboration of the TRRA Report. For each CTE the TRRA Report captures the key requirements, heritage, Technology Readiness Level (TRL) achieved, Technology Need Value (TNV), the Research and Development Degree of Difficulty (R&D3) to complete the development, and references to supporting evidence for all assessments.

PREPARATION INSTRUCTIONS:

The TRRA Report must contain the following information, as a minimum:

1. INTRODUCTION

This section should include

- 1.1. Project Description;
- 1.2. Purpose of Document;
- 1.3. Scope.

2. DOCUMENTS

This section must include

- 2.1. Applicable Documents (which must include the following):
 - i) TRRA Guidelines (CSA-ST-GDL-0001 at latest approved revision).
- 2.2. Reference Documents (which must include the following):
 - i) TRL Handbook for Space Applications (TEC-SHS/5574; ESTEC);
 - ii) all evidence documents referred to in body of report.

3. MISSION OBJECTIVES

This section must provide an overview of the mission, describing the key mission requirements and any assumptions.

4. MISSION ENVIRONMENT

This section must describe in detail the mission environment and any assumptions.

This section should include a summary comparison table(s) between heritage and current mission environments with references to source documents.

5. PRODUCT BREAKDOWN STRUCTURE

This section must provide a table or diagram with hierarchy of PBS and element numbers.

This section must provide schematics illustrating the elements of the PBS and their parts.

This section should use the CSA proposed PBS provided in the MCD [AD-07].

6. KEY PERFORMANCE PARAMETERS (KPPS) FOR EACH CTE

This section must describe the Key Performance Parameter(s) identified for each PBS element (where applicable). The KPP description must identify what parameter value and range is currently achievable and what is required.

7. CRITICAL TECHNOLOGY ELEMENTS (CTES)

7.1. Description of the CTE;

7.2. Rationale for selecting the CTEs.

The intent of this section can be met by completing and cross-referencing the Critical Technologies Elements Identification Criteria Worksheet (CSA-ST-FORM-0003).

8. TECHNOLOGY MATURITY AND VIABILITY ASSESSMENTS

This section must include a sub-section for each CTE covering:

8.1. Description;

8.2. Main requirements (including KPP(s) associated with this CTE);

8.3. Heritage and compliance;

8.4. TRL achieved;

8.5. R&D3;

8.6. TNV.

The intent of this section can be met by completing and cross-referencing the applicable Technology Readiness and Risk Assessment Worksheet (CSA-ST-FORM-0001) for each CTE and including the Technology Risk Matrix generated from the Technology Readiness and Risk Assessment Data Rollup Tool (CSA-ST-RPT-0002).

9. TRRA SUMMARY AND RECOMMENDATIONS

This section must include a Summary table of results with columns covering:

- PBS # ; Technology Name; TRL (calculated); TNV (user input);
- R&D3 (user input); TNV • Δ -TRL (calculated); /R&D3/ (calculated).

This section must present a summary of remaining Technology R&D Options, Risks, Cost, and Feasibility for each CTE of the PBS.

This section must summarize the recommended technology development plan and should refer to a separate Technology Development Plan report if appropriate.

10. CONCLUSIONS

This section should include a statement regarding current overall state of TRRA assessment and identify any open work.

11. APPENDIX A – TECHNOLOGY READINESS AND RISK ASSESSMENT WORKSHEETS

This section must include, or refer to an attachment which includes, all of the completed worksheets: the Critical Technologies Elements Identification Criteria Worksheet (CSA-ST-FORM-0003 – AD-02), the Technology Readiness and Risk Assessment Worksheet (CSA-ST-FORM-0001 (AD-03) for each CTE and rollup using the Technology Readiness and Risk Assessment Data Rollup Tool (CSA-ST-RPT-0002). These worksheets can be obtained from the FTP site:

<ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/>.

DID-101 – Project Management Plan

PURPOSE:

The Project Management Plan (PMP) is used to guide both project execution and project control.

The PMP is used by the Government to assess the adequacy of the Contractor's plan for management of the work and to provide a basis on which to monitor and assess the progress of the work.

PREPARATION INSTRUCTIONS:

The PMP is used to:

- a) Guide the project execution;
- b) Document project planning assumptions;
- c) Document project planning decisions regarding alternatives chosen;
- d) Facilitate communications amongst stakeholders;
- e) Define key management reviews as to content, extent and timing; and
- f) Provide a baseline for progress measurement and project control.

When the Contract has specified delivery of another document that contains aspects of the required information, the PMP should summarize these aspects and refer to the other document.

The below follows the PMI PMBoK [RD-01] processes.

The PMP must contain the following information, as a minimum:

1. INTRODUCTION

- a) Project Objectives;
- b) Scope of the Plan; and
- c) Applicable and Reference Documents.

2. PROJECT INTEGRATION MANAGEMENT

[This section must describe the processes planned to be used to ensure that the various elements of the project are properly coordinated. It must describe:](#)

- a) The overall project management strategy;
- b) How the plan will be executed; and
- c) Overall change control mechanisms.

3. PROJECT SCOPE MANAGEMENT

This section must describe the processes planned to be used to ensure that the project includes all the work required, and only the work required, to complete the project successfully. It must address:

- a) Initiation;
- b) Scope Planning;

- c) Scope Definition;
- d) Scope Verification; and
- e) Scope Change Control.

4. PROJECT TIME MANAGEMENT

This section must describe the processes planned to be used to ensure timely completion of the project. It must address:

- a) Activity Definition;
- b) Activity Sequencing;
- c) Activity Duration Estimating
- d) Schedule Development; and
- e) Schedule Control.

This section must include the detailed project baseline schedule down to the activity level. The baseline schedule must include all elements of the CWBS and must depict all linkages and dependencies.

5. PROJECT COST MANAGEMENT

This section must describe the processes planned to be used to ensure that the project is completed within the approved budget. It must address:

- a) Resource Planning;
- b) Cost Estimating;
- c) Cost Budgeting; and
- d) Cost Control.

This section must include the detailed project cost baseline down to the activity level. The cost baseline must include all elements of the CWBS.

6. PROJECT QUALITY MANAGEMENT

This section must describe the processes planned to be used to ensure that the project will satisfy the needs for which it was undertaken. It must address:

- a) Quality Planning;
- b) Quality Assurance; and
- c) Quality Control.

7. PROJECT HUMAN RESOURCES MANAGEMENT

This section must describe the processes planned to be used to make the most effective use of the people involved with the project. It must address:

- a) Organisational Planning;
- b) Staff Acquisition;
- c) Team Development;
- d) Project organizational chart; and
- e) Key personnel.

8. PROJECT COMMUNICATIONS MANAGEMENT

This section must describe the processes planned to be used to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. It must address:

- a) Communications Planning;
- b) Information Distribution;
- c) Performance Reporting; and
- d) Administrative Closure.

9. PROJECT RISK MANAGEMENT

This section must describe the processes planned to be used to identify, analyze and respond to projects risks. It must address:

- a) Risk Identification;
- b) Risk Quantification;
- c) Risk Response Development; and
- d) Risk Response Control.

This section must also refer to the detailed project risk assessment and plan to manage project risks.

10. PROJECT PROCUREMENT MANAGEMENT

This section must describe the processes planned to be used to acquire goods and services (“products”) from outside the Contractor’s organisation. It must address:

- a) Procurement Planning;
- b) Solicitation Planning;
- c) Solicitation;
- d) Source Selection;
- e) Contract Administration; and
- f) Contract Closeout.

11. PROJECT STAKEHOLDERS MANAGEMENT

NOTE: this section of the PMP is required if the PMP is being developed by the CSA, but may not be needed or possible if the PMP is being developed by the Contractor.

This section must describe the processes required to identify the people, groups or organisations that could impact or be impacted by the project, to analyze all the stakeholders’ expectations and impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in projects decisions and execution. Stakeholder management also focuses on continuous communication with stakeholders to understand their needs and expectations, addressing issues as they occur, managing conflicting interests and fostering appropriate stakeholder engagement in project decisions and activities.

It must address:

- a) Stakeholders identification and analysis;
- b) Stakeholder management planning;
- c) Stakeholder engagement management; and
- d) Stakeholder engagement control.

DID-102 – CWBS and Work Package Descriptions

PURPOSE:

The Contractor Work Breakdown Structure (CWBS) is used during planning for estimating resources and scheduling the work. During the implementation phase, it is used for reporting and controlling costs and schedule.

PREPARATION INSTRUCTIONS:

The Contractor must provide a Work Breakdown Structure (WBS) chart describing all the project elements that organize and define the total scope of the project, including subcontracted work, and must be product-oriented.

The Contractor must prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. The WBS Dictionary must be ordered in consonance with the WBS index and must reference each WBS element by its identifier and name.

Each WPD must include, as a minimum:

- a) A unique identifier traceable to the WBS;
- b) A title;
- c) The name of the individual responsible for completion of the work;
- d) The **scope** of the work package;
- e) The start date and duration;
- f) Required **inputs** and dependencies;
- g) A description of every activity covered by the WPD including the level of effort and earned value measurement method for each activity (if applicable), and all non-labour costs;
- h) Assumptions;
- i) **Output** and work package acceptance criteria;
- j) Issue date;
- k) Version number; and
- l) List of deliverable with delivery milestone.

DID-103 – LCC Project Cost Estimates

DID Issue: Tailored for Rover

Date: 2020-06-23

PURPOSE:

To provide cost estimates for Phases A, B, C, D and E.

PREPARATION INSTRUCTIONS:

The Phases A, B, C, D and E Cost Estimates may be prepared in the Contractor's format and must be based on the corresponding CWBS. The Cost Estimates must be provided by the Contractor at the requested date and at end of each project phase in order for CSA to refine the budget required for the succeeding phases with more detail. There are general requirements and specific requirements to be met by these estimates.

1. GENERAL REQUIREMENTS

The Cost Estimates must, as a minimum, contain the following information:

- 1) The costs must include the overall management of the project industrial activity by the Contractor including subcontract management;
- 2) The costs estimates must be consistent with the WBS, product tree and the qualifications model philosophy required elsewhere in this SOW;
- 3) The costs estimates must include, but identify separately, costs for each separate element of the rover, payload(s), other major sub-systems and the Ground Segment, any special hardware that needs to be procured and the cost of verification and integration activities needed to integrate the integrated rover on the lander and launcher;
- 4) The costs estimates must include costs of safety and mission assurance activities, including preparation for, attendance at, and participation in launch provider safety reviews;
- 5) The costs estimates must also include inputs required by CSA to assess estimated mission operation costs;
- 6) The costing package must be prepared in a level of detail sufficient to support an analysis and assessment of the validity of the costs in relation to the programmatic and technical performance requirements of the program;
- 7) Financial assumptions such as inflation rates;
- 8) Assumptions regarding modelling, parts and materials, environmental testing, ground support equipment and other significant cost drivers must be clearly stated in relation to their WPs;
- 9) As per 3.2.4; the Contractor will provide a cost estimate for the Threshold Mission level and the Baseline Mission level irrespective of limits in order to allow the CSA to determine what is the best ROI;

At the end of Phase A;

- a) the estimates for Phases B, C and D must be substantive;
- b) the estimates for phase E and F must be indicative or better
- c) the cost estimates must be provided in its electronic native format
- d) The cost estimates must be provided:
 - i) Per government fiscal year

- ii) Monthly
- iii) Per phase
- iv) Without escalation
- v) With escalation
- vi) Without risks
- vii) With risks

If the Contractor's planning includes cost-sharing or contributions, the cost estimates must show the costing with and without it.

2. SPECIFIC REQUIREMENTS

The cost estimates must contain estimates by phase, by month, and by CWBS item, of:

- 1) Labor Hours in Person-Hours or Person-Days and in Canadian dollars;
- 2) Non-Labor costs;
- 3) Material costs;
- 4) Purchased Equipment;
- 5) Material Handling;
- 6) Subcontracts Cost Breakdown;
- 7) Travel and living;
- 8) General & Administrative (G&A) expenses;
- 9) Contractor overhead;
- 10) Contractor profit; and
- 11) Taxes.
- 12) The estimates must include total project costs for each phase and for the entire project
- 13) Escalation rates

These cost estimates must be provided in an integrated Excel spreadsheet where a pivot table is provided to allow expression of the estimates according to:

- 1) WBS
- 2) Government Fiscal Year
- 3) Phase
- 4) Cost items (labour, non-labour, etc...)

3. SUPPORTING INFORMATION AND ANALYSIS

The costing model must identify the methods used for estimating cost of work packages (bottoms up, parametric, comparative) including sources of estimates.

Since this a Class C mission, the costing estimate, as well as risk cost, should be supported by Monte Carlo simulation. Cost estimates are inherently uncertain values. Monte Carlo simulation allows for the portrayal of cost estimates as probability distributions. As a minimum, the probabilistic assessment must include:

- a) Description, assumptions and conditions of each cost item (e.g. distribution models used, range of uncertainty, etc...)
- b) Description of method of application, conditions, and processes used for the simulations
- c) References to documentation used to support the analyses
- d) Results that show cumulative distribution (S-curve), and probabilistic distribution, and sensitivity
- e) Description of results, recommendations, conclusions.

DID-104 – Phases B, C, D and E Project Schedule

DID Issue: IR**Date: 2014-01-06**

PURPOSE:

To provide a schedule estimate for Phases B, C, D and E.

PREPARATION INSTRUCTIONS:

The Schedule may be prepared in the Contractor's format provided it is in a Gantt chart style, must be based on the CWBS, and must, as a minimum, contain the following information:

- 1) The Schedule must include all elements of the system and be in consonance with the CWBS.
- 2) All design reviews must be shown.
- 3) All spacecraft level readiness reviews and mission milestones must be indicated.
- 4) The schedule must be at a level sufficient to support project management reviews and interface activities between the organizations part of the Project.
- 5) The Contractor must also prepare preliminary networks to a level indicating the critical path activities and events:
 - a) This schedule must continue through spacecraft level assembly, integration, test, launch site and early operation activities again clearly indicating critical path activities and events.
 - b) Modelling and environmental testing requirements for the instrument or payload, spacecraft bus and the full spacecraft must be clearly shown.
 - c) The network must also identify any requirement for spacecraft level testing facilities other than those of the Contractor.
- 6) The network must go to a level sufficient for the Contractor to be able to evaluate and report on the status of the instrument development and manufacturing activities at the major component and subsystem level and their progress relative to the requirements of the project schedule critical path.
- 7) The Contractor must also prepare a network indicating the critical path activities for the definition, documentation, design, development and production of ground station equipment and operations for the launch, early operations and post commissioning operation of the spacecraft.
- 8) Networks can be integrated if required.
- 9) Milestone events relating to the use of international ground stations must be included.
- 10) The schedule (on 11x17) must include and show to the CSA the dependencies, constraint types, actual start and finish dates, duration, slack, and critical path. The critical path schedule can be shown on a separate sheet (11x17).

DID-105 – Project Schedule

PURPOSE:

To provide a schedule planning and control system for the project and to provide visibility to the CSA of the program progress and status.

PREPARATION INSTRUCTIONS:

The project schedule must be based on the CWBS, in the form of a Gantt chart. The schedule must be provided in MS Project software format, and in PDF (11x17" sheet or larger). The project schedule must be detailed enough to show each CWBS task to be performed, and must provide the following information:

- 1) dependencies,(predecessors and successors)
- 2) resource requirements,
- 3) the start and end date of each task (baseline and actual),
- 4) task duration,
- 5) completion status in percentage;
- 6) deadlines and milestones, and
- 7) Critical path.
- 8) Constraints

The schedule must show dependencies between the Contractor and other organizations.

The tasks related to deliverables must be limited to three months in the project schedule. When applicable, the Contractor must divide longer tasks into smaller significant tasks.

Tasks that are not related to any specific deliverable, such as Project Management and S&MA activities, must be grouped separately from the deliverables, and must be shown at the top of the chart.

DID-107 – Progress Report

PURPOSE:

The Progress Report presents the results of the work done to date in the contract, and in particular since the previous report. The Progress Report is used by the Government to assess the Contractor's progress in performance of the work.

PREPARATION INSTRUCTIONS:

The Monthly Progress Report must include status data and information summarizing project management, technical and schedule progress and accomplishment for each element of the Contractor's Work Breakdown Structure (CWBS). The report must address the major activities of the reporting period and must emphasize major achievements and events of special significance. Difficulties or problems that have affected the work progress, proposed corrective actions, project impact expected and concerns for the future, must also be reported.

Each progress report must answer the following three questions:

- a) Is the project on schedule?
- b) Is the project within budget?
- c) Is the project free of any areas of concern in which the assistance or guidance of the CSA may be required?

Each negative response must be supported with an explanation.

The Progress Report must include the following information, as a minimum:

- 1) Summary outlook, including technical performance, work performed, schedule, organization and key personnel changes and areas of concerns;
- 2) A detailed integrated project schedule status including:
 - a) Dependencies between activities;
 - b) Percent of completion for all activities;
 - c) List of completed milestones;
 - d) Critical path;
 - e) 1st level subcontractor's activities having impact on WP delivery date;
 - f) All other activities having an impact on WP delivery date.
- 3) Schedule variances from the plan, including deviations from schedule and proposed corrective actions for significant variances;
- 4) Major meetings schedule update;
- 5) Status of the work in progress, specifically the work performed in the previous calendar period; sufficient sketches, diagrams, photographs, etc. must be included, if necessary, to describe the progress accomplished;
- 6) The work projected for the next period, and estimated date of completion of next milestone;
- 7) Outline of technical and programmatic issues, with solutions recommended;

- 8) Contractual issues, including changes to activities;
- 9) Subcontracts events, status and issues;
- 10) Equipment ordered, received, made and assembled;
- 11) Description of trips or conferences connected with the Contract during the period of the report;
- 12) Risk status report including previous issues resolved, status of on-going risks (changes, likelihoods and impacts), and identification of new risks, their likelihood and impact, and proposed mitigation action;
- 13) Status of all action items from previous review(s) and meeting(s).

DID-108 – Kick-off Meeting Presentation

PURPOSE:

To present the Contractor's plan for carrying out the project and to address all significant issues.

PREPARATION INSTRUCTIONS:

The Kick-off Meeting Presentation must contain the following information, as a minimum:

- 1) Review of the Mission Requirements
- 2) Review of major assumptions;
- 3) Review of contract deliverables;
- 4) Work requirements, WBS status and schedule;
- 5) Project's funding and expected cash-flow;
- 6) Discussion on ways to reduce mission cost
- 7) FIP and BIP;
- 8) Licensing issues if any;
- 9) Presentation to include the required copyrights and IP disclosure;
- 10) Other items as deemed appropriate

DID-109 – Project Development Plan

PURPOSE:

To define the activities required to initiate and develop the mission. As such it describes the project development plans from Phase B through to D, including integration support to the International Partners (CLPS lander). The development plan provides an outline for the project through delivery and integration to provide validity and context for the project cost and schedule assessment. This document describes the plan for the development lifecycle and verification. The plan begins with the kick-off of Phase B and follows through the definition, development and integration.

PREPARATION INSTRUCTIONS:

The Project Development Plan must include the content listed below. However when one of the items listed below is the subject of a separate document, the Plan must include a high level summary and a pointer to that document.

- 1) An introduction including the scope, the purpose and a list of assumptions (if any);
- 2) A description of the Project including goals and objectives;
- 3) Identification of stakeholders and their needs and expectations;
- 4) A description of the science development plan required
 - a) Detailed science team roles and responsibilities
 - b) Description, methodology and plan for the instruments support activities
 - c) Description, methodology and plan for development of science investigations
 - d) Potential science collaborations
 - e) Proposed Canadian science capabilities development strategy
 - f) Recommendations for Science Research and Capabilities Development.
- 5) Implementation strategies
 - a) Key assumptions
 - b) Product assurance approach
 - c) System verification and validation approach
 - d) Development and Manufacturing Approach
 - e) Models Philosophy (e.g. breadboard, engineering model, qual. models, etc.)
 - f) Simulation
 - g) Technology development
 - h) Collaboration
 - i) Training

- 6) Summary of Phase BCD substantive cost estimates; (Detailed version in DID-103)
- 7) Overall Schedule;
- 8) Overall Risk Assessment;
- 9) Overall Work Breakdown Structure and WBS Dictionary;
- 10) Long Lead items;
- 11) Canadian Capabilities Development strategies & Canadian content relative to overall cost to maximize these;
- 12) Teaming arrangements, Intellectual Property (IP) ownership, licensing, royalties and opportunities;
- 13) Recommendations for follow-on activities.

DID-113 – Review Data Package

PURPOSE:

The Review Data Package is a collection of all documents to be presented by the Contractor at a formal Technical Review.

PREPARATION INSTRUCTIONS:

The Review Data Package must contain the following:

- 1) The documents identified in the Milestone column of the CDRL Table as due for that review;
- 2) The presentations made at the meeting;
- 3) The meeting agenda;
- 4) The minutes of the previous meeting;
- 5) Copies of the comments or RIDs raised since the previous formal review;
- 6) The Action Item List (AIL).

For Test Readiness Reviews, the following additional items are required:

- 7) Test specifications and procedures;
- 8) Test support requirements and status;
- 9) Documentation status;
- 10) Functional and environmental test history of systems and subsystems;
- 11) Anomalies and their resolution;
- 12) Deviations and waivers.

DID-114 – Phase Closure / Final Report

PURPOSE:

The purpose of the Phase Closure/Final Report is to record formally the history of the Phase (or Project if this is the Final Report), its achievements, financial, material and human resources expenditure, problems encountered and solutions implemented.

PREPARATION INSTRUCTIONS:

The Phase Closure / Final Report will encompass all the work done in the project during the Phase just ended or for the entire project. It should be a comprehensive summary of the phase or project work with the emphasis on the problems encountered, solutions implemented, successes encountered and lessons learned. It must include sufficient drawings, graphs, tables, figures, sketches and photographs as appropriate. The Phase Closure Report must be a standalone document and must contain at least the following information:

- 1) Executive Summary.
- 2) Comparison of mission and system requirements against user requirements and objectives.
- 3) Comparison of run-out costs with estimates by major Work Package (if applicable).
- 4) Comparison of actual versus planned schedules and milestones.
- 5) Comparison of risks anticipated versus actual experience.
- 6) Problems encountered and solutions implemented.
- 7) Final CDRL.
- 8) Lessons learned.

DID-115 – Public Outreach Animation or Video

PURPOSE:

To provide the format and the specifications that both the Public Outreach Animation or the Communications Video must meet.

PREPARATION INSTRUCTIONS:

The animation or the video must be provided in all of the following formats:

- High Definition with 1920x1080 resolution (pixel ratio: 0.9 wide screen or better);
- Windows Media Player video in SD 720x480 resolution for use on internet (file should not exceed 30MB);
- Windows Media Player video in 360x240 for use on internet (file should not exceed 3MB).

If informative text or voice should appear, two versions must be produced, one in English, and one in French. The Contractor must include only information and graphic material that can be released to the public and does not contain any IP or material that belongs to a third party without written authorization.

The animation must identify Contractor's name, contract number and title as well as the CSA copyright statement as follows.

© CANADIAN SPACE AGENCY yyyy (insert year)

DID-400 – System Requirements Document

PURPOSE:

To define the functional, performance, environmental and other requirements for a given system, segment, subsystem, unit, module or assembly and to provide the basis on which the Specifications Documents will be developed.

NOTE: Requirements Documents are sometimes called "Requirements Specification". This DID applies to them as well.

PREPARATION INSTRUCTIONS:

- 1) Requirements documents must conform to norms of English usage for Systems Engineering:
 - "must" indicates a mandatory requirement
 - "should" indicates a goal or preferred alternative. Such goals or alternatives must be treated as requirements on a best efforts basis, and verified as for other requirements. The actual performance achieved must be included in the appropriate verification report, whether or not the goal performance is achieved.
 - "will" indicates statement of intention or fact
 - "may" indicates an option.
- 2) Requirements documents must define the requirements on the subject item (segment, subsystem, etc.) as a whole and must not contain specific requirements on sub-items. All requirements must be verifiable on the item as integrated.
- 3) Requirements documents must cite applicable standards and parent requirements, and must make clear the priority sequence of the applicable documents.
- 4) There must be one set of requirements for each node in the System Hierarchical Tree. Note that interface requirements (which are between two or more nodes) are in separate documents.
- 5) Requirements must conform to the following standards for quality:
 - a) They must be unambiguously clear to the intended readership;
 - b) There must be one requirement per paragraph;
 - c) Each requirement must have a unique identifier (e.g. an ID number or paragraph number);
 - d) They must not define design solutions;
 - e) They must define their source or rationale;
 - f) They must be verifiable, preferably by test;
 - g) They must specify the conditions under which they apply; and
 - h) Performance requirements must be quantified.

- 6) The Requirements Document must comprise a number of sections, each defining a specific set of requirements. The document must address all of the following categories of requirements, as applicable to the project:
- a) Functional and performance requirements (see item 7) below);
 - b) External interface requirements (unless done in a separate document);
 - c) Resource allocation requirements;
 - d) Design requirements;
 - e) Construction requirements (see item 8) below);
 - f) Environmental requirements (see item 9) below);
 - g) Qualification and verification requirements;
 - h) Safety requirements;
 - i) System environmental requirements associated with:
 - i) Storage, packaging and handling environment;
 - ii) External stowage requirements, if any;
 - iii) Ground operations environment;
 - iv) Integration to launch vehicle environment (for flight payload only);
 - v) Launch environment (for flight payload only);
 - vi) On-orbit environment (for flight payload only).
 - j) Operational requirements, (unless done in a dedicated document);
 - k) Ground Support Equipment requirements, if any (unless done in a separate document); and
 - l) Other applicable requirements types.
- 7) Functional and performance requirements must include:
- a) Functional and performance requirements imposed on the system by the needs (flow down from MRD);
 - b) Operating modes requirements;
 - c) Power requirements including:
 - i) Power consumption;
 - ii) Power transients;
 - iii) Voltage requirements;
 - d) Telemetry and Telecommand requirements;
 - e) Software requirements;
 - f) Other applicable requirements.

- 8) Construction requirements must include, as applicable to the project:
 - a) Requirements associated with materials, parts and processes;
 - b) Physical requirements including:
 - i) mass properties;
 - ii) envelopes;
 - iii) physical attributes (# of samples, etc.).
 - c) Containment requirements.
- 9) Environmental requirements must address the following, as applicable to the project:
 - a) Environmental test factors;
 - b) Protoflight and Qualification testing, philosophy and factors;
 - c) Environmental Design and Test Requirements:
 - i) Structural/Mechanical Design Requirements;
 - ii) Thermal Design requirements;
 - iii) Grounding requirements;
 - iv) Electrostatic and EMC Design requirements;
 - v) Atmospheric Environment;
 - vi) Radiation Environment;
 - vii) Meteoroid and orbital debris environment, and
 - viii) Cleanliness and contamination environment.
 - d) Subsystem and Component requirements Item c) applied to subsystem and units.

DID-501 – Interface Control Document (ICD)

PURPOSE:

To define and control the interface between several cooperating or attached Hardware Configuration Items (HWCI) or Configuration Software Configuration Items (CSCI).

PREPARATION INSTRUCTIONS:

The ICD may describe the interfaces between a system or subsystem and all external systems or subsystems with which it interfaces (External ICD), or it may define all interfaces amongst subsystems within a system (Internal ICD).

Examples of External ICDs are:

- Spacecraft-to-Launch Vehicle ICD
- Spacecraft-to-Ground Segment ICD

Examples of Internal ICDs are:

- Spacecraft Internal ICD (e.g. between Bus and Payloads)
- Ground Segment Internal ICD

Systems may be manned or unmanned; they may be space or ground systems such as Ground Segment facilities. The specific requirements below must be tailored accordingly.

The ICD may be structured by types of interfaces (as defined above), or by subsystem and then by types of interfaces under each subsystem.

The ICD must contain the following information, as a minimum, tailored as required by the type of ICD as described above, and the particular system and interfaces being defined:

- 1) Purpose and Scope
- 2) Applicable and Reference Documents
- 3) Identification (name, number) and brief overview of the system and role within the system, of the interfaces to which the ICD applies
- 4) Interface diagrams showing by name and identifier all interfaces among the HWCI and CSCIs to which this ICD applies
- 5) Identification (name, identifier) and purpose of each of the interfaces
- 6) Physical / Mechanical Interfaces
 - a) Coordinate System
 - b) Dimensions and tolerances
 - c) Units of measurement
 - d) Envelope, Volume and Mass Properties
 - e) Attachment methods

- f) Alignment features
- 7) Structural/Mechanical Interfaces
 - a) Applied Loads and Disturbances (including random vibrations, frequency spectrum)
 - b) Acoustics
 - c) Depressurization/Repressurization
 - d) Ground Handling Environment
- 8) Thermal/Fluids Interfaces
 - a) General Requirements (touch temperature, condensation prevention, etc.)
 - b) Thermal Environment
 - c) Payload/Subsystems Cooling
 - d) Vacuum Exhaust Interfaces
- 9) Electrical Power Interfaces
 - a) Electrical Power Requirements, Sources and Allocation
 - b) Power Supply characteristics and limits
 - c) Overload protection and limits
 - d) Power control
 - e) Electrical connectors (types, pinouts, locations, mating and demating)
 - f) Cable schematics
- 10) Electromagnetic Compatibility (EMC)
 - a) EMC Classifications
 - b) Host system produced interference environment
 - c) Payload produced interference environment
 - d) Bonding and grounding
 - e) Power and signal circuits isolation
- 11) Command and Data Handling (C&DH)
 - a) Communications Technology (RS-422, Ethernet, Analog, Discrete, video, laptop, etc.)
 - b) Signal Characteristics
 - c) Response / Telemetry Format
 - d) Request/Command Format
 - e) Processing Requirements
 - f) Connector/Pin Interface
 - g) Data Acquisition, Storage and Management
 - h) Synchronization
 - i) Application Programming Interfaces

- 12) Environmental Interfaces
- 13) Any environmental factors not addressed elsewhere in the ICD (e.g. radiation, atmosphere, illumination, etc.)
- 14) Materials and Processes Interfaces
- 15) Human Factors Interfaces
- 16) Propulsion Interfaces
- 17) Pyrotechnic Interfaces
- 18) Fire Prevention
- 19) Ground Operations and scientific data processing
 - a) Facilities
 - b) Payload Handling
 - c) Ground Support Equipment (GSE)
 - d) Communications Requirements
 - e) Power Requirements
 - f) Special Equipment
 - g) Storage

DID-530 – Technical Performance Measures Report

PURPOSE:

The purpose of this document is to identify and track Technical Performance Measures (TPMs) during system development. It is issued periodically to show the current performance expectations of the system with respect to key performance and resource parameters, and the comparison of current predictions versus the defined requirements and allocated resources. It allows trends in the program technical progress to be discerned.

PREPARATION INSTRUCTIONS:

The TPMs must include the following parameters, as appropriate:

1) Physical Resources

- a) Mass: this section must indicate the current allocated Spacecraft mass, the current estimated mass, and the current mass margin; mass estimates should be broken down to the unit level.
- b) Power (steady-state and transient peaks): this section must provide estimates of power consumption (maximum, minimum) and available load power (maximum, minimum) against the Requirements Document or Specification.
- c) Volume: this section must indicate the current allocated Spacecraft volume, the current estimated volume, and the current volume margin; volume estimates should be broken down to the unit level.

2) Computer Resources

- a) Processor usage: for each microprocessor used in the Spacecraft, this section must allocate a processing capacity budget and estimate the average and peak loading on the processor, as well as calculate the processing margin.
- b) Memory usage: for each microprocessor used in the Spacecraft, this section must allocate a Random Access Memory (RAM) and Electronically Erasable Programmable Read-Only Memory (EEPROM) usage budget and estimate the current memory margin.

3) Communication Bandwidth: for each onboard data equipment (bus or payload), this section must allocate a communication bandwidth budget between subsystems (down to the unit level) and estimate the current margin against the data Instrument bandwidth.

4) Radio-Frequency Link Margin: this section must allocate a communication bandwidth budget between the Spacecraft and the Ground Segment.

5) Command and Telemetry: this section must allocate a Command and Telemetry budget and estimate the current rate and volume of commands and telemetry in each subsystem.

6) Synchronization and Timing;

7) Thermal Margins (including model uncertainty): this section must present the equipment temperature limits (down to the unit level), and the current estimated operational temperature range for the equipment based on an analysis of the mission states.

8) Mechanism Torque Margin: this section must present the torque margin allowed over the minimum design torque.

- 9) EMC/EMI:** this section must allocate the Spacecraft Electromagnetic Compatibility / Electromagnetic Interference (EMC/EMI) budget conducted susceptibility, radiated emissions, and radiated susceptibility for the components (down to the unit level). The margin against the GDIR requirements must be calculated.
- 10) Reliability** (probability of success): this section must present an estimate of reliability (nominal and Safe-hold modes), and a calculation of the reliability margin against the Requirements Document or Specification.
- 11) Payload-Specific Performance Criteria and Parameters.** This must include an error budget, which must present the error budget for the overall instrument performance and the allocations to the various sources of measurement errors.

The report must show a history of changes, and must highlight the change since the last issue.

The report must show the decomposition of the TPM requirement into allocations for subsystems and different sources and should follow the Product Tree. Similarly the report must show the parallel roll-up of current estimates for the TPM values.

The report must show:

- a) the historic trend of requirements and estimates,
- b) all the margins being carried on the estimates, and
- c) the source of the estimates (e.g. allocation, estimation, analysis, measurement).

DID-531 – Verification and Compliance Matrix

PURPOSE:

To show the details of the compliance of a system, subsystem or payload and the verification thereof through the life of the project with respect to each requirement. It is a living document that is updated at each review with new data. The matrix is tightly coupled with the Verification Plan because it provides the detailed linkage of verification activities to the specific requirements they address.

PREPARATION INSTRUCTIONS:

The Verification and Compliance Matrix must contain, for each requirement, as a minimum:

- 1) The requirement document number and requirement identifier;
- 2) The requirement description;
- 3) Other relevant requirement references;
- 4) Verification method for each requirement, indicating level-of-assembly;
- 5) Requirement compliance based on verification data presented at the current phase;
- 6) Link to the verification data that justifies the compliance and the quantitative value;
- 7) Comments as required; and
- 8) Verification Status.
- 9) The Verification and Compliance Matrix may be contained within the Verification Plan document, or delivered under a separate cover, since the two are closely linked.
- 10) Software Verification and Compliance Matrices must be developed within the Unified Modeling Language (UML) model and the deliverable document expressed therefrom.

DID-600 – Models and Analyses

PURPOSE:

To support the feasibility assessment and provide background information on the concept and design at system level, it is required to conduct analyses. This DID is to provide guidelines on deliverables related to analyses conducted including CAD models, schematics, tools and data to be delivered to the CSA focusing on thermal and power related analysis and models.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

All CAD models developed must be delivered as appropriate. Models must be delivered in the following formats:

- a) Mechanical design: STEP AP203 (.stp)
- b) Electrical design: .dsn, .sch, Pspice and Gerber formats, or applicable native format and a .pdf export
- c) NX Space Systems Thermal native format (NX 10 or higher)
- d) Software design: UML 2., XML or specific format definition provided as part of the SOW
- e) Model-based Systems Engineering Model (if required): Artisan Studio.
- f) Optical design models: Zemax

In cases where a different tool is used from the one CSA uses, the model and outputs must be supplied in native format in addition to the required format. For generic modeling and analyses that don't use a specialty tool, CSA will accept Matlab, Excel, CSV and MathCad format data. Where a highly specialized tool is used, the delivery format must be negotiated with the TL. Translation from the Contractor's tool to the required format is only acceptable where the results can be repeated in CSA's tool. Translation that corrupts the model, loses data, or produces data that is interpreted differently, is not acceptable.

Analysis documents must contain all analysis work that is performed in support of the design. This includes, but is not limited to, any spreadsheet (e.g. Excel) and script (e.g. Matlab) used to elaborate the analysis. The analysis material must be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis must establish feasibility and verification of the design to meet the requirements.

The data must include references to sources such as equations, material values, parameters and properties.

Each report must contain the following information, as a minimum:

- a) Objectives of the analysis;
- b) Reference to the relevant requirements;
- c) Description of the analysis tools used;
- d) Description of the model developed to aid the model user (if applicable);
- e) Identification of the assumption(s) made;

- f) Description of the main analysis steps and intermediate results;
- g) Results of the analysis and compatibility with the requirements;
- h) Identification of potential problem areas and presentation of alternative design solutions; and
- i) Conclusion.

Delivered models must contain at least example outputs so that the user can validate their function, and should contain the main outputs used in the analysis documents.

SPECIFIC CONTENTS

THERMAL MODEL AND ANALYSIS:

The Thermal Model and Analysis must predict the operating temperature of the electronic or other heat-sensitive components, allowable flight temperature margins, and internal and external heat exchange breakdown. The analysis must cover the worst cases of the operating environment using beginning and end of life properties. Furthermore, sensitivity analyses must be performed on critical and marginal components.

Thermal analysis and budgeting must include allowance for contamination build-up (i.e. regolith) for cryogenically operated equipment and radiative surface. Sources of thermal and thermo-optical properties, including contact conductance must be provided.

Specific attention must be given to account for thermal contact resistance variation with key parameters of contact (pressure, material, surface finish, flatness) as they vary with temperature.

Margins for temporal stability must be determined both for spatial and temporal variations, and must cover transient events such as operational manoeuvres worst-case variations, and operational states.

ELECTRICAL POWER AND DISTRIBUTION MODEL AND ANALYSIS:

The Electrical Power and Distribution Analysis must document all analyses and activities performed to evaluate the system electrical power and distribution design, providing information on the following aspects, as a minimum:

- 1) Electrical architecture: power, grounding, shielding, data, and redundancy;
- 2) Electronics: circuitry, protection, and switching of components; and
- 3) Power budgets and distribution.

The power analysis must consider the whole life of the system, if the design is such that power generation or consumption properties change. Power analysis must cover mean and peak behaviour for each mode of operation of the system. A power operational profile must be defined, indicating, for each phase of the mission, the corresponding maximum and average power during the sunlight and eclipse portion of the mission and the energy margin (if applicable).

The power analysis must be complete, showing all calculations and assumptions used for every item estimated.

DID-700 – Phase A System Conceptual Design Document

PURPOSE:

To describe the conceptual design of the system, to assist in finalizing the design of the system and allocating the requirements to subsystems, to demonstrate its feasibility and to support programmatic estimates.

PREPARATION INSTRUCTIONS:

The baseline and final document must include the following:

- 1) Introduction: recalling the major objectives and guidelines for the project;
- 2) Architecture, design and interfaces: giving a high level description of the architecture and design of the system and its subsystems, including internal and external interfaces;
- 3) Trade-offs: criteria definition, analysis, criteria results, decisions;
- 4) Design decisions: rationales for design choices;
- 5) Budgets: a summary of the engineering budgets, Technical Performance Measures (TPM), and margins, their allocation to subsystems;
- 6) Drawings and schematics: architectural diagrams for the main aspects of the system (structure, electronics, power, communications, software, etc.) describing and referencing important design drawings such as functional interconnect diagrams, activity flow diagrams, ICDs;
- 7) Analyses: summarizing the analyses performed, main results and problems encountered; this is a summary of each full analysis report presented separately;
- 8) Tests: summarizing the tests to be performed to verify the performance and environmental requirements;
- 9) Operations concepts: summarizing the operations of the system in both nominal and contingency conditions;
- 10) Maintenance approach: describing the maintenance approach especially for maintainable items such as the spares for manned systems, flight software and ground systems;
- 11) Matrix: To demonstrate design compliance to requirements by providing clear link between design and requirements. Indication of design compliance, non-compliance and partial compliance.

DID-800 – Operations Requirements Document

PURPOSE:

To define the operations requirements for the entire mission.

PREPARATION INSTRUCTIONS:

- 1) Requirements documents must conform to norms of English usage for Systems Engineering:
 - "must" indicates a mandatory requirement
 - "should" indicates a preferred but not mandatory alternative,
 - "will" indicates statement of intention or fact
 - "may" indicates an option.
- 2) Requirements documents must define the requirements on the mission as a whole and must not contain specific requirements on sub-items. All requirements must be verifiable at the mission level.
- 3) Requirements documents must cite applicable standards and parent requirements, and must make clear the priority sequence of the applicable documents.
- 4) All operations requirements, including operational interface requirements, must be defined and must be verifiable, preferably by test.
- 5) The operations requirements must respond to the mission requirements and the Concept of Operations (ConOps).
- 6) The operations requirements must be complete and sufficiently accurate to proceed with the preliminary design.
- 7) Traceability from operations requirements to mission requirements must be established and maintained throughout the system life cycle.
- 8) Operational requirements must be derived from the following:
 - a) Mission requirements (driver);
 - b) ConOps (driver);
 - c) Feedback from Requirements Analysis;
 - d) Feedback from Validation activities; and
 - e) Existing constraints and assumptions.
- 9) In the development process, new constraints and assumptions must be identified, if any.

10) Requirements must conform to the following standards for quality:

- a) They must be unambiguously clear to the intended readership;
- b) There must be one requirement per paragraph;
- c) Each requirement must have a unique identifier (e.g. an ID number or paragraph number);
- d) They must not define design solutions;
- e) They must define their source or rationale; and
- f) They must specify the conditions under which they apply.

DID-825 –System Concept of Operations

PURPOSE:

To define the overall end-to-end System Concept of Operations.

PREPARATION INSTRUCTIONS:

This document should be prepared in accordance with standard ANSI/AIAA G-043-1992 - Guide for the Preparation of Operational Concept Documents.

The System Concept of Operations must contain the following information:

- 1) Introduction including the scope, the purpose and a list of assumptions (if any);
 - 2) Description of the overall concept of operations that proves the feasibility of command and control, housekeeping and payload data acquisition, downlinking, turnaround time, processing, analysis and distribution and payload calibration;
 - 3) System operations requirements and constraints:
 - a) System description,
 - b) End-users description and requirements,
 - c) System Health and Safety requirements,
 - d) Programmatic and operational constraints,
 - e) Relationship with other missions or programs,
 - f) External dependencies or interfaces with other organizations;
 - 4) Space segment characteristics including spacecraft monitoring and control, and spacecraft modes;
 - 5) Ground segment characteristics including Command & Control and Data Reception for the LEOP, commissioning phase and routine operations phase;
 - 6) System operations concepts:
 - a) Planning processes,
 - b) Operations execution processes,
 - c) Evaluation processes,
 - d) Data Reception,
 - e) Data Transfer,
 - f) Data processing,
 - g) Data turnaround time,
 - h) Instrument calibration,
 - i) Support processes,
 - j) Operations team,
 - k) Orbit determination and maintenance;
 - 7) Operational Scenarios.
-

C CONTRACTOR DISCLOSURE OF INTELLECTUAL PROPERTY

C.1 PURPOSE

The BIP and FIP Disclosure Report serves to identify FIP produced under the Contract with the CSA, as well as any BIP elements that were used to develop the FIP.

This is not to be confused with the identification of the FIP and BIP that will be generated throughout the entire project, which is documented in DID-109 – Project Development Plan.

C.2 DEFINITIONS

Intellectual Property (IP)	Any information or knowledge of an industrial, scientific, technical, commercial artistic or otherwise creative nature relating to the work recorded in any form or medium; this includes patents, copyright, industrial design, integrated circuit topography, patterns, samples, know-how, prototypes, reports, plans, drawings, Software, etc.
Background Intellectual Property (BIP)	IP that is incorporated into the Work or necessary for the performance of the Work and that is proprietary to or confidential information of the Contractor, its subcontractors or any other third party.
Foreground Intellectual Property (FIP)	IP that is first conceived, developed, produced or reduced to practice as part of the Work under the Contract.

C.3 INSTRUCTIONS FOR COMPLETING IP DISCLOSURE TABLES

Identification

- a) The Contractor must respond to the 7 questions in Table C-1 when Foreground Intellectual Property (FIP) is created under the Contract with the CSA.

BIP

- a) If the Contractor intends to use Background Intellectual Property (BIP) to develop the FIP, the Contractor must complete Table C-2 (Disclosure of BIP brought to the project by the Contractor) and forward it to the CSA Project Manager before the beginning of the Contract if any.
- b) At the end of the Contract, the Contractor must review and update the BIP disclosure (Table C-2) when applicable.
- c) Only the BIP elements that were used to develop the FIP elements should be listed.

FIP

- a) At the end of the Contract, the Contractor must complete Table C-3 (Disclosure of the FIP developed under the Contract).
- b) If Canada is the owner of the FIP and identifies some FIP elements that would benefit from being patented by Canada, the Contractor must also complete Table C-4 (Canada's Owned FIP Additional Information).

General Instructions for BIP and FIP tables

- a) Tables must be structured according to the CSA IP form provided.
- b) Each IP element must have a unique ID # in order to easily link the elements of the different tables.
- c) Titles of IP elements must be descriptive enough for project stakeholders to get a general idea of the nature of the IP.
- d) Numbers and complete titles of reference documents must be included.

TABLE C-1 CONTRACTOR DISCLOSURE OF INTELLECTUAL PROPERTY

Contractor Legal Name:	
Project Title supported by the Contract:	
CSA Project Manager of the Contract:	
Contract #:	
Date of the disclosure:	
Will there be Contractor's Background Intellectual Property brought to the project:	
<input type="checkbox"/>	Yes - Complete Table C-2 - Disclosure of Background Intellectual Property
<input type="checkbox"/>	No
For Canada's owned IP, are there any IP elements that, to your opinion, would benefit from being patented by Canada?	
<input type="checkbox"/>	Not applicable, FIP resides with the Contractor
<input type="checkbox"/>	Yes - Complete Table 5.5 - Canada's Owned Additional Information
<input type="checkbox"/>	No
For the Contractor:	
Signature	Date
For CSA Project Manager:	
Signature	Date

TABLE C-2 BIP DISCLOSURE

1	2	3	4	5	6	7	8	9
BIP ID#	Project Element	Title of the BIP	Type of IP	Type of access to the BIP required to use or improve the FIP	Description of the BIP	Reference documentation	Origin of the BIP	Owner of the BIP
Provide ID # specific to each BIP element brought to the project (e.g. BIP-CON-99, where CON is the contract acronym)	Describe the system or sub system in which BIP is integrated (e.g. camera, control unit, etc.)	Use a title that is descriptive of the BIP element integrated to the work	Is the BIP in the form of an invention, trade secret, copyright, design?	Describe how the BIP will be available for Canada to use the FIP (e.g. BIP information will be incorporated in deliverable documents, software will be in object code, etc.)	Describe briefly the nature of the BIP (e.g. mechanical design, algorithm, software, method, etc.)	Provide the number and fill title of the reference documents where the BIP is fully described. The reference document must be available to Canada. Provide patent# for Canada if BIP is patented.	Describe circumstances of the creation of the BIP Was it developed from internal research or through a contract with Canada? If so, provide contract number.	Name the organization that owns the BIP. Provide the name of the subcontractor if not owned by the Contractor.

TABLE C-3 FIP DISCLOSURE

1	2	3	4	5	6	7	8	9
FIP ID #	Project Element	Title of FIP	Type of FIP	Description of the FIP	Reference documentation	BIP used to generate the FIP	Owner of the FIP	Patentability
<p>Enter an ID # specific to each FIP element</p> <p>(e.g. FIP-CON-99, where CON is the contract acronym)</p>	<p>Describe the system or sub-system for which the FIP element was developed (e.g. a camera, ground control, etc.)</p>	<p>Use a title that is descriptive of the FIP element.</p>	<p>Specify the form of the FIP e.g. invention, trade secret, copyright, industrial design</p>	<p>Specify the nature of the FIP e.g. software, design, algorithm, etc.?</p>	<p>Provide the full title and number of the reference document where the FIP is fully described. The reference document must be available to Canada</p>	<p>BIP referenced in Table C-2 (e.g. BIP-CON-2, 15)</p>	<p>Specify which organization owns the FIP e.g. Contractor, Canada* or Subcontractor.</p> <p>Provide the name of the subcontractor if not owned by the Contractor.</p> <p>*If Canada is the owner of the FIP, complete Table C-4 below.</p> <p>Provide reference to contract clauses that support FIP ownership.</p> <p>Provide reference to WPDs under which the technical work has been performed.</p>	<p>In the case where the IP is owned by Canada, indicate with an "X", any IP elements described is patentable and complete Table C-4 only for this IP.</p>

TABLE C-4 CANADA'S OWNED FIP ADDITIONAL INFORMATION

1	2	3	4	5	6	7	8
FIP ID #	Title of FIP	Aspects of FIP that are novel, useful and non obvious	Limitations or drawback of the FIP	References in literature or patents pertaining to the FIP	Has the FIP been prototyped, tested or demonstrated? (e.g. analytically, simulation, hardware)? Provide results	Inventor(s)	Was the FIP disclosed to other parties?
<i>ID# should be same as corresponding FIP element in Table C-3.</i>	<i>Title of FIP should be same as corresponding FIP element in Table C-3.</i>	<i>How is the FIP addressing a problem (useful) and what is thought to be novel in this solution (novel)?</i>	<i>Describe the limitations of present apparatus, product or process</i>	<i>Provide references in published literature or patents relating to the problem or subject if any.</i>	<i>Describe briefly how the process, product or apparatus performed during testing or simulation. Provide reference document # where the performance is compiled if applicable.</i>	<i>Provide name and coordinates of the person(s) who created the FIP</i>	<i>Has any publication or disclosure of the FIP or any of its elements been made to third parties? If so, provide when, where and to whom.</i>

D PERFORMANCE INDICATOR REPORTING

D.1.1 Purpose:

The goal of the questions is to provide data to the Canadian Space Agency in order to document the results achieved in one fiscal year. The report will provide the Space Exploration Program with validated, reliable, complete and timely information to support decision-making and program evaluation. Such data allow evidence-based decisions to be made within the space exploration program.

D.1.2 Preparation Instructions:

The Contractor must answer a series of questions pertaining to the outcomes achieved through the Contract. The questions will be made available through an electronic link provided by CSA at the end of each government fiscal year (around January or February), for the duration of the Contract. Approximately one month will be provided for the Contractor to answer the questions. It is foreseen that approximately 5-10 questions will be asked. Below is an example of the most salient questions.

Questions
<p>Please enter the number of people working on this specific project. To the best of your knowledge, include students and employees involved in the project at your organization and at sub-contracting organizations.</p> <p>Categories provided in UNITAS are:</p> <p>Management</p> <p>Administration</p> <p>Scientists</p> <p>Engineers</p> <p>Technicians</p> <p>Health Professionals</p> <p>Post-Doc Fellows</p> <p>Graduate Students (Masters and Doctoral)</p> <p>Undergraduate Students (Bachelors)</p> <p>College or CEGEP Students (below Bachelors)</p> <p>Others</p>

Organizations Involved in the Project

Please provide in the table below, the names of all Canadian or international organizations (private companies, not-for-profits, universities) who are your sub-contractors on this project. Add a line in the form for each organization.

`-Organizations working on the project as sub-contractors

Maturity status

Please select from the drop down list below, the maturity level of the application or technology in association with the project **PREVIOUS** to receiving CSA funding. Note that the technology maturity levels are defined with a (T) and software application levels are defined with an (A).

Space Flight Status

Has the technology or application flown, or will it fly, on a space mission? All types of missions can be considered, e.g. technology demonstration, science mission, and missions in operation, as long as the mission is in space. Space is defined as Low-Earth-Orbit and beyond.

Publications Acknowledging CSA Funding

Please indicate below published works that meet the following criteria:

1. Made possible (in part or wholly) by CSA funding for the space-related project in reference to this questionnaire; AND
2. Produced by the (research) team members based in Canada;

Please add a line for each publication.

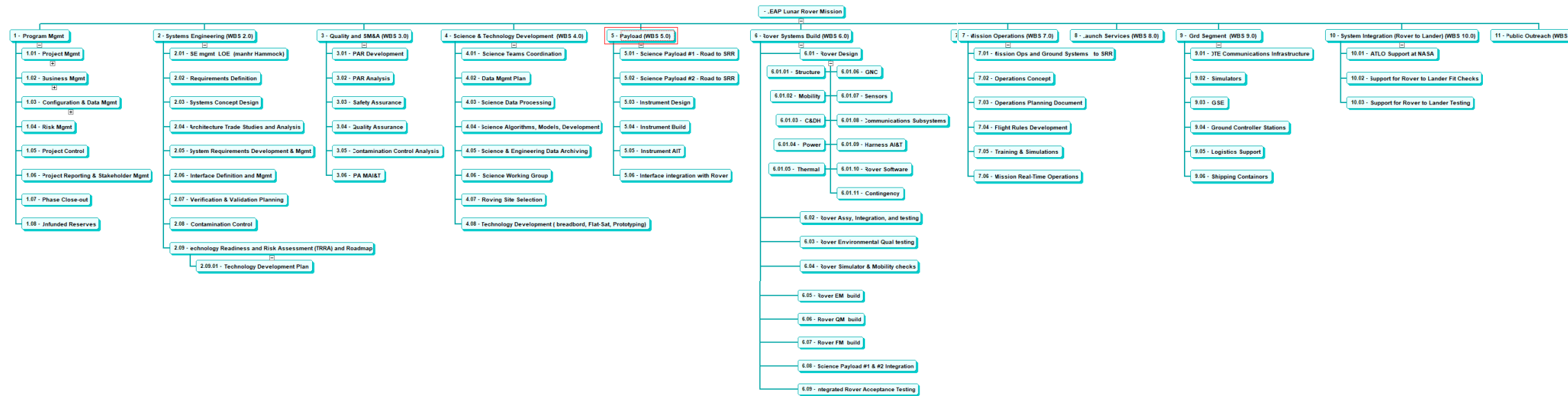
E PROPOSED MARGIN PHILOSOPHY

Table E-1 shows the system engineering margins for a typical project at the CSA. The Contractor may propose other margins that are more suited for the LRM development, but it must be justified; for example referring to the appropriate standards like the NASA Space Mechanisms Handbook and the AIAA Moving Mechanical Assemblies.

TABLE E-1 SYSTEM ENGINEERING MARGINS

Item	SRR Margin (Phase A)	PDR Margin (Phase B)	CDR Margin (Phase C)	Acceptance Margin (Phase D)
Mass	50% new design 30% iterative design 10% existing	30% new design 15% iterative design 5% existing	10% new design 5% iterative design 2% existing	0
Power (EOL Requirement)	50% new design 30% iterative design 10% existing	30% new design 15% iterative design 5% existing	10% new design 5% iterative design 2% existing	0
Volume	50% new design 30% iterative design 10% existing	30% new design 15% iterative design 5% existing	10% new design 5% iterative design 2% existing	0
Performance measures (payload data quality)	50% new design 30% iterative design 10% existing	30% new design 15% iterative design 5% existing	10% new design 5% iterative design 2% existing	0
Computer Resources	200%	100%	50%	40%
Communication Bandwidth	200%	100%	50%	40%
RF Link Margin	10 dB UpLink 3 dB DownLink			
Structural Margins (beyond required Factor of Safety)	100%	50%	0	0
Heat Flows and Heater Sizing	80%	50%	30%	30%
Temperatures vs Allowable Limits	$\pm 15^{\circ}\text{C}$			
Thermal Stability	50%	30%	20%	10%
Mechanisms minimum margin of safety or torque margin	300%			

F WBS FOR ROVER MISSION



WBS	Task Name
	▸ LEAP Lunar Rover Mission
1	▸ Program Mgmt
1.01	▸ Project Mgmt
1.02	▸ Business Mgmt
1.03	▸ Configuration & Data Mgmt
1.04	Risk Mgmt
1.05	Project Control
1.06	Project Reporting & Stakeholder Mgmt
1.07	Phase Close-out
1.08	Unfunded Reserves
2	▸ Systems Engineering (WBS 2.0)
2.01	SE mgmt LOE (manhr Hammock)
2.02	Requirements Definition
2.03	Systems Concept Design
2.04	Architecture Trade Studies and Analysis
2.05	System Requirements Development & Mgmt
2.06	Interface Definition and Mgmt
2.07	Verification & Validation Planning
2.08	Contamination Control
2.09	▸ Technology Readiness and Risk Assessment (TRRA) and Roadmap
2.09.01	Technology Development Plan
3	▸ Quality and SM&A (WBS 3.0)
3.01	PAR Development
3.02	PAR Analysis
3.03	Safety Assurance
3.04	Quality Assurance
3.05	Contamination Control Analysis
3.06	PA MAI&T
4	▸ Science & Technology Development (WBS 4.0)
4.01	Science Teams Coordination
4.02	Data Mgmt Plan
4.03	Science Data Processing
4.04	Science Algorithms, Models, Development
4.05	Science & Engineering Data Archiving
4.06	Science Working Group
4.07	Roving Site Selection
4.08	Technology Development (breadbord, Flat-Sat, Prototy

5	▸ Payload (WBS 5.0)
5.01	Science Payload #1 - Road to SRR
5.02	Science Payload #2 - Road to SRR
5.03	Instrument Design
5.04	Instrument Build
5.05	Instrument AIT
5.06	Interface integration with Rover
6	▸ Rover Systems Build (WBS 6.0)
6.01	▸ Rover Design
6.01.01	Structure
6.01.02	Mobility
6.01.03	C&DH
6.01.04	Power
6.01.05	Thermal
6.01.06	GNC
6.01.07	Sensors
6.01.08	Communications Subsystems
6.01.09	Harness AI&T
6.01.10	Rover Software
6.01.11	Contingency
6.02	Rover Assy, Integration, and testing
6.03	Rover Environmental Qual testing
6.04	Rover Simulator & Mobility checks
6.05	Rover EM build
6.06	Rover QM build
6.07	Rover FM build
6.08	Science Payload #1 & #2 Integration
6.09	Integrated Rover Acceptance Testing
7	▸ Mission Operations (WBS 7.0)
7.01	Mission Ops and Ground Systems to SRR
7.02	Operations Concept
7.03	Operations Planning Document
7.04	Flight Rules Development
7.05	Training & Simulations
7.06	Mission Real-Time Operations
8	Launch Services (WBS 8.0)

9	▴ Grd Segment (WBS 9.0)
9.01	DTE Communications Infrastructure
9.02	Simulators
9.03	GSE
9.04	Ground Controller Stations
9.05	Logistics Support
9.06	Shipping Containers
10	▴ System Integration (Rover to Lander) (WBS 10.0)
10.01	ATLO Support at NASA
10.02	Support for Rover to Lander Fit Checks
10.03	Support for Rover to Lander Testing
11	Public Outreach (WBS 11.0)

G ACRONYMS AND ABBREVIATIONS

AD	Applicable Document
AI	Approach Initiation
AIL	Action Item Log
API	Application Programming Interface
AT	Analogue Terrain
BIP	Background Intellectual Property
CAD	Computer Assisted Design
CDRL	Contract Data Requirements List
CF	Contractor's Format
cFS	Core File System
CLPS	Commercial Lunar Payload Services
CoDR	Conceptual Design Review
CONOPS	Concept of Operations
COTS	Commercial Orbital Transportation Services
CSA	Canadian Space Agency
CTE	Critical Technology Element
CWBS	Cost Work Breakdown Structure
DAP	Delivered at Place
DID	Data Item Description
DFL	David Florida Laboratory
DOF	Degrees of Freedom
DSNE	Design Specification for Natural Environments
DTE	Direct-to-Earth
DTVAC	Dusty TVAC
ECMs	Engineering Coordination Memos
ESA	European Space Agency
ExDOC	Exploration Development & Operations Center
FIP	Foreground Intellectual Property
FTP	File Transfer Protocol
GEVS	Goddard Technical Standard: General Environmental Verification Standard
GFE	Government Furnished Equipment
GSFC	Goddard Space Flight Center
HERACLES	Human Enhanced Robotic Architecture and Capability for Lunar Exploration and Science
ICD	Interface Control Document
IP	Intellectual Property
IPs	International Partners
ISRU	In-Situ Resource Utilization
ISS	International Space Station
KOM	Kick-Off Meeting
LAN	Local Area Network
LCC	Life Cycle Cost

LEAP	Lunar Accelerated Exploration Program
LEO	Low Earth Orbit
LRM	Lunar Rover Mission
LSM	Lunar Surface Mobility
LSR	Lunar Sample Return
MCD	Mission Concept Document
MCR	Mission Concept Review
MM	Mission Manager
MRD	Mission Requirements Document
MRR	Mission Requirements Review
NASA	National Aeronautics and Space Administration
ORD	Operations Requirements Document
PIP	Performance Information Profile
PAR	Product Assurance Requirements
PM	Project Manager
PMI	Project Management Institute
PMBok	Project Management Book of Knowledge
PSPC	Public Services and Procurement Canada
RD	Reference Document
RFP	Request for Proposal
RID	Review Item Discrepancies
RIF	Rover Integration Facility
RIW	Rover Indoor Workplace
ROI	Return On Investment
SDD	System Design Document
SI	« Système International »
SME	Small and Medium Enterprises or Subject Matter Experts
SOW	Statement of Work
SRD	Systems Requirement Document
SRR	Systems Requirement Review
STDP	Space Technology Development Program
STEP	Standard for The Exchange of Product model data
TL	Technical Lead
TNs	Technical Notes
TB	Treasury Board
TBD	To be determined
TRRA	Technology Readiness and Risk Assessment
TRL	Technology Readiness Level
TRM	Technology Road Map
TVAC	Thermal Vacuum
WLAN	Wireless LAN

Attachment 1 to Part 3

Technical and Managerial Bid Preparation Instructions

1. GENERAL INFORMATION

The Bidder should present the information in the Technical and Managerial Bid in the following order:

1. Title / Project Identification Page
2. Table of Contents;
3. Executive Summary;
4. Mandatory Criterion;
 - 4.1. M1 U.S. Science Instrument(s) Partnership
5. Point Rated Criteria (Canada and U.S. portions)
 - 5.1. Mission Merit Criteria
 - 5.1.1. P1 Relevance of the Proposed Mission and expected impact
 - 5.1.2. P2 Suitability of the technology in meeting the engineering objectives
 - 5.1.3. P3 Suitability of the payloads and science measurements in meeting the scientific objectives
 - 5.2. Feasibility Criteria:
 - 5.2.1. P4 Scope, feasibility and risks of the engineering approach
 - 5.2.2. P5 Scope, feasibility and risks of the scientific approach
 - 5.3. Managerial Criteria:
 - 5.3.1. P6 Team capability and experience
 - 5.3.2. P7 Project Management Plan
6. Letter(s) of Intent
7. Bid Appendices.
 - 7.1 U.S. Science Instrument Appendix
 - 7.2 List of Acronyms
 - 7.3 Bidder's Criteria Substantiation, (one for Canadian and one for U.S. instruments)
 - 7.4 Curriculum Vitae
 - 7.5 All other information as specified at section 4.3. Bid Appendices

The structure of the Technical and Managerial Bid, and its sections, are described below. Some of the section headings include numbers. These numbers represent the Evaluation Criteria that are applicable to that specific section for each bid submitted by a Bidder.

The bid must be submitted electronically in a searchable format, such as a searchable PDF format.

The bid should not exceed 250 pages, excluding the appendices. If the number of pages is exceeded, the evaluation will strictly be based on the first 250 pages submitted with the required appendices. Information provided in the appendices is considered optional, except for résumés and the U.S. Science Instrument Appendix which will not count towards the 250 page limit. The letter(s) of intent should be part of the main bid.

1.1. General Instructions

Canada will evaluate the combined merit of the rover technologies together with the science capacity, hence the Bidder is to self-organize and coordinate the Work with the Canadian and U.S. scientific teams to offer the best possible and complementary science in the bid.

The Bidder should assume that the rover operations will be controlled and managed from the CSA Headquarters, most likely from its Exploration Development & Operations Center (ExDOC) supported by

appropriate science and engineering backroom(s). The Bidder should also assume a Launch window during the summer of 2025 with the goal of landing on the lunar surface from September to December 2025.

At its discretion, Canada may exercise the optional goods and/or optional services as specified at section 7.1.1 of Part 7 of the bid solicitation within five months after Contract award and bidders should plan accordingly.

If the proposed scientific instruments are currently being developed under a separate contract with Canada, the difference between the work carried out in such contract and the proposed incremental work should be clearly explained in the bid. There should be no redundant costs in the financial bid for Work already covered under another contract with Canada. If the work carried out in another contract with Canada is also fulfilling the requirement of the Statement of Work (SOW) under this bid solicitation, it should be clearly stated in the bid and reflected in the cost of the Phase A in the financial bid. If the proposed Work in the bid could be enhanced by the Work carried out under another contract with CSA, the added value should be explained in detail in the bid.

The CSA will make available the applicable and reference documents through the FTP site as specified in the SOW.

2. TITLE/PROJECT IDENTIFICATION PAGE

The first page of the bid submitted should state the following information.

- a) The Request For Proposal file number;
- b) The date in YYYY-MM-DD format;
- c) The Bidder's name and address;
- d) The Bidder's authorized representative;
- e) The title of the proposed Work (the use of acronyms in the title is discouraged, unless they are described);
- f) A short summary of the Technical and Managerial bid that should not exceed 8 lines;
- g) A one sentence description of the bid that could be published on CSA's website or social media, at CSA's discretion, at the time of the public announcement of the contract award if the bid is successful. The Bidder is advised not to include any confidential information in the one sentence description.

3. EXECUTIVE SUMMARY

The Executive Summary of the Technical and Managerial Bid should be a stand-alone document suitable for public dissemination, for example, through the Canadian Space Agency (CSA) web site, if the bid is successful. It should not exceed one page in length (8.5" x 11") and should highlight the following elements:

- a) Mission Description and objectives summary;
- b) Lunar Rover and its technology description and objectives;
- c) Science instruments and related investigation objectives;
- d) Brief description of the team;
- e) Main scientific and technical innovations;
- f) Major milestones and deliverables; and
- g) Relevance to CSA LEAP program.

4. TECHNICAL AND MANAGERIAL BID

The Bidder should address the mandatory criterion and items detailed under the letter “D” of each point rated criterion presented in Attachment 1 to Part 4 – Evaluation Criteria. In addition, the bid should describe the proposed project as indicated in sections 4.1 to 4.4.

4.1. Mandatory Criterion

4.1.1. M1- U.S. Science Instrument(s) Partnership

Under this criterion, as specified in Attachment 1 to Part 4 – Evaluation Criteria, the Bidder must demonstrate that at least one U.S.-led science instrument will be integrated onto the rover and that a partnership will be put in place with the U.S. partner(s) proposed in the bid to work together and deliver the capabilities in accordance with the required LEAP timeline (refer to SOW Figure 1-5) should a contract be awarded to the Bidder. Evidence of such a collaboration is required in the bid via a signed Letter of Intent between the Bidder and the U.S. science instrument(s) institution for the proposed U.S. payload.

4.2. Point Rated Criteria

4.2.1. Mission Merit Criteria

4.2.1.1. P1- Relevance of the proposed mission and expected impact (applies to Canada and U.S. portions)

This section should provide substantiated evidence describing the relevance of the proposed mission objectives relative to past, ongoing, and planned Bidder's activities to the requirements and objectives as described in the SOW. The objectives should be defined in the context of the provided Mission Requirements Document (AD-8), the Concept of Operations Document (AD-6), and the Mission Concept Document (AD-7), referred as part of the SOW, as well as the supporting documents such as the Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond 2017 (RD-6) (Canada portion only). The Bidder should demonstrate and substantiate its intent to comply with the overall proposed mission and clearly identify the objectives covered in terms of Threshold, Baseline and Augmented mission objectives and requirements, including the engineering goals, the science returns, and overall alignment with the LEAP Science and Technology priorities as described in the SOW. The Bidder should also demonstrate how the proposed mission constitutes a timely and achievable advancement in terms of technology and science development. All evidence should be supported by comprehensive references to previous and/or on-going developments, studies or/and literature review that help the Bidder define how the proposed mission has the potential to impact the science discipline, and is aligned with national and international lunar science objectives or missions.

4.2.1.2. P2- Suitability of the technology in meeting the engineering objectives (applies to Canada portion only)

This section should describe the technological objectives of the mission and demonstrate a clear link between the proposed engineering measurements and metrics with respect to reaching the mission technological objectives and demonstrate a path forward for characterization and further usage of the technologies. The bid should describe the engineering measurements and metrics required to prove out the full capability of the technology, and show that none are missing. In addition, this section should explain the suitability of the selected technology to reach the objectives of the mission based on the proposed engineering measurements and substantiated by past studies, development and/or publications. Appropriate description of the rover and its subsystems should be included in the bid, in line with the product breakdown structure defined in the Mission Concept Document (AD-7). The bid should then reference to preliminary operational scenarios and include the preliminary systems requirements for assessing the applicability of the proposed solution (i.e. alignment with mission documents described in the SOW) and, its readiness for meeting the mission objectives.

4.2.1.3. P3- Suitability of the science measurements and instrument in meeting the scientific objectives (applies to Canada and U.S. portions)

This section should describe how the proposed science measurements for each instrument category (Canada & U.S.) are fulfilled and appropriate to reach the science objectives. In addition, this section should explain how the selected science instruments fulfill the needs to reach the science objectives. The science instruments should thus be detailed with a description of their subsystems and the measurement capacity known at the bid stage. The relationship between the pursued scientific objectives, the needed science measurements and the proposed science mission and instrument(s) should be described in a comprehensive manner supported by a review of the existing relevant literature. The bid should reference preliminary operational scenarios and include preliminary requirements for the proposed science instruments that should be aligned with applicable mission documents described in the SOW.

4.2.2. Feasibility Criteria

4.2.2.1. P4- Scope, feasibility and risks of the engineering approach (applies to Canada and U.S. portions)

This section should describe the work plan developed to address all engineering elements specified in the SOW for the rover and the scientific instruments. The work plan should be described in the body of the bid and include the Work Breakdown Structure (WBS) for the Phase A. It should provide a detailed description and substantiation of the approach for the technical concept development and the degree to which it is capable of delivering the objectives including the trade-offs that will be needed. The proposed effort should be well presented and substantiated through well-conceived and feasible concepts and methods (engineering approach) to obtain the desired technical results.

The bid should explain and substantiate that the overall scenario is valid and should demonstrate that the proposed mission is based on well proven technology using references from past studies, development and publications.

The engineering approach should describe how the work would be conducted using proven techniques, industry standards and best practices, for pertinent disciplines to develop all critical systems. The bid should also present the work that was done in previous development, the availability of Commercial-off-the-Shelf (COTS) technologies (if used) and the estimated actual Technology Readiness Level (TRL) of the rover, its main subsystems, and the payload(s) (e.g. scientific instruments) based on the previous work. The bid should indicate what testing campaign is necessary for the qualification of the space systems along with the necessary information to assess its feasibility (e.g. how and where the testing would be done, has the facility been or will be contacted to verify availability, has cost been taken into account). The Bidder should include a list of technological risks known at the bid stage along with a sound mitigation strategy to deliver the mission as per the LEAP schedule. The Bidder should also address the TRL roadmap and how the progression will be achieved within the current proposed LEAP timeline and funding available with respect to the mission objectives proposed.

The selected systems engineering approach should be specified along with a description of the proposed path to reach TRL 9 and applicable certifications and standards. If subcontractors will be involved, qualifications of their manufacturing process (Quality Assurance) should be provided in the bid appendices. If the subcontractors do not have the correct processes and/or policies for space flight assets in place to be able to perform and track the work to the highest standards (e.g. ISO-9000s), the Bidder should explain how it will oversee their processes and approve the work to the standards of the CSA. Specific needs for testing at analogue sites should also be described where other test methods are insufficient (e.g. 1/6-g simulators for mobility, especially for mobility condition when the undercarriage bottoms-out against the regolith and takes the weight off the traction wheels and impedes movement), including test objectives and rationale.

A list of technical risks known at the bid stage associated with the engineering approach should be presented along with a sound mitigation strategy for each identified risk to enable feasibility within the prescribed LEAP constraints (e.g. budget and timeline).

4.2.2.2. P5- Scope, feasibility and risks of the scientific approach (applies to Canada and U.S. portions)

This section should describe the work plan developed to address all scientific elements specified in the SOW. The work plan should be described in the body of the bid and appear in the Work Breakdown Structure (WBS) for the Phase A. The bid should demonstrate a deep understanding of the required scientific approach and knowledge necessary to realize the proposed science instruments. The bid should also detail the work that will be performed to define the high level concept of operations (e.g. operation steps, specific constraints, and timeline).

The scientific approach should describe how the work would be conducted using analytical methods, procedures, and best practices for pertinent disciplines. Specific needs for testing at analogue sites should also be described where other test methods are insufficient, including test objectives and rationale.

The Bidder should include the current estimate of the Science Readiness Level (SRL) for the proposed science mission or science instrument and present a coherent plan to reach the SRL 9 within the LEAP timeline. The Bidder should also describe how the Phase A work plan will result in the establishment of mandatory and target instrument requirements and how the latter will have an impact on the science return.

In addition, the Bidder should provide a description and overall feasibility assessment of the scientific approach and the degree to which it is capable of delivering the goals and scientific objectives. A list of scientific risks, risks that are inherent to the selected analytical method or the targeted object to be analyzed, at the bid stage associated with the scientific approach should be presented along with a sound mitigation strategy for each identified risk to enable feasibility within the prescribed LEAP schedule.

4.2.3. Managerial Criteria

The managerial section of the Technical and Managerial Bid should demonstrate the effectiveness and commitment of the Bidder to deliver the project on time and within budget. Its sections should address in detail: key-personnel qualifications, team organization and arrangements, previous project experience, and the Management Plan including risks and mitigation.

4.2.3.1. P6- Team Capability and Experience (applies to Canada and U.S. portions)

4.2.3.1.1. Team Expertise

This section should identify the key personnel and outline their respective qualifications. Key personnel is referred as the personnel required to carry on the project such as but not limited to Project Manager, Principal Investigators and co-Investigators, Chief Engineer and Engineering Leads. It should include a Product Assurance & Safety representative as part of the Phase A team as well. It should identify the members of the project's technical, scientific and management teams and state their specific qualifications for the work required. Detailed résumés are to be included in an appendix of the bid (see section 4.4.1 below). Provisions for back-up personnel for key positions are to be stated. The Canadian instrument (s) science team should include members from at least two Canadian universities.

4.2.3.1.2. Team Organization and Arrangements

This section should outline the roles and responsibilities of the proposed team members, and discuss and highlight the unique expertise that they offer with respect to the capability of the team. This section should also provide details on the subcontractors' roles, responsibilities and on the nature of their contractual relationship with the Bidder. An organization chart should illustrate the structure and lines of responsibility of the proposed project team, including the sub-contractors, academic institutions, and international

partners. The Bidder should also demonstrate success in leading a team and that the proposed Canadian project team (within the Bidder, sub-contractor(s) or partner(s)) includes at least two small enterprises directly involved in the core Canadian space business required for the project; where small enterprise is defined as a company of less than 100 employees employed in Canada. Proper substantiation regarding the number of employees should be provided in the bid to justify this criterion is met. This is required in order to meet the intent of the LEAP initiative in terms of Small & Medium Enterprise (SME) commitment.

In line with one of the priorities of the Government aiming at encouraging Canadians to develop science, technology, engineering and math (STEM) related skills to prepare them for the jobs of tomorrow; and to obtain the maximum score, it will be essential for the Bidder to involve at least one student to perform (STEM) tasks as part of the Canadian contribution of the project.

4.2.3.1.3. Previous Project Experience

The Bidder should identify any previous experience with projects of a similar scope as the one proposed, including any projects undertaken with the CSA or other institutions. The Bidder should list previous projects and assignments undertaken which are relevant to the proposed scope of work including studies, technology development program and previous space project experience of the team members and the overall organization across the Bidder and the overall team. The Bidder should identify any team members in the current bid that participated in those projects and describe the nature and duration of their contributions.

Note: The Bidder may describe as many previous projects as necessary in order to adequately demonstrate the experience and qualifications of the Bidder and of the proposed team, as long as the length of the bid is compliant to the requirement.

4.2.3.2. P7- Project Management Plan (applies to Canada and U.S. portions)

This section describes the Management Plan that will be retained to effectively deliver the project.

The Management Plan should demonstrate a clear understanding of the scope of work for the project and demonstrate that the organization possesses the required tools including key engineering software to perform space mission analyses & design, perform simulations, and analysis of rover/payload performance measures.

The bid's Management Plan should describe the Work Breakdown Structure (WBS) shown in Figure 1 down to level 2 (i.e. WBS 1.01) and to level 3 (i.e. WBS 1.01.01) for the Rover elements under WBS 6 in a graphical format, Work Packages Descriptions (WPD), personnel allocation, managerial risk assessment, milestones and deliverables, schedule (Gantt chart which should include dependencies, constraints, dates, etc.), costing methodology or approach, and a project control system.

The Management Plan's presentation should be based on management methods, processes and tools most applicable to the proposed project, such as a scope planning (WBS) and schedule development charts (e.g. Gantt chart, etc.). Equivalent company-developed, project-tailored tools and charts are also acceptable, provided that the information is complete and comprehensive. Additionally, the Project Control System should provide the capability to report the amount of work per WBS item for each individual on a monthly basis. The earned value management (EVM) measurement technique is also another acceptable approach.

4.2.3.2.1. Work Package Description

This Management Plan subsection should define and specify the work to be executed according to the requirements of the SOW. The project should be broken down into Work Packages (WPs). Each WP should focus on specific activities that will form the total Phase A project and, as a minimum, should define and describe the specific work to be carried out and indicate: the person responsible, the WP's associated levels-of-effort and required resources, the schedule, and the associated deliverables or outputs.

WPs stem from the WBS. As a guideline, Table 1 of this attachment presents a sample Work Package Description Sheet. The bid should adhere to the level 1 (i.e. WBS 1.0) numbering system specified in the Figure 1 template. Prices should appear in the Financial Bid only.

The WPD should be included in the Section 1 Technical and Managerial Bid with the Level of Efforts (LoE) (in hours) included but not the cost (\$). However, in the Section II Financial Bid, the WPDs should be included with the LoE (in hours) and the dollar cost values.

The level 2 WP number for the Rover Design does not have to be 6.01. It can be 6.02 or 6.03. The same goes for the other level 2 WPs numerical order. However, the level 1 numbering should not change and the WPs included in Figure 1 should be accounted for in the Management Plan.

If the Bidder deems that a Work Package (WP) is not applicable, they should indicate and justify the reasoning behind this, but they should not alter the order of the Level 1 WBS as indicated herewith in Figure 1. This WBS structure derives from the NASA 7120.5 Project Management Requirements (RD-12), and will serve to integrate the work more seamlessly (and be more compatible) into NASA's work packages for the overall mission.

Table 1: Example of Phase A Work Package Description Sheet

Project Name:	LEAP Lunar Rover Mission	Date:	
Customer:	CSA		

Work Package Description:	Thermal subsystem System Engineering		Work Package Number:	6.01.05.03.01
			Working toward Milestone:	
Estimated Effort: (hrs)		Human Resources (ordered by skills):		
Estimated Duration: (days)	(see schedule)			
Work Package Objective:	The system engineering of thermal subsystem			
Inputs:				
Tasks/Activities:	<p>Phase A:</p> <ul style="list-style-type: none">• Define the top-level thermal requirements of the rover.• Develop the thermal SOW of phase B/C/D.• Define the thermal WPs of phase B/C/D.• Define the deliverables of thermal designs.• Define the thermal interface controls between the rover and the payloads, lander, and launch vehicle.• Budget the mass, volume, power.• Determine initial req'mts for telemetry of thermal subsystem.• Develop risk analysis of thermal subsystem.• Acquire tools for thermal subsystem analysis during phase B/C/D.• Present/Review/evaluate/verify the thermal design philosophy, concept, analysis.• Perform trade studies for thermal system.			
Outputs:	<ul style="list-style-type: none">• Documentation of "Thermal Analysis and Designs of Lunar Rover";• WP for phase B/C/D;• mass, volume, power,• telemetry budgets for the rover system level;• ICD requirements;			
Assumptions for Effort Estimation:	example: Interfaces have been agreed to with Lander Provider.			
T&L :	Prices should appear in the Financial Bid only.			
Material Cost:	Prices should appear in the Financial Bid only.			
Total: (Labour & non-Labour)	Prices should appear in the Financial Bid only.			

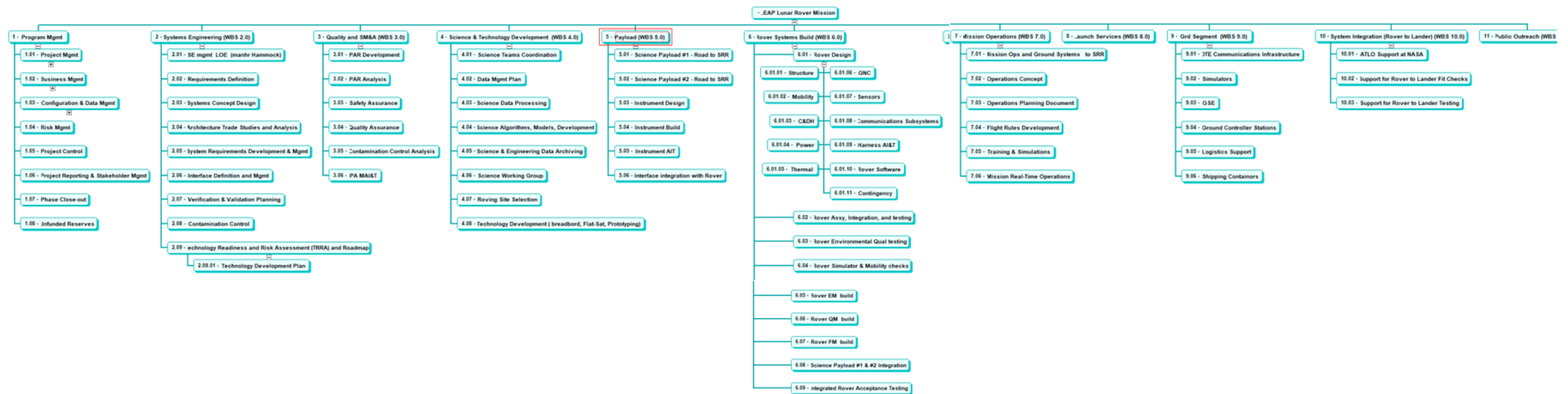


Figure 1: Work Breakdown Structure

4.2.3.2.2. Milestones and Deliverables

Milestones and deliverables should be described in detailed in accordance with what is specified in the SOW.

4.2.3.2.3. Schedule

The Bidder should use a notional start date of September 1st 2021. The Management Plan should explain how the performance management baseline will be measured and how variances will be handled.

The Bidder should provide a preliminary Schedule relative to the overall life cycle of the mission including the impact of hardware (including payloads) integration and qualification milestones. The schedule should be organized by a product-based WBS and its WPs to detail the work that requires to be done for the whole project. For the initial Phase A bid, the WP to level 2 (i.e. WBS 1.01) with some elements (e.g. 6.01 Rover) at WBS level 3 (i.e. WBS 6.01.01), see Figure 1, is sufficient to show an understanding of the Work that is necessary to be done and provide CSA with an evaluation marker for the bid selection process.

The schedule should integrate the various schedules from the different entities like the rover, instruments, sub-contractors, and the launcher/lander dates (which are in the SOW Figure 1-5) to show the overall effort. The Launch window currently in the SOW Figure 1-5 is the proposed date and has not been finalized with NASA. Hence, CSA is open to the opportunity to launch earlier than proposed in this bid subject to negotiations with NASA, with the understanding the CSA desires the rover to land during the lunar “Spring or Summer” in the South Pole region. The timeline should include key system engineering reviews from Phase A to Phase F, such as Preliminary Design Review (PDR), Critical Design Review (CDR) and Launch Readiness Date (LRD). Refer to CSA Systems Engineering Technical Review Standard [RD-03] for a full description of all the possible reviews, which may vary depending on the nature of the mission architecture and to SOW section 3.3.

The project schedule prepared by the Bidder should provide a graphical representation (i.e. Gantt) of predicted tasks, milestones, dependencies, deliverables, task duration, and the critical path on 11x17 page(s). The Bidder should mention what software project tool will be used, (e.g. MS Project, Primavera, or others). The project schedule should be detailed enough to show each WBS task to be performed to the appropriate level. The project’s master schedule should inter-relate all tasks on a common timescale and be in the form of a Gantt chart. The critical path schedule can be on a separate 11x17 sheet (submitted in electronic format with this section of the bid).

4.2.3.2.4. Managerial Risk Assessment

This Management Plan section should provide an assessment of the risks involved in performing the work for the Project, and identify critical elements that may jeopardize successful completion of the project within cost and schedule constraints. In particular, risks associated with procurement, international participation, commitment from contributors, availability of the required manufacturing, testing, or other facilities and the likelihood of meeting the proposed launch readiness date should be addressed in the bid. The Bidder could include additional risks considered to have a significant impact on the project. Also, to be considered, is the adequacy of the plan to mature systems to TRL-6 by the CDR, or earlier, within the proposed cost and schedule. The Bidder should provide an assessment of the likelihood of meeting the proposed launch readiness date. The Bidder should propose methods to address the risks, and mitigation strategies should be presented for all medium and high risks. Contingencies (implying back-up plans if your mitigation does not work) for at least the top three highest risks should be explained.

4.2.3.2.5. Resources Allocation

This Management Plan section should include a resource assignment matrix showing the level-of-effort expressed in hours for each individual team member that has been apportioned to each WP. The matrix should identify each individual by name, and provide the estimated time (number of hours or days) required

to complete each task. As a guideline, Table 2 of this attachment presents a sample of a Resource Allocation Matrix (RAM). The RAM should be presented in the Management Plan as part of the Technical and Managerial Bid in terms of LoE (in hours) and the associated costs should be reflected in the Financial Bid. The work load should be distributed between individuals in a way that favors the development of less experienced personnel with a good level of support from more experience personnel. (Ideally this should be a 60/40 split). Also, an Organizational chart should be presented showing the various lines of responsibility of the sub-contractors, Universities, and partners.

Table 2: Example of Resource Allocation Matrix

WBS Number	Work Package Title	Resource A		Resource B		Resource C		Total
1.1	Project Management	A	200	P	25	P	25	250
1.2	Literature Survey	A	25	P	100	-	0	125
1.3	Requirements	P	50	A	100	P	100	250
1.4	Design	P	100	A	100	P	150	350
1.5	Build	-	0	P	200	A	150	350
1.6	Test and Analysis	A	100	P	200	P	200	500
Total			475		725		625	1825

P: Participant
A: Accountable

4.2.3.2.6. Project Management Approach

This Management Plan section should outline the methods and systems to be used to control tasks, schedules, and costs for the project. Any project management tool or spreadsheet software package may be used as long as it contains, as a minimum, the information required in the SOW to provide a Monthly report. Additionally, the Project Control System should provide the capability to report the amount of work and cost per WBS item for each individual on a monthly basis. Also, the approach should specify whether they are using the PMI (PMBok) method or other means to manage a project of this scope.

As an example, Earned Value Management (EVM) is another approach that can be used. Although CSA will not ask the Bidder to be certified to NASA's NFS 1852.234-2, the Bidder can show how it complies to the principles of EVM and demonstrate its overall intent to manage program cost, schedule, and technical performance by utilizing the Earned Value processes such as establishing Control Accounts to a low enough level of the WBS, establishing a baseline for the schedule and showing traceability during the project, provide for Contract Performance Reports (CPRs) which record actual costs, budget, and schedule performance by WBS elements, provide Change Management reports which record the changes to the baseline, and so on.

In order to demonstrate that the Bidder is capable of performing reliable cost estimates for the Life-Cycle Costs (LCC) of space missions, two Rough-Order of Magnitude (ROM) cost estimates, using two separate cost models (e.g. parametric, analogous, bottoms-up, top-down, or web-based models, etc.) for Phases A-E should be provided in the financial bid. If the discrepancy between the 2 estimates is greater than 25%, the Bidder should provide an explanation of why this occurred. In the Technical and Management Bid, the Bidder should explain its cost estimating methodology, its rationales for the inputs, and its assumptions used to create the estimates, together with a discussion of the costs risks, the reasoning behind the allocation of the cost reserves, its adequacy, and how they will be managed.

For the purposes of this exercise, the Bidder can refer to the SOW section 8.1 and 8.2 for an indication of the hardware and software deliverables for future phases of the mission, noting that the Bidder may propose supplemental hardware as needed (i.e. fit check models, prototypes, 3-D printed models, mock-ups, Flight Spares, etc.). Also, in order to inform on the validation and verifications costs involved, the Bidder can obtain the initial baseline Product Assurance Requirements (PAR) document [AD-09] through the FTP site as specified in Section 2.1 of the SOW.

In the Financial Bid, the Bidder should include the results of their mission ROM cost model estimates for Phases A to E leading to the development, implementation, and operations of the systems as per the format specified in the SOW Table 3-1. These ROM cost estimates will be used as a starting point for discussions at the KOM.

The planned budget for the U.S. scientific instrument(s) is \$5,000,000.00 US Dollars (USD) for Phases A, B, C and D.

4.3. Bid Appendices

The following items should be addressed in individual appendices as part of the bid.

4.3.1. Required Bid Appendices

- 1) List of acronyms used in the bid;
- 2) Bidder's Criteria Substantiation (see Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria);
- 3) List of past successful projects that are relevant to proposed work and reference letters including contact information of the reference;
- 4) Résumés: Résumés, NSERC form 100, or Canadian Common CV (CCCV) of all key resources proposed; and
- 5) List of Contacts: The list of contacts should be presented in a format suitable for distribution and should include all of the Bidder's points-of-contact involved in the bid development and/or contract negotiations. The example format presented in Table 3 should be used.

Table 3: Sample List of Contacts

Role	Name	Telephone	E-mail
Project Manager			
Principal Investigator			
Lead Engineer			
Instrument scientist			
Contracting Authority			
Claims officer			
Communications (for press releases)			
Etc.			

4.3.2. U.S. Science Instrument Appendix

The Bidder should not only include the U.S. instrument information through-out the bid to be evaluated, but also summarize the information regarding the U.S. scientific instrument into a separate appendix (e.g. section 7.1 in proposed bid template) in order to be a stand-alone document. This appendix will not be counted towards the page limits. This self-contained appendix of the U.S. Science Instrument will not only provide a description of the science instrument(s) systems and sub-systems, but also provide answers to the applicable point rated criteria. This following the same logic of section 5 of the bid. Additionally, this

appendix should explain the scientific merit of the proposed investigation, the scientific implementation merit; and the technical, management, and cost feasibility (TMC) of the proposed science instrument, and the reason why the science is complementary to the Canadian science instrument.

4.3.3. Other Bid Appendices

The following bid appendices may be provided with the Technical and Managerial Bid:

- 1) Corporate literature.
- 2) Relevant technical or scientific papers published by team members.
- 3) Any other bid appendices deemed appropriate by the Bidder.

Only documents that are relevant and will be useful to support the bid should be provided.

Attachment 1 to Part 4 Mandatory and Point Rated Evaluation Criteria

This section describes the applicable Mandatory and Point Rated Criteria.

1. MANDATORY CRITERION

The mandatory criterion will be evaluated on a pass or fail basis, and no point rating is associated with it. Bids not meeting the mandatory criterion will be deemed non-responsive and given no further consideration.

The mandatory criterion applicable to this bid solicitation is as follows:

1) M1 U.S. Science Instrument(s) Partnership

The Bidder must demonstrate, as part of the bid, in the form of a signed letter of intent between the Bidder and the U.S. science instrument(s) institution, also referred to as U.S. instrument provider in the bid solicitation, that a clear partnership is intended with the U.S. science instrument(s) institution for the proposed U.S. payload that is to be hosted on the rover mission.

2. POINT RATED CRITERIA

2.1. Mission Merit, Feasibility and Management Point Rated Criteria

The evaluation team established by the Canadian Space Agency (CSA) will evaluate the bid based on its clarity, relevance and its conformity to the requirements of the Technical and Managerial evaluation criteria as outlined in this bid solicitation. In addition to the mandatory criterion (see section 1 above), bids will be evaluated in accordance with the point rated criteria as specified in Table 2-1 "List of Point Rated Evaluation Criteria and Associated Ratings" and the Bidder's provided substantiation as detailed in subsection 2.2 of this document: "Bidder's Criteria Substantiation".

As part of the point rated criteria evaluation, both the CSA and the National Aeronautics and Space Administration (NASA) evaluation teams will evaluate the bids as presented in Table 2-1 where the columns including the scores are applicable to the Canada portion of the evaluation and the United States (U.S.) portion. It is therefore important for the Bidder to clearly indicate the respective portions of its bid to answer all the criteria required for each category (Canada and U.S. portions).

Bids which fail to obtain the required minimum number of points as specified in Table 2-1 will be declared non-responsive. Each point rated criterion should be addressed separately and for each of the Canada and U.S. portions.

In the event that two or more responsive bids obtain the same total number of points for the combined portions, the responsive bid with the highest number of points for criterion P4 (Scope, feasibility and risks of the engineering approach) will be ranked higher overall. Then, if the responsive bids also have the same number of points for criterion P4, the responsive bid with the highest number of points for criterion P5 (Scope, feasibility and risks of the scientific approach) will be ranked higher. Lastly, if the responsive bids happen to still have the same number of points for criterion P5, the responsive bid with the highest number of points for the first remaining criteria in the following order will be used as the final tie breaker: criterion P7 (Project Management Plan), criterion P6 (Team capability and experience, criterion P1 (Relevance of the Proposed Mission and expected impact), criterion P2 (Suitability of the technology in meeting the engineering objectives), and finally criterion P3 (Suitability of the science measurements and instruments in meeting the science objectives).

The criteria are grouped under the following divisions:

- 1) Mission Merit;
- 2) Feasibility; and
- 3) Management.

Section 2.3 “Point Rated Evaluation Criteria and Benchmark Statements” contains a series of evaluation criteria, each supported by a set of benchmark statements (0, A, B, C, D). Each of these statements has a corresponding relative value:

0 = 0% of maximum point rating;

A = 50% of maximum point rating;

B = 70% of maximum point rating;

C = 85% of maximum point rating;

D = 100% of maximum point rating.

As an example, the maximum point rating for the “P1: Relevance of the Proposed Mission and expected impact” criterion is 10 points. If a bid receives a “C” for this criterion in the evaluation process, the score attributed will be:

85% of 10 points = 8.5 points (score)

Table 2-1 identifies:

1. The maximum point rating assigned to each criterion;
2. The maximum point rating possible for each criteria category (*Mission Merit, Feasibility, and Managerial*);
3. The minimum point rating required for each criteria category (*Mission Merit, Feasibility, and Managerial*);
4. The maximum point rating possible for the overall score.

Table 2-1: List of Point Rated Evaluation Criteria and Associated Ratings

Point Rated Evaluation Criteria	Points Per Portion		
	Canada portion	U.S. portion	Total
Mission Merit Criteria			
1) P1: Relevance of the proposed mission and expected impact	10	5	15
2) P2: Suitability of the technology in meeting the engineering objectives	10	N/A	10
3) P3: Suitability of the science measurements and instruments in meeting the scientific objectives	10	5	15
Minimum Score	19.5	6.5	26
Maximum Score	30	10	40
Feasibility Criteria			
4) P4: Scope, feasibility and risks of the engineering approach	30	6	36
5) P5: Scope, feasibility and risks of the scientific approach	20	4	24
Minimum Score	32.5	6.5	39
Maximum Score	50	10	60
Managerial Criteria			
6) P6: Team capability and experience	10	4	14
7) P7: Project Management Plan	20	6	26
Minimum Score	19.5	6.5	26
Maximum Score	30	10	40
Maximum Overall Score	110	30	140

2.1.1. Cross-References to Evaluation Criteria in the bid (Optional)

In order to assist in the assessment of the bid, the Bidder may complete a table as the example given in Table 2-2 by indicating where the information is found in its bid demonstrating how the bid meets the evaluation criteria.

Table 2-2: Cross-References to Evaluation Criteria in the bid

Evaluation Criteria	Section(s) in the bid where the criterion is addressed.	
	Canada portion	U.S. portion
1		
2		
3		
4		
5		
6		
7		

2.2. Bidder's Criteria Substantiation

The Bidder is requested to provide their own substantiation, which should be submitted as an appendix to their Technical and Managerial bid.

The substantiation should be concise yet sufficiently complete to give the evaluators a good overall appreciation of the bid's merit relative to each criterion. Cross-references to appropriate sections of the bid should be provided and the essence of the referenced information should be summarized in the substantiation.

For convenience, a template for the Self-Evaluation Table is provided in Table 2-3. Enter each criterion number and the substantiation.

Table 2-3: Bidder's Criteria Substantiation.

Company:		
Project Title:		
Criteria Substantiation		
	Canada portion	U.S. portion
<i>Ex.: 1 (criterion number)</i>	<i>Criterion substantiation and Bidder's bid cross-reference for the Canada Portion.</i>	<i>Criterion substantiation and Bidder's bid cross-reference for the U.S. Portion.</i>

2.3. POINT RATED EVALUATION CRITERIA AND BENCHMARK STATEMENTS

MISSION MERIT CRITERIA

Criterion P1 – Relevance of the proposed mission and expected impact (Canada & U.S. portions)

This criterion evaluates the relevance of the proposed mission against the Mission Requirements (AD-8), the Mission Concept (AD-7) and the Concept of Operations (AD-6) provided by the CSA as applicable documents and described in the Statement of Work (SOW). This criterion in particular evaluates the compliance of the bid with the overall proposed mission, including the engineering goals, the science returns, and overall alignment with the priorities of LEAP Science and Technology explained in the SOW. Through this criterion, the Bidder must demonstrate compliance with the engineering and science success criteria described in Table 1-1 of the SOW. This criterion also evaluates the alignment of the Science Objectives of the bid with the scientific priorities identified in the SOW that are derived from the Canadian science priorities as described in the Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond 2017 (RD-6) for the Canada portion of the bid. The expected impact on the science discipline, at the national and international level, is also evaluated.

- 0)**
 - The proposed Mission Objectives are not aligned with the background, objectives, scope and applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW; OR
 - The bid does not meet the requirements of A), B), C) or D).

- A)**
 - The proposed Mission Objectives are described and they are aligned with the background, objectives, scope and applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW; AND
 - The proposed Mission Objectives meet all the Threshold mission success criteria listed in Table 1-1 of the SOW; AND
 - The Science Objectives address at least one of the scientific priorities identified in the SOW.

- B)**
 - The proposed Mission Objectives are described and they are aligned with the background, objectives, scope and applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW. The Mission Objectives are presented and discussed in the context of relevant past and current developments; AND
 - The proposed Mission Objectives meet all the Baseline mission success criteria listed in Table 1-1 of the SOW; AND
 - The Science Objectives address two or more of the scientific priorities identified in the SOW; AND
 - The bid demonstrates how the Mission Objectives, if realized, might advance some of the technology and/or scientific knowledge; AND
 - The proposed investigation presents how it may contribute to international lunar technology and science objectives or mission(s).

- C)**
 - The proposed Mission Objectives are described and a rationale is provided for the alignment to the background, objectives, scope and applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW. The Mission Objectives are presented and discussed in the context of relevant past and current developments, as found in the literature; AND

- The proposed Mission Objectives meet all the Baseline mission success criteria listed in Table 1-1 of the SOW and the proposed Mission Objectives meet at least two of the Augmented mission success criteria listed in Table 1-1 of the SOW; AND
 - The Science Objectives address two or more of the scientific priorities identified in the SOW which is demonstrated with references from past studies; AND
 - The bid demonstrates how the Mission Objectives, if realized, will advance the technology and scientific knowledge; AND
 - The proposed investigation demonstrates, with references from international plans, how it will contribute to international lunar technology and science objectives or mission(s).
- D)**
- The proposed Mission Objectives are described and a rationale is provided for the alignment to the background, objectives, scope and applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW. The Mission Objectives are presented and discussed in the context of relevant past and current developments, as found in the literature, attesting to the potential impact of the investigation; AND
 - The proposed Mission Objectives meet all the Baseline mission success criteria listed in Table 1-1 of the SOW and the proposed Mission Objectives meet at least four of the Augmented mission success criteria listed in Table 1-1 of the SOW; AND
 - The Science Objectives address two or more of the scientific priorities identified in the SOW which is demonstrated with references from past studies and peer-reviewed publications; AND
 - The bid demonstrates how the Mission Objectives, if realized, will significantly advance the technology and scientific knowledge; AND
 - The proposed investigation demonstrates, with references from international plans and peer-reviewed publications, how it will contribute to international lunar technology and science objectives or mission(s).

Criterion P2 – Suitability of the technology in meeting the engineering objectives (Canada portion only)

This criterion evaluates the clarity and completeness of the bid in describing the relationship between the engineering objectives, the needed performance measurements and the proposed mission and how this would feed-forward into future lunar rover missions.

- 0)**
- The engineering measurements and metrics addressing the engineering objectives are not described; OR
 - The bid does not meet the requirements of A), B), C) or D).
- A)**
- The engineering measurements and metrics addressing the engineering objectives are described but incomplete; AND
 - The proposed rover is described.
- B)**
- The link between the engineering objectives, the needed measurements and metrics, and the proposed mission is described; AND
 - The engineering measurements and metrics addressing the engineering objectives are described but are insufficient to demonstrate the capability of the technology; AND

- The proposed rover is described, is appropriate and aligned with the MCD Product Breakdown Structure (AD-7).
- C)**
- The link between the engineering objectives, the needed measurements and metrics, and the proposed mission is sound and justified with references from past studies and/or publications; AND
 - The engineering measurements and metrics addressing the engineering objectives are described and are sufficient to demonstrate some of the capability of the technology; AND
 - The proposed rover including its subsystems are described, are appropriate and aligned with the MCD Product Breakdown Structure (AD-7).
- D)**
- The link between the engineering objectives, the needed measurements and metrics, and the proposed mission is sound and justified with references from past studies and/or publications; AND
 - The engineering measurements and metrics addressing the engineering objectives are described and are complete to demonstrate the full capability of the technology; AND
 - The proposed rover including its subsystems are described, are appropriate and aligned with the MCD Product Breakdown Structure (AD-7); AND
 - Proposed rover preliminary operational reference scenarios and preliminary systems requirements are provided and aligned with the applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW.

Criterion P3 – Suitability of the science measurements and instruments in meeting the scientific objectives (Canada & U.S. portions)

This criterion evaluates the clarity and completeness of the bid in describing the relationship between scientific objectives, the needed science measurements and the proposed U.S. and Canadian science instruments.

- 0)**
- The proposed science instruments and/or the needed science measurements are not described in the bid; OR
 - The bid does not meet the requirements of A), B), C) or D).
- A)**
- The science measurements addressing the scientific objectives are described; AND
 - The proposed science instruments for the mission are described.
- B)**
- The science measurements addressing the scientific objectives of the mission are described and are appropriate; AND
 - The proposed science instruments for the mission are described, including their subsystems, but at least one instrument is not appropriate; AND
 - The link between the scientific objectives, the needed science measurements and the proposed science instruments for the mission is described.
- C)**
- The science measurements addressing the scientific objectives of the mission are described and are appropriate; AND
 - The proposed science instruments for the mission, including their subsystems, are described and all instruments are appropriate; AND

- The link between the scientific objectives, the needed science measurements and the proposed science instruments for the mission is sound and justified with references from past studies and publications.
- D)**
- The science measurements addressing the scientific objectives of the mission are described and are appropriate; AND
 - The proposed science instruments for the mission, including their subsystems, are described and all instruments are appropriate; AND
 - The link between the scientific objectives, the needed science measurements and the proposed science instruments for the mission is sound and justified with references from past studies and peer-reviewed publications; AND
 - Proposed science instruments operational reference scenarios and preliminary systems requirements are provided and aligned with the applicable mission documents (AD-6, AD-7 and AD-8) as described in the SOW.

FEASIBILITY CRITERIA

Criterion P4 – Scope, feasibility and risks of the engineering approach (Canada & U.S. portions)

This criterion assesses the scope and suitability of the work plan addressing the engineering elements of the SOW required to meet the proposed objectives. This criterion also assesses the understanding of the technical principles involved (engineering approach) through the bid technical documentation, substantiation, and technical risks identification and mitigation in line with the proposed mission timeline to reach the goals. This includes the suitability of the technology selected to meet the mission goals, and to fulfill Phase A.

- 0)**
 - No work plan is provided to address the engineering elements (rover and science instruments) of the SOW; OR
 - No risks known at the bid stage are described; OR
 - The bid does not meet the requirements of A), B), C) or D).
- A)**
 - A work plan addressing the development of the engineering elements (rover and science instruments) of the SOW is described; AND
 - The engineering approach and its relevance to the mission objectives is described but not supported with references; AND
 - Risks known at the bid stage associated with the technology (rover and science instruments) are identified.
- B)**
 - A work plan addressing the development of the engineering elements (rover and science instruments) of the SOW is described for all critical systems. The engineering approach detailed in this plan is appropriate; AND
 - The engineering approach and its relevance to the mission objectives is described with references from past studies and/or R&D development and/or publications; AND
 - Technical risks at the bid stage associated with the technology (rover and science instruments) are identified and described along with a mitigation strategy for each.
- C)**
 - A work plan addressing the development of the engineering elements (rover and science instruments) of the SOW is described for all critical systems. The engineering approach detailed in this plan is appropriate and the current

- Technology Readiness Level (TRL) of the rover and science instruments is provided; AND
 - The bid describes the proposed path to reach TRL 9 during the LEAP timeframe; AND
 - The engineering approach and its relevance to the mission objectives, constraints and context is described with references from past studies and past R&D development and/or publications; AND
 - Technical risks at the bid stage associated with the technology (rover and science instruments) are identified and described along with a sound mitigation strategy for each; AND
 - A systems engineering approach for all the elements (rover and science instruments) is presented.
- D)**
- A work plan addressing the development of the engineering elements (rover and science instruments) of the SOW is described for all critical systems. The engineering approach detailed in this plan is appropriate, and the current Technology Readiness Level (TRL) of the rover and science instruments is provided and substantiated by a description of past work performed; AND
 - The bid describes, with the needed steps outlined, the proposed path to reach TRL 9 during the LEAP timeframe; AND
 - The engineering approach and its relevance to the mission objectives, constraints and context is described with rationales and references from past studies and past R&D development and publications; AND
 - Technical risks at the bid stage associated with the technology (rover and science instruments) are identified and described along with a sound mitigation strategy for each aligned with the LEAP constraints (e.g. budget and timeline); AND
 - A systems engineering approach is described for all the elements (rover and science instruments) along with references, including a description of its method.

Criterion P5 – Scope, feasibility and risks of the scientific approach (Canada & U.S. portions)

This criterion assesses the scope and suitability of the work plan in addressing the scientific elements of the SOW required to meet the proposed mission objectives. The scientific approach (needed investigation, trade-off analyses, reviews and instrument selection) that will result in a well-defined science traceability matrix is evaluated. This criterion also assesses the risk associated with the scientific approach.

- 0)**
 - No work plan is provided to address the science elements of the SOW; OR
 - No risks known at the bid stage are described; OR
 - The bid does not meet the requirements of A), B), C) or D).
- A)**
 - A work plan addressing the development of the scientific elements of the SOW is described; AND
 - Science risks at the bid stage associated with the scientific approach are identified.
- B)**
 - A work plan addressing the development of the scientific elements of the SOW is described, and the scientific approach detailed in this plan is appropriate; AND

- Science risks at the bid stage associated with the scientific approach are identified and described along with a mitigation strategy for each; AND
 - The work plan demonstrates that the proposed work will result in a science traceability matrix; AND
 - The current Science Readiness Level (SRL) is provided.
- C)
- A work plan addressing the development of the scientific elements of the SOW is described, and the scientific approach detailed in this plan is appropriate; AND
 - Science risks at the bid stage associated with the scientific approach are identified and described along with a detailed mitigation strategy for each risk; AND
 - The work plan demonstrates that the proposed work will result in a detailed and complete science traceability matrix with clear traceability to science objectives.
 - The current Science Readiness Level (SRL) is provided; AND
 - The bid describes the proposed path to reach SRL 9 during the LEAP timeframe.
- D)
- A detailed work plan addressing the development of the scientific elements of the SOW is described including the preliminary high level concept of operations, and the scientific approach detailed in this plan is appropriate; AND
 - Science risks at the bid stage associated with the scientific approach are identified and described along with a detailed mitigation strategy for each risk aligned with the LEAP constraints (e.g. budget and timeline); AND
 - The work plan demonstrates that the proposed work will result in a detailed and complete science traceability matrix with clear traceability to science objectives and a well understood impact on science return; AND
 - The current Science Readiness Level (SRL) is provided and substantiated by a description of past work performed.; AND
 - The bid describes, with credible arguments, the proposed path to reach SRL 9 during the LEAP timeframe.

MANAGEMENT CRITERIA

Criterion P6 - Team capability and experience (Canada & U.S. portions)

This criterion assesses the capability (education, knowledge, experience, and expertise), completeness and complementarity of skill sets of the personnel assembled to carry out the work and the organization of the team in order to meet the intent of the LEAP initiative in terms of Small & Medium Enterprise (SME) commitment. Key personnel is referred as the personnel required to carry on the project including Project Manager, Principal Investigator and co-Investigators, Chief Engineer and Engineering Leads.

The elements marked with “*” apply only to the evaluation of the Canada portion.

- 0) • The bid does not demonstrate that the proposed team has the required skill-set to fulfill all areas of the SOW; OR
 - The bid does not meet the requirements of A), B), C) or D).
- A)
- The proposed team is lacking some expertise or capabilities required to fulfill the Work under the SOW; AND
 - All required key personnel are identified.

- B)**
 - The proposed team is lacking some expertise but demonstrates that it is capable of performing part of the Work under the SOW; AND
 - All required key personnel are identified; AND
 - The roles and responsibilities for key team members are defined; AND
 - * At least one key personnel has significant experience (more than 8 years each) in software or hardware related to spaceflight; in terms of design and development and/or operation; AND
 - * The bid includes at least one small enterprise in its teaming arrangement (Bidder or sub-contractor) that will be involved in the project. The term “small” meaning a company or entity of less than 100 employees employed in Canada.

- C)**
 - The expertise of the proposed team demonstrates that it is capable of performing all of the Work under the SOW; AND
 - All required key personnel are identified; AND
 - The roles and responsibilities for key team members, including sub-contractors, are defined; AND
 - The bid describes previous experience with projects of a similar scope; AND
 - * At least two key personnel have significant experience (more than 8 years each) in software or hardware related to spaceflight; in terms of design and development and/or operation; AND
 - * The bid includes at least one small enterprise with demonstrated experience in the core space business required for the project in its teaming arrangement (Bidder or sub-contractor). The term “small” meaning a company or entity of less than 100 employees employed in Canada; AND
 - * The science team includes researchers and/or professors from at least one Canadian university.

- D)**
 - The expertise of the proposed team demonstrates that it is capable of performing all of the Work under the SOW; AND
 - All required key personnel are identified and the bid demonstrates that there are qualified back-up personnel identified for all of them; AND
 - The roles and responsibilities of all the team members, including all subcontractors, are defined and a team organisational chart is provided; AND
 - The bid describes previous experience with projects of a similar scope and complexity; AND
 - * At least four key personnel have significant experience (more than 8 years each) related to spaceflight software or hardware; in terms of design and development and/or operation; AND,
 - * The bid includes at least two small enterprises with demonstrated experience in the core space business required for the project in its teaming arrangement (Bidder and/or sub-contractors). The term “small” meaning a company or entity of less than 100 employees employed in Canada; AND
 - * The science team includes researchers and/or professors from two or more Canadian universities; AND
 - * The bid involves at least one student to perform science, technical engineering and/or mathematical (STEM) tasks.

Criterion P7 - Project Management Plan (Canada & U.S. portions)

This criterion assesses the completeness of the management plan (Work Breakdown Structures, Work Packages, personnel allocation, schedule and milestones, programmatic risk assessment, and costing methodology) and

evaluates the effectiveness of the described project management approach in achieving the stated mission objectives.

- 0)** • The management plan does not present a Work Breakdown Structure (WBS) or Work Package Descriptions (WPD) for the Phase A; OR,
- The bid does not meet the requirements of A), B), C) or D).

- A)** • **WBS:**
 - ❖ The management plan presents an incomplete or non-product-based Work Breakdown Structure (WBS) expanded to level 2 (i.e. WBS 1.01) for the whole mission, in a graphical format. Also, not all the level 2 Work Packages Descriptions (WPDs) are provided for the work needed to be performed in Phase A; AND
- **SCHEDULE:**
 - ❖ The management plan does not describe the integration of the various schedules; such as the rover, instrument, subcontractors, and the launcher/lander schedules for the mission; AND
 - ❖ The assessed relationship of the work elements to the project schedule are not explained and not in consonance with the WBS; the dependencies, milestones, task durations, constraints, and deliverables are not illustrated in a Gantt chart; AND
 - ❖ The schedule margins are not defined and not explained; AND
 - ❖ A critical path is not identified; AND
- **RISKS:**
 - ❖ The risks known at the bid stage are not specified for at least those mentioned in the section 4.2.3.2.4 of Attachment 1 to Part 3 – Bid Preparation Instructions; AND
 - ❖ A qualitative risk assessment was NOT done and presented; AND
 - ❖ Mitigation strategies are presented but are not feasible (i.e. based on the schedule and/or budget available) to fully mitigate the impacts; AND
 - ❖ Contingency plans on the top three highest risks are not presented; AND
- **ORGANIZATION:**
 - ❖ The bid does not demonstrate that each organization involved has the appropriate methods, processes and tools⁽¹⁾ in place to successfully complete such projects; AND
 - ❖ The Resource Allocation Matrix (RAM) is presented with incomplete allocation to each work package and the workload is limited to junior personnel or senior personnel ; AND
- **PROJECT COST METHODOLOGY:**
 - ❖ The assessment of the basis of estimate, the adequacy of the approach and robustness⁽²⁾ of the cost plan do not contribute confidence in achieving mission success and meeting the mission's overall budget; AND
 - ❖ Cost estimating models and rationale were NOT used to estimate the cost, and lack explanations and assumptions; AND
 - ❖ A discussion of the costs risks, with the allocation of cost reserves, its adequacy, and the team's understanding of how to manage the reserves were not included.
- B)** • **WBS:**
 - ❖ The management plan presents a complete product-based Work Breakdown Structure (WBS) expanded to level 2 (i.e. WBS 1.01) for the whole mission, in a graphical format. However, not all the level 2 Work Packages Descriptions (WPDs) were provided for the work needed to be performed in Phase A; AND

- SCHEDULE:
 - ❖ The management plan does not describe the integration of the various schedules; such as the rover, instrument, subcontractors, and the launcher/lander schedules for the mission; AND
 - ❖ The assessed relationship of the work elements to the project schedule are poorly explained but still in consonance with the WBS; BUT some of the dependencies, milestones, task durations, constraints, and deliverables are not illustrated in a Gantt chart; AND
 - ❖ The schedule margins are not adequate and not explained; AND
 - ❖ A critical path is not identified; AND
- RISKS:
 - ❖ The risks known at the bid stage are not specified for at least those mentioned in the section 4.2.3.2.4 of Attachment 1 to Part 3 – Bid Preparation Instructions; AND
 - ❖ A qualitative risk assessment was done and presented; AND
 - ❖ Mitigation strategies are presented but are not feasible (i.e. based on the schedule and/or budget available) to fully mitigate the impacts; AND
 - ❖ Contingency plans for at least the top three highest risks are presented but lack credibility; AND
- ORGANIZATION:
 - ❖ The bid demonstrates that each organization involved has the appropriate methods, processes and tools⁽¹⁾ in place to successfully complete such projects; AND
 - ❖ The Resource Allocation Matrix (RAM) is presented and realistic but with incomplete allocation to each work package and the workload is skewed towards less experience personnel; AND
- PROJECT COST METHODOLOGY:
 - ❖ The assessment of the basis of estimate, the adequacy of the approach and robustness⁽²⁾ of the cost plan do not contribute confidence of mission success; AND
 - ❖ The cost model method and rationale described is not appropriate for space missions and lack explanations and assumptions; AND
 - ❖ A discussion of the costs risks, with the allocation of cost reserves, its adequacy, and the team's understanding of how to manage the reserves were not included.

- C) • WBS:
- ❖ The management plan presents a complete product-based Work Breakdown Structure (WBS) expanded to level 2 (i.e. WBS 1.01) for the whole mission, in a graphical format. Additionally, all the level 2 Work Packages Descriptions (WPDs) were provided for the work needed to be performed in Phase A; AND
- SCHEDULE:
- ❖ The management plan demonstrates the integration of the various schedules; such as the rover, instrument, subcontractors, and the launcher/lander schedules for the mission; AND
 - ❖ The assessed relationship of the work elements to the project schedule are sound and in consonance with the WBS; BUT some of the dependencies, milestones, task durations, constraints, and deliverables are not illustrated in a Gantt chart; AND
 - ❖ The schedule margins are adequate to accommodate risks for this mission, BUT not explained; AND
 - ❖ A critical path is poorly identified; AND
- RISKS:
- ❖ The risks known at the bid stage are specified for at least those mentioned in the section 4.2.3.2.4 of Attachment 1 to Part 3 – Bid Preparation Instructions; AND

- ❖ A qualitative risk assessment was done and presented; AND
- ❖ Mitigation strategies are presented and sound AND
- ❖ Contingency plans for at least the top three highest risks are presented but lack credibility to be done within the confines of the budget and schedule; AND
- ORGANIZATION:
 - ❖ The bid demonstrates that each organization involved has the appropriate methods, processes and tools⁽¹⁾ in place to successfully complete such projects AND
 - ❖ The Resource Allocation Matrix (RAM) is presented and realistic but with incomplete allocation to each work package and the workload is skewed towards more experience personnel; AND
- PROJECT COST METHODOLOGY:
 - ❖ The assessment of the basis of estimate, the adequacy of the approach and robustness⁽²⁾ of the cost plan contribute to increasing confidence of mission success; AND
 - ❖ Only one cost model method and rationale is described and is appropriate for space missions, or both cost models were described, BUT lacking good explanations and assumptions; AND
 - ❖ A discussion of the costs risks, with the allocation of cost reserves, its adequacy, and the team's understanding of how to manage the reserves were included but not detailed.

D) • WBS:

- ❖ The management plan presents a complete product-based Work Breakdown Structure (WBS) expanded to level 2 (i.e. WBS 1.01) for the whole mission, and to level 3 for the Rover elements (i.e. 6.01.01) in a graphical format. Additionally, all the level 2 Work Packages Descriptions (WPDs) were provided for the work needed to be performed in Phase A; AND
- SCHEDULE:
 - ❖ The management plan demonstrates the integration of the various schedules; such as the rover, instrument, subcontractors, and the launcher/lander schedules for the mission; AND
 - ❖ The assessed relationship of the work elements to the project schedule are sound and in consonance with the WBS; with the dependencies, milestones, task durations, constraints, and deliverables illustrated in a Gantt chart; AND
 - ❖ The schedule margins are adequate to accommodate risks for this mission, and are explained; AND
 - ❖ A critical path is clearly identified; AND
- RISKS:
 - ❖ The risks known at the bid stage are all specified for those mentioned in section 4.2.3.2.4 of Attachment 1 to Part 3 – Bid Preparation Instructions and any additional risk(s) considered to have a significant impact on the project; AND
 - ❖ A qualitative risk assessment was done and presented; AND
 - ❖ Mitigation strategies are presented and sound; AND
 - ❖ Contingency plans for at least the top three highest risks are presented and sound, within the confines of the budget and schedule; AND
- ORGANIZATION:
 - ❖ The bid demonstrates that each organization involved has the appropriate methods, processes and tools⁽¹⁾ in place to successfully complete such projects; AND
 - ❖ The Resource Allocation Matrix (RAM) is presented and realistic with clear allocation to each work package and the workload between less and more experienced personnel is balanced; AND
- PROJECT COST METHODOLOGY:

- ❖ The assessment of the basis of estimate, the adequacy of the approach and robustness⁽²⁾ of the cost plan contribute to increasing confidence of mission success; AND
- ❖ The two separate cost models described are appropriate for space missions with the proper explanations, assumptions and rationales for the parameters used in the cost models; AND
- ❖ A discussion of the costs risks, with the allocation of cost reserves, its adequacy, and the team's understanding of how to manage the reserves were included.

Notes:

(1) Tools: include key engineering software to perform space mission analyses & design, simulations, and analysis of high-level performance of rover/payload systems.

(2) Robustness: implying the ability to withstand adverse conditions and resistant to errors, having margins in the plan, having descopes in the plan, recognizing maturity levels, and the flexibility of the mission architecture