



RETURN BIDS TO:

RETOURNER LES SOUMISSIONS À:

Travaux publics et Services gouvernementaux
Canada

Place Bonaventure,
800 rue de la Gauchetière Ouest

Voir aux présentes - See herein

Montréal

Québec

H5A 1L6

FAX pour soumissions: (514) 496-3822

**REQUEST FOR PROPOSAL
DEMANDE DE PROPOSITION**

**Proposal To: Public Works and Government
Services Canada**

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

**Proposition aux: Travaux Publics et Services
Gouvernementaux Canada**

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

Comments - Commentaires

Title - Sujet LunarSurfaceAutonomous Sci Payload	
Solicitation No. - N° de l'invitation 9F063-190040/A	Date 2019-08-05
Client Reference No. - N° de référence du client 9F063-190040	
GETS Reference No. - N° de référence de SEAG PW-\$MTB-770-15431	
File No. - N° de dossier MTB-9-42033 (770)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2019-09-27	Time Zone Fuseau horaire Heure Avancée de l'Est HAE
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Mathurin, Martine	Buyer Id - Id de l'acheteur mtb770
Telephone No. - N° de téléphone (514) 712-5733 ()	FAX No. - N° de FAX (514) 496-3822
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: Agence Spatiale Canadienne - 9F063-Sciences et technologies Spatiales Gestion Développement technologique 6767 ROUTE DE LAEROPORT ST HUBERT Québec J3Y8Y9 Canada	

Instructions: See Herein

Instructions: Voir aux présentes

Vendor/Firm Name and Address

**Raison sociale et adresse du
fournisseur/de l'entrepreneur**

Issuing Office - Bureau de distribution

Travaux publics et Services gouvernementaux Canada
Place Bonaventure, portail Sud-Oue

800, rue de La Gauchetière Ouest

7e étage, suite 7300

Montréal

Québec

H5A 1L6

Delivery Required - Livraison exigée Voir Doc.	Delivery Offered - Livraison proposée
Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur	
Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

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9F063-190040/A
Client Ref. No. - N° de réf. du client
9F063-19-0040

Amd. No. - N° de la modif.
File No. - N° du dossier
MTB-9-42033

Buyer ID - Id de l'acheteur
MTB770
CCC No./N° CCC - FMS No./N° VME

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PART 1 - GENERAL INFORMATION

1.1 Introduction

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

The following Annexes:

Annex A Statement of Work
Annex B Basis of Payment

The following Attachments:

Attachment 1 to Part 3 Technical and Managerial Bid Preparation Instructions
Attachment 2 to Part 3 Electronic Payment Instructions
Attachment 1 to Part 4 Point Rated Evaluation Criteria

1.2 Summary

Project Title

Concept Studies and Technology Developments for Lunar Surface Autonomous Science Payloads (LSASP)

Description

Public Works and Government Services Canada (PWGSC) on behalf of the Canadian Space Agency (CSA) located in St-Hubert, (Quebec), is seeking bids to conduct concept studies and technology developments for Lunar Surface Autonomous Science Payloads.

These activities correspond with the Canadian Space Agency's (CSA) priorities and mission roadmaps. This Priority Technology (PT) is specified in APPENDIX A-5 of ANNEX A and the work solicited is the development and advancement of this technology up to potentially TRL 6 (Technology Readiness Levels), (see APPENDIX A-1 of ANNEX A) to reduce technical uncertainties and support approval and implementation of specific potential future space missions of interest to Canada.

Up to six (6) contract is expected to be awarded. *For additional information, please refer to Part 4 - Evaluation Procedures and Basis of Selection, of the bid solicitation.*

Period of Contract

From date of award for up to 18 months.

Intellectual Property

The Intellectual property will vest with the contractor

Maximum Funding

The maximum funding available for each Contract resulting from the bid solicitation is \$ 700 000.00 per contract (Applicable Taxes extra). Bidders must refer to Part 2, section 2.6 – *Maximum Funding*, of the bid solicitation.

Security Requirements

There are no security requirements associated with this requirement.

Trade agreements

This requirement is not subject to the trade agreements.

Canadian Content

The requirement is limited to Canadian goods and services.

Controlled Goods Program

This procurement could be subject to the Controlled Goods Program. The *Defence production Act* defines Canadian Controlled Goods as certain goods listed in Canada's Export Control List, a regulation made pursuant to the Export and Import Permits Act (EIPA)."

Epost Connect

This bid solicitation allows 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 fifteen (15) working days from receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

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 (2019-03-04) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference 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: 240 days

2.2 Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit by the date, time and place indicated on page 1 of the bid solicitation:

**Public Works and Government Services Canada
Quebec Region,
Place Bonaventure, 7th Floor
800 de la Gauchetière Street West
South West Portal, Suite 7300
Montreal (QC), H5A 1L6**

Bids may also be submitted using the epost Connect service as detailed in the Standard Instructions 2003.

The following PWGSC Regional Bid Receiving Unit e-mail address is to be used for epost Connect services:

TPSGC.RQReceptionSoumissions-QRSupplyTendersReception.PWGSC@tpsgc-pwgsc.gc.ca

Note: Bids will not be accepted if emailed directly to this e-mail address. This e-mail address is to initiate an epost Connect conversation, as detailed in the 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 to PWGSC will not be accepted.

2.3 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.

2.4 Applicable Laws

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

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.

2.5 Improvement of Requirement During Solicitation Period

Should Bidders consider that the specifications or Statement of Work 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) days before the bid closing date. Canada will have the right to accept or reject any or all suggestions.

2.6 Maximum Funding

The maximum funding available for each contract resulting from the bid solicitation is \$ 700,000.00 as specified in the Table1 below, (Applicable Taxes extra, as appropriate). Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

Priority Technology Title	Maximum Funding (K\$) Concept Study	Maximum Funding (K\$) Contract value (Concept Study and Technology Development)
Lunar Surface Autonomous Science Payloads (LSASP)	200k	700k

Table 1 – Priority Technology

A maximum of six (6) contracts* is expected to be awarded.

**Note: the number of contracts may be different. For additional information, please refer to Part 4 - Evaluation Procedures and Basis of Selection.*

PART 3 - BID PREPARATION INSTRUCTIONS

3.1 Bid Preparation Instructions

A Bidder can bid more than one concept study and associated technology development but must submit one separate bid for each concept study and associated technology development.

A Bidder can also bid more than one technology development for a given concept study. In this case, the bidder must submit as many bids as the number of technology developments.

Example: A bidder who presents 2 technology developments for the same concept study, must submit 2 separate bids, each bid with the same concept study and a different technology development.

Note: If Canada recommends to award more than one contract for a given concept study, with a different technology development, Canada will only pay once for the concept study.

The Bidder must follow the same instructions described in this bid solicitation for each bid submitted.

If the Bidder chooses to submit its bid electronically, Canada requests that the Bidder submits bid in accordance with section 08 of the 2003 standard instructions. 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 as follows:

Section I: Technical and Managerial Bid
Section II: Financial Bid
Section III: Certifications

If the Bidder chooses to submit its bid in hard copies, Canada requests that the Bidder submits its bid in separately bound sections as follows:

Section I: Technical and Managerial Bid (1 hard copy and 1 soft copy on CD, DVD or USB key)
Section II: Financial Bid (1 hard copy and 1 soft copy on CD, DVD or USB key)
Section III: Certifications (1 hard copy and 1 soft copy on CD, DVD or USB key)

If there is a discrepancy between the wording of the soft copy on electronic media and the hard copy, the wording of the hard copy will have priority over the wording of the soft copy.

If the Bidder is simultaneously providing copies of its bid using multiple acceptable delivery methods (electronically and hard copies), and if there is a discrepancy between the wording of any of these copies and the electronic copy provided through epost Connect service, the wording of the electronic copy provided through epost Connect service will have priority over the wording of the other copies.

Prices must appear in the financial bid only. No prices must be indicated in any other section of the bid.

Canada requests that bidders follow the format instructions described below in the preparation of hard copy of their bid:

- (a) use 8.5 x 11 inch (216 mm x 279 mm) paper;
- (b) use a numbering system that corresponds to the bid solicitation.

In April 2006, Canada issued a policy directing federal departments and agencies to take the necessary steps to incorporate environmental considerations into the procurement process [Policy on Green Procurement](https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32573) (<https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32573>). To assist Canada in reaching its objectives, bidders should:

- 1) use 8.5 x 11 inch (216 mm x 279 mm) paper containing fibre certified as originating from a sustainably-managed forest and containing minimum 30% recycled content; and
- 2) use an environmentally-preferable format including black and white printing instead of colour printing, printing double sided/duplex, using staples or clips instead of cerlox, duotangs or binders.

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.

To maintain the integrity of the evaluation, evaluators will consider only information presented in the bid. No information will be inferred and personal knowledge or beliefs will not be utilized in the assessment.

Please note: Website references, relevant technical papers, product samples, videotapes, slides, or other ancillary items will not be considered during the evaluation process.

Part 4: *Evaluation Procedures and Basis of Selection* contains additional instructions that Bidders should consider when preparing their technical and managerial bid.

The structure and content requested for the Technical and Managerial Bid (Section I) are detailed in Attachment 1 to Part 3: *Technical and Managerial Bid Preparation Instructions*.

Section II: Financial Bid

3.1.1 Bidders must submit their financial bid in accordance with the following:

- (a) A firm, all-inclusive lot price for the Work, which must not exceed the maximum funding available for each contract resulting from the bid solicitation, as specified in Part 2, Section 2.6 – Maximum Funding, Table 1 – Priority Technology. The total amount of Applicable Taxes must be shown separately, if applicable.

- (b) Prices must be in Canadian funds, Applicable Taxes excluded and Canadian customs duties and excise taxes included.

3.1.2 Electronic Payment of Invoices – Bid

If you are willing to accept payment of invoices by Electronic Payment Instruments, 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 Price Breakdown

Note: Bidders are requested to provide separate price breakdowns, one for the concept study and one the technology development.

For each price breakdown, Bidders are requested to detail the following elements for the performance of each task, milestone or phase of the Work, as applicable:

- (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.
- (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 which must not exceed the limits of the National Joint Council (NJC). With respect to the NJC's Directive, only the meal and private vehicle allowances specified in Appendices B, C and D of the Directive <http://www.njc-cnm.gc.ca/directive/travel-voyage/index-eng.php>, and the other provisions of the Directive referring to "travellers", rather than those referring to "employees", are applicable. The Treasury Board Secretariat's Special Travel Authorities, http://www.tbs-sct.gc.ca/pubs_pol/hrpubs/tbm_113/statb-eng.asp, also apply.
- (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) Applicable Taxes: Identify any Applicable Taxes separately.

Section III: Certifications

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

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 will evaluate the bids;

4.1.1 Technical and Management Evaluation

4.1.1.1 Point Rated Technical and Management Criteria

The Point Rated Technical and Management Criteria are described at Attachment 1 to Part 4: *Point Rated Evaluation Criteria*. Criteria not addressed will be given a score of zero.

4.1.2 Financial Evaluation

4.1.2.1 Mandatory Financial Criteria

The Bidder must submit a firm, all-inclusive lot price for the Work, which must not exceed the maximum funding available for each contract resulting from the bid solicitation as indicated in Part 2, Section 2.6 *Maximum Funding*, Table 1 – *Priority Technology* (Applicable Taxes extra, as appropriate).

Bids which fail to meet the mandatory financial criteria will be declared non-responsive. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

4.1.2.2 Evaluation of Price

The price of the bid will be evaluated in Canadian dollars, the Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included.

4.2 Basis of Selection – Highest Combined Rating of Technical Merit and Price

4.2.1 To be declared responsive, each bid must:

- (a) comply with all the requirements of the bid solicitation;
- (b) meet all mandatory evaluation criteria;
- (c) obtain the required minimum of 7.5 points, on a scale of 15 points, for the Evaluation Criterion #1 *Understanding the technology to fulfill mission objectives*, indicated in Table 4A.1: *List of Evaluation Criteria and Associated Ratings*, of Attachment 1 to Part 4;
- (d) obtain the required minimum of 20 points, on a scale of 40 points, for the Evaluation Criterion #4: *Feasibility of proposed solution in meeting the scientific and technical objectives* indicated in Table 4A.1: *List of Evaluation Criteria and Associated Ratings*, of Attachment 1 to Part 4; and

- (e) obtain the required minimum of 70 points, on a scale of 100 points, for the overall Technical Evaluation portion of the bid as indicated in Table 4A.1: *List of Evaluation Criteria and Associated Ratings*, of Attachment 1 to Part 4.

4.2.2 Bids not meeting (a) or (b) or (c) or (d) or (e) will be declared non-responsive;

4.2.3 Responsive Bids, will be ranked according to their combined score made up of the overall technical score and pricing score.

For each responsive bid, the overall technical score and the pricing score will be added to determine its combined score.

Bids will be ranked starting from the Bid with the highest combined score down to the lowest combined score resulting in a Responsive Bid List;

4.2.4 For each responsive bid, the score obtained for each technical criterion will be added to determine its overall technical score (maximum of 100 points);

4.2.5 To establish the pricing score, the following equation will be used:

$$\text{pricing score} = \left(\frac{\text{max funding} - \text{bid price}}{\text{max funding}} \right) \times 50$$

the pricing score is limited to 10 points. It therefore follows that the maximum pricing score is awarded to bids with a price representing 80% of the maximum funding. Bids with a price lower than 80% funding will receive the maximum score of 10;

4.2.6 The first six responsive bids with the highest combined score of technical merit and price will be recommended for award of a contract.

In the event that more than one responsive bid has the same combined score, the bid which obtained the highest overall technical score will be recommended for award of a contract.

In the event that all available budget has not been spent or that additional budget is made available, Canada may elect to award one or more contracts to responsive bid(s) with the next highest overall score(s).

The table below illustrates an example where all three bids are responsive and the selection of the contractor is determined by adding the overall technical score and pricing scores, respectively. In this example, the maximum funding is 100 000\$ (100)

Ex. Basis of Selection – Highest Combined Rating of Technical Merit and Price

Bidder	Bidder 1	Bidder 2	Bidder 3
Overall Technical Score	70	85	92
Bid Price	\$90 000	\$80 000	\$100 000
Calculation of Pricing Score	$((100-90)/100) \times 50 = 5$	$((100-80)/100) \times 50 = 10$	$((100-100)/100) \times 50 = 0$
Combined Score	75	95	92
Overall Rating	3 rd	1st	2nd

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 procurement 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.

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 annex Federal Contractors Program for Employment Equity - Certification, for each member of the Joint Venture

5.2.3 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 with FPS, 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 FPS 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: 2012-2 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.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is \$5,000, including Applicable Taxes.

5.2.4 Additional Certifications Precedent to Contract Award

5.2.4.1 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 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.(9), Example 2, of the Supply Manual

5.2.4.1.1 Canadian Content Definition

SACC Manual clause [A3050T](#) (2018-12-06) Canadian Content Definition

5.2.4.2 Status and Availability of Resources

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

5.2.4.3 Education and Experience

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

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PART 6 - FINANCIAL AND OTHER REQUIREMENTS

6.1 Financial Capability

SACC Manual clause A9033T (2012-07-16), Financial Capability

6.2 Controlled Goods Requirement (if applicable)

SACC Manual clause A9130T (2014-11-27), Controlled Goods Program – Bid

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 in Annex A and the Contractor's technical and Managerial Bid entitled _____, dated _____ (*will be inserted at contract award*).

7.2 Work Authorization

Despite any other condition of the Contract, the Contractor is only authorized to perform the Work up to the "Work Authorization Meeting and Decisions" (see Annex A – Statement of Work, section A.7.2.3). Depending on the results of the review and evaluation of the Work, Canada will decide at its discretion whether to continue with the Work.

If Canada decides to continue with the Work, the Contracting Authority will advise the Contractor in writing to continue with the work in accordance with the Statement of Work. The Contractor must immediately comply with the notice.

If Canada decides not to proceed with the Work, the Contracting Authority will advise the Contractor in writing of the decision and the Contract will be considered completed at no further costs to Canada. In no event will the Contractor be paid for any cost incurred for unauthorized work.

7.3 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>) issued by Public Works and Government Services Canada.

7.3.1 General Conditions

2040 (2018-06-21), General Conditions - Research & Development, apply to and form part of the Contract.

7.3.2 Supplemental General Conditions

The following supplemental general conditions apply to and form part of the Contract:

4002 (2010-08-16), Software Development or Modification Services
4003 (2010-08-16), Licensed Software

7.4 Term of Contract

7.4.1 Period of the Contract (*will be inserted at contract award*)

From date of Contract award until _____.

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7.5 Authorities

7.5.1 Contracting Authority

The Contracting Authority for the Contract is:

Martine Mathurin
Procurement Specialist
Public Works and Government Services Canada
Place Bonaventure, South-West Portal
800, de La Gauchetière Street West,
7th Floor, suite 7300
Montréal, Québec
H5A 1L6

Telephone: 514-712-5733
E-mail address: martine.mathurin@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.

7.5.2 Project Authority *(will be inserted at contract award)*

The Project Authority for the Contract is:

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

Telephone: _____
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 technical content of the Work under the Contract. Technical 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.

7.5.3 Contractor's Representative *(will be inserted at contract award)*

The Contractor's Representative for the Contract is:

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

Telephone: _____ - _____ - _____

E-mail: _____

7.6 Proactive Disclosure of Contracts with Former Public Servants

SACC Manual Clause A3025C (2013-03-21)

7.7 Payment

7.7.1 Basis of Payment

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 the Contract for a cost of \$_____ (*the amount will be inserted at contract award*). Customs duties are included and Applicable taxes are extra, if applicable.

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.

7.7.2 Method of Payment

7.7.2.1 Milestone Payments

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 if:

(a) an accurate and complete claim for payment using form PWGSC-TPSGC 1111 (<http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1111.pdf>) and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;

(b) all the certificates appearing on form PWGSC-TPSGC 1111 have been signed by the respective authorized representatives;

(c) all work associated with the milestone and as applicable any deliverable required has been completed and accepted by Canada.

7.7.2.2 Schedule of Milestones

The schedule of milestones for which payments will be made in accordance with the Contract is detailed in Annex B.

7.8 SACC Manual Clauses

A9117C (2007-11-30), T1204 - Direct Request by Customer Department
C0101C (2010-01-11), Discretionary Audit - Non-commercial Goods and/or Services

7.9 Electronic Payment of Invoices – Contract

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)

7.10 Invoicing Instructions - Progress Claim - Firm Price

1. The Contractor must submit a claim for progress payment using form PWGSC-TPSGC 1111 Claim for Progress Payment (<http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1111.pdf>).

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. The Contractor must prepare and certify **one PDF copy** of the claim on form PWGSC-TPSGC 1111, and **send it by e-mail** to the Contracting Authority and Project Authority identified under the section entitled "Authorities" of the Contract, with copy to the following:

CSA e-mail address: asc.facturation-invoicing.csa@canada.ca PWGSC e-mail address:
QueReclamationsMontreal.QueMontrealClaims@tpsgc-pwgsc.gc.ca

3. **If mailed**, the Contractor must prepare and certify **one (1) original and two (2) copies** of the claim on form PWGSC-TPSGC 1111, and forward:

- a) the **original and one (1) copy** to the Canadian Space Agency at the address shown on page 1 of the Contract under "Invoices" (Financial Services Section) for appropriate certification by the Project Authority identified herein after inspection and acceptance of the Work takes place;

and,

- b) **one (1) copy of the original** progress claim to the Contracting Authority identified under the section entitled "Authorities" of the Contract.

4. The CSA's Financial Services Section 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.

5. The Contractor must not submit claims until all work identified in the claim is completed.

7.11 Certifications and Additional Information

7.11.1 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.

7.11.2 SACC Manual Clause

A3060C (2008-05-12), Canadian Content Certification

7.12 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*).

7.13 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 (2018-06-21) General Conditions - Research and Development;
- c) the supplemental general conditions 4002 (2010-08-16), Software Development or Modification Services and 4003 (2010-08-16), Licensed Software;
- d) Annex A, Statement of Work;
- e) Annex B, Basis of Payment; and
- f) the Contractor's bid dated ____ (insert date of bid) (If the bid was clarified or amended, insert at the time of contract award: "as clarified on ____" **or** ", as amended on ____" and insert date(s) of clarification(s) or amendment(s)).

7.14 Foreign Nationals (Canadian Contractor)

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

7.15 Insurance

SACC Manual clause G1005C (2016-01-28), Insurance

7.16 Controlled Goods Program (if applicable)

SACC Manual clause A9131C (2014-11-27), Controlled Goods Program

7.17 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, mentioned in section **7.5.2** 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 present 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.

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ANNEX A

STATEMENT OF WORK

The Statement of Work, appended to the bid solicitation package, is to be inserted at this point and forms part of this document.

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ANNEX B

BASIS OF PAYMENT

SCHEDULE OF MILESTONES

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

No	Milestone	Milestone Deliverables	Firm Amount	Delivery Date

Total Firm Price CAN \$ _____
(Taxes Extra, if applicable)

ATTACHMENT 1 TO PART 3

TECHNICAL AND MANAGERIAL BID PREPARATION INSTRUCTIONS

3A.1. Technical and managerial bid

The details provided in this Attachment complement the information introduced in paragraph 3.1 of Part 3: *Bid Preparation Instructions*.

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

1. Title / Project Identification Page (see 3A.2);
2. Executive Summary (see 3A.3);
3. Table of Contents (see 3A.4);
4. Project Definition and Plan (see 3A.5);
5. Bid Appendices (see 3A.6)

The structure of the Technical and Managerial Bid, and its subsections, are described below. Some of the subsection headings are followed by numbers in brackets. These numbers represent the Evaluation Criteria (see Table 4A.1 of Attachment 1 to Part 4) that are applicable to that specific section/subsection, for each bid submitted by a Bidder.

3A.2 Title/Project Identification Page

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

- a) The Request For Proposal file number (Space Technologies 9F063-190040/A);
- b) The company's name and address;
- c) The title of the proposed Work (the use of acronyms in the title is discouraged, unless they are described);
- d) The current and targeted TRL (up to TRL 6) of the proposed technology (refer to Annex A, Appendix A-1 Technology readiness Levels (TRLs) for TRL descriptions); and
- e) A short extract from the Executive Summary (maximum **7 lines**) of the bid. The technology development being proposed and its relevance to the targeted Priority Technology should be described.

3A.3 Executive Summary

The Bidder should provide an Executive Summary. The Executive Summary is a stand-alone document suitable for public dissemination, for example, through the CSA web site. The Executive Summary should not exceed two pages in length (8.5" x 11") and should highlight the following elements:

- a) Work objectives;
- b) Main innovations;
- c) TRL development;
- d) Technical risks;
- e) Major milestones and deliverables; and
- f) Impact on the proposed technology and the associated targeted Future Mission(s).

Bidder must provide the Executive Summary in soft copy with the only acceptable format: MS Word, PDF (unprotected) or HTML in a separate unprotected file and not contain any proprietary markings.

3A.4 Table of Contents

The table of contents should be formatted such that its headings are linked to their respective location in the bid for ease of reference when using the bid's Soft copy version.

3A.5 Project Definition and Plan

This section should describe the project and plan as outlined in the following subsections.

3A.5.1 Understanding the Technology to Fulfill Mission Objectives (Evaluation Criterion 1) (see section 4A.3.1 Criterion 1 Understanding the Technology to Fulfill Mission Objectives of Attachment 1 to Part 4)

This criterion assesses the degree to which the bid exhibits clear mission objectives as per the SOW and demonstrate an understanding of the fundamental concepts of the technology, of its associated systems level design tradeoffs and of its usage in the proposed application. In order to do the assessment, the Bidder should demonstrate a detailed understanding as well as broaden the fundamental concepts.

The understanding can be demonstrated by description of the overall problem and solution proposed by the Bidder, an overview of the background context, such as results of literature searches, prior development, state-of-the-art, and a general description of the expected improvement, results and benefits, based on the technical objectives described in Annex A, Appendix A-5: *Priority Technology and associated specific statement of work*.

3A.5.2 Team Experience and Capability (Evaluation Criterion 2) (see section 4A.3.2 Criterion 2 Team Experience and Capability of Attachment 1 to Part 4)

This criterion assesses the combined technical capability and experience of the key project Scientists/Engineers identified to carry out the work as well as the qualifications and experience of the Project Manager. In order to do the assessment, the Bidder should:

- Provide an overview of its organisation. It should cover the following elements: the nature and structure of the Bidder's organization; the level of Canadian ownership; the location, size and general description of the plant facility; the size and composition of staff; the principal product or field of endeavour; the annual business volume and general nature of the company's client base; and a list of any applications for funding from other Government sources and/or Government contracts received for similar and/or related work. This section should identify the location where the Work will be performed.
- Identify the key members of the project's technical and management teams and state their specific roles, qualifications and experience for the work involved. For the science team, identify representation from at least one Canadian university. The Bidder should include an organization chart that illustrates the structure of the proposed project team. The project manager's track record in past projects must be detailed. Detailed resumes should be provided into an Appendix to Section I of the bid. Names of back-up personnel for key positions should also be included.

- 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, to obtain the maximum score, it will be essential for the bidder to involve at least one student to perform science, technical, engineering and/or mathematical (STEM) tasks. To this effect, potential bidders may be interested in contacting Mitacs (www.mitacs.ca), a national not-for-profit organization, to investigate if and how such resources can be leveraged or co-funded in collaboration with universities on research projects.

**3A.5.3 Implementation Plan (Evaluation Criterion 3)
(see section 4A.3.3 Criterion 3 Implementation Plan of Attachment 1 to Part 4)**

The Bidder should present an Implementation Plan that will effectively and efficiently direct the project to a successful completion. The Implementation Plan's presentation should be based on the recognized management tools most applicable to the proposed project, such as a scope planning (Work Breakdown Structure), and schedule development charts (Gantt, Program Evaluation and Review Technique -PERT, etc). Equivalent Bidder-developed, project-tailored tools/charts are also acceptable, provided that the information is complete.

3A.5.3.1 Work Breakdown Structure and Work Package Definition

This Implementation Plan subsection should define and specify the scope of Work to be executed according to the requirements of the Statement of Work, Contract Deliverables and Meetings (Annex A). Work Breakdown Structure (WBS) is a recognized scope definition technique, while Work Packages (WP) stem from the WBS. The WBS should flow down to a low enough level and the associated WP should be defined in sufficient depth in order for the Bidder to demonstrate the methodology that will be followed to perform the project.

Each WP should focus on specific activities that will form the total Work and, as a minimum, should define and describe the specific work to be carried out. It should also indicate: the person responsible, the WP's associated levels-of-effort and required resources, the schedule (start and finish dates), and the associated inputs and deliverable or output.

As a guideline, Figure 3A.1 presents a fictitious example of a WBS, while Table 3A.1 presents a fictitious example of a Work Package Definition Sheet. For each work packages the Bidder should provide a detailed statement of work and list the associated resources.

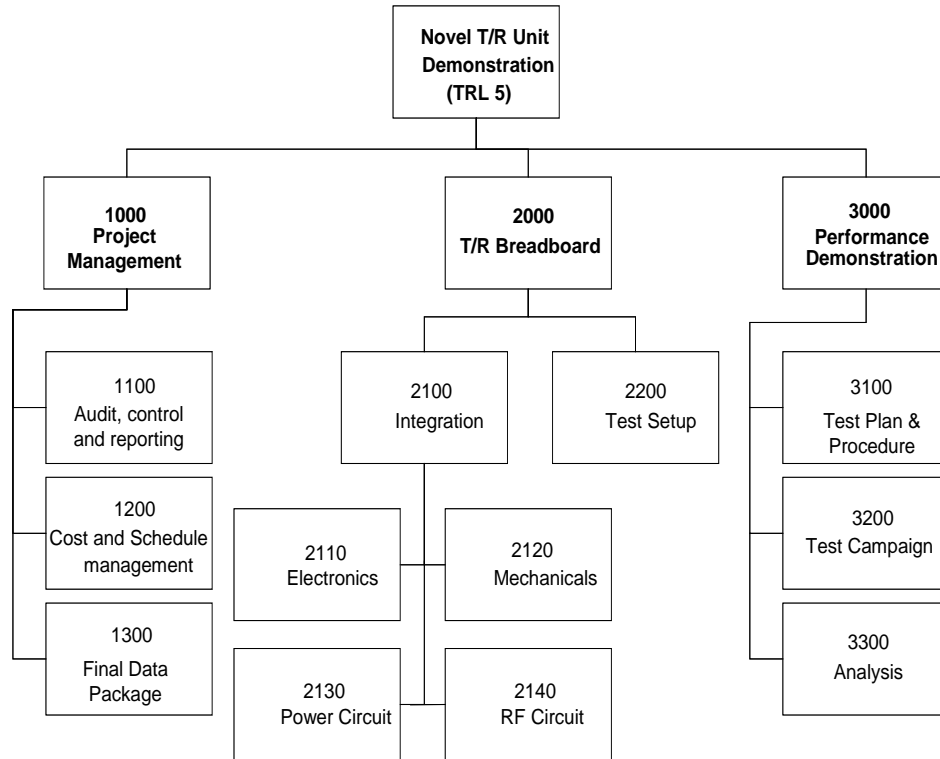


Figure 3A.1: Example of a Work Breakdown Structure

Project: T/R Unit Demonstration		
Work Pack Title:	TEST SETUP	WBS Ref: 2200
Sheet: 1 of 1	WP Estimated Value:	Do not indicate \$ value in Section I of the bid, indicate value only in Section II
Scheduled Start: T0 + 2 weeks	Accountable Manager:	Resource A
Scheduled End: T0 + 12 weeks	Resources:	Resource A, Resource B, Resource C
Estimated Effort: 80 hours		
Objectives:		
<ul style="list-style-type: none"> Deliver a functional test setup for the T/R unit 		
Inputs:		
<ul style="list-style-type: none"> Test plan and procedure Unit drawings Unit Interface Control Documents 		
Tasks:		
<ul style="list-style-type: none"> Review input documentation Define requirements 		

<ul style="list-style-type: none"> • Produce initial concept • Design test setup • Fabricate test setup • Commission and debug
<p>Outputs and Deliverables:</p> <ul style="list-style-type: none"> • Fully functional T/R unit test setup • Test setup log manual • Test setup user manual

Table 3A.1: Example of Work Package Definition Sheet

3A.5.3.2 Personnel Allocation

This Implementation Plan subsection should include a Responsibility Assignment Matrix (RAM) showing the level-of-effort for each individual team member or sub-contractor that has been allocated to each WP. The matrix should identify each individual by name and organisation, and provide the estimated time (number of hours or days) required to complete each task. Also, the RAM should identify the role of the individual, either being the accountable person for the WP (A), or being a participant (P). Bidders must provide letters of intent from involved subcontractors or major contributors to the project. As a guideline, Table 3A.2 presents a fictitious example of a RAM. The RAM should be presented in both the technical bid and the financial bid

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

Table 3A.2: Example of Responsibility Allocation Matrix (RAM)

3A.5.3.3 Technical Risk Assessment/Analysis

The Bidder should provide an assessment of the technical risks/uncertainties involved as well as the major assumptions upon which the work is based. In particular, this subsection should address any performance risks that pertain to the new technology. The risks should be identified and a Risk Mitigation Plan, that would include contingency plans, alternatives or other means of limiting adverse impacts of risks being realized, should be provided. As a guideline, Table 3A.3 presents a fictitious example of a Technical Risk Assessment Matrix, while Table 3A.4 presents an example of a Project Risk Profile Matrix.

Risk Event 1 (R1)	Limited availability of key documents	
Probability	Low	1/20 Past experience demonstrates important number of different sources for patents and articles covering this subject
Consequence to project	Low	\$5 000 - \$10 000 Cost growth Schedule delays
Risk Assessment	Low	\$250 - \$500 (R < 5% of overall project value, \$250K)
Mitigation Plan	Secure at least 2 sources for each type of document	
Contingency Plan	Use second source	

Table 3A.3: Example of a Technical Risk Assessment Matrix

Probability			
High			R2
Medium			
Low	R1		
	Low	Medium	High
	Consequence		

Table 3A.4: Project Risk Profile Matrix

It is understood that in order to develop advanced technologies, a certain amount of technical risk should be assumed. The extent to which higher technical risks are acceptable depends upon how well they have been identified, defined, assessed, planned for, and managed once realized. If the technical risks are poorly defined, or the risk mitigation is inadequately planned, then the project's evaluation score is likely to diminish.

3A.5.3.4 Managerial Risk Assessment

This Implementation Plan subsection should provide an assessment of the managerial risks involved, provide a Risk Mitigation Plan and identify critical issues that may jeopardize the successful completion of the Work within cost and schedule constraints. As a guideline, Table 3A.5 presents a fictitious example of a Managerial Risk Assessment Matrix. Additionally, Table 3A.6 presents an example of a Project Risk Profile Matrix.

Risk Event 2 (R2)	Late delivery of test equipment	
Probability	High	1/3 Past experience with provider demonstrated poor respect of schedule
Consequence to project	High	\$110 000 (cost of securing optional test facility) Significant cost growth Significant schedule delays
Risk Assessment	High	\$55 000 High (R > 25% of overall project value)
Mitigation Plan	Identify and secure equivalent equipment in immediate geographical region Ensure equipment will be available for needed time frame Memo of understanding with facility key managers	
Response Plan	Secure equipment with MOU Confirm time frame options with facility	

Table 3A.5: Example of a Managerial Risk Assessment Matrix

Probability			
High			R2
Medium			
Low	R1		
	Low	Medium	High
	Consequence		

Table 3A.6: Example of a Project Risk Profile Matrix

3A.5.3.5 Milestones and Deliverables

This Implementation Plan subsection should contain a definition of the milestones and describe in details all expected deliverables, including hardware, software, and relevant documentation (refer to Annex A for more details). When appropriate, the milestones and deliverables should contain all elements identified in the SOW (Table A-2 of Annex A and the specific SOW) and should relate to the corresponding WP definition in a manner enabling clear monitoring of progress (see paragraph 3A.5.3.1)

3A.5.3.6 Schedule

The Bidder should provide a project timetable that relates tasks, milestones and deliverables. A Gantt chart and/or PERT chart should be used to illustrate the schedule. The schedule should show significant details for events associated with achievement of major tasks, milestones and deliverables. Linkage between activities should also be identified in the schedule. For planning purposes, use a project start date of October 2019.

3A.5.3.7 Performance Evaluation Criteria (PEC)

The Bidder should establish technical conditions and criteria to be met for each TRL targeted in the project as well as a list of objectively measurable or binary (yes/no) Performance Evaluation Criteria (PEC). These will be reviewed at the kick off meeting and serve to determine which criteria will be used for the work authorization decision and determine project success at the final review meeting.

3A.5.3.8 Project Control System

This Implementation Plan subsection should outline the methods and systems to be used to control and report on the various aspects of project (e.g. tasks, schedules, and costs for the Work). Additionally, the Project Control System should be capable of reporting the amount of work per WBS item for each individual on a monthly basis.

3A.5.3.9 Background Intellectual Property and Foreground Intellectual Property

This subsection should identify and describe all Background Intellectual Property (BIP) that is required to conduct and/or support the Work and all Foreground Intellectual Property (FIP) expected to arise from the proposed Work. BIP and FIP element should be described in sufficient detail so as to be clearly distinguishable. The expected format to provide this information is as per Tables 3A.7 and 3A.8.

1 BIP ID#	2 Project Element	3 Title of the BIP	4 Type of IP	5 Type of access to the BIP required to use/improve the FIP	6 Description of the BIP	7 Reference documentation	8 Origin of the BIP	9 Owner of the BIP
	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 full 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 prime contractor.

Table 3A.7: Disclosure of Background Intellectual Property (BIP) expected to be required for the Contract

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

Table 3A.8: Disclosure of the Foreground Intellectual Property (FIP) expected to be developed under the Contract

Use of graphical representations that include block diagrams is encouraged in order to demonstrate the relationships between the various elements of the BIP and the FIP. The BIP and the expected FIP will be reviewed at the Kick-Off Meeting, and updated at the end of the contract.

Bidder's realizations that are software oriented and propose to improve upon existing software programs/applications will be required to adhere to supplemental general conditions 4002 (Software Development or Modification Services) and 4003 (Licensed Software).

3A.5.4 Feasibility of Proposed Solution in Meeting the Scientific and Technical Objectives (Evaluation Criterion 4) (see section 4A.3.4 Criterion 4 Feasibility of the Proposed Solution in Meeting the Scientific and Technical Objectives of Attachment 1 to Part 4)

The criterion assesses the overall feasibility of the proposed technical approach and the degree to which the solution will satisfy the scientific and technical objectives. In order to do the assessment, the bid should:

- Clearly describe the proposed solution in terms of its physical characteristics, functionality and performance. When applicable, the foreseen concept of operation should be introduced.
- Describe the physical principles under which the solution operates.
- Described critical design and fabrications steps.
- Clearly state the degree to which the solution satisfies the technical and scientific objectives sought in the specific statements of work.

3A.6. Bid Appendices

3A.6.1 Appendices Required with the Bid

The following item should be addressed in individual appendices as part of the bids:

- a) List of Acronyms: All the acronyms used in the Section I: Technical and Managerial Bid, should be explained;
- b) Resumes: The bid should include resumes of the proposed resources and these should be appended to Section I: Technical and Managerial Bid;
- c) Relevant Technical Papers Published by Team Members: Only literature that is relevant and that would be useful to support the bid;
- d) List of Contacts: The list of contacts should be appended to Section I: Technical and Managerial Bid, in a format suitable for distribution and should include all the Bidder's points-of-contacts involved in the bid development and/or during the Contract;

The following example format should be used:

Role	Name	Telephone	E-Mail
Project Manager			
Project Engineers/Head Investigator			
Contractor's Representative			
Claims(Invoicing) Officer			
Communications (for press release)			
Etc.			

Table 3A.9: Bidder's List of Contacts

Solicitation No. - N° de l'invitation
9F063-190040/A
Client Ref. No. - N° de réf. du client
9F063-19-0040

Amd. No. - N° de la modif.
File No. - N° du dossier
MTB-9-42033

Buyer ID - Id de l'acheteur
MTB770
CCC No./N° CCC - FMS No./N° VME

- e) Letters of intent: Letters of intent to participate should be provided by all sub-contractors or co-contributors to the project;
- f) Bidder's criteria Substantiation: For each of the applicable evaluation criteria, provide the substantiation and summarized cross-reference(s) to the bid.

Solicitation No. - N° de l'invitation
9F063-190040/A
Client Ref. No. - N° de réf. du client
9F063-19-0040

Amd. No. - N° de la modif.
File No. - N° du dossier
MTB-9-42033

Buyer ID - Id de l'acheteur
MTB770
CCC No./N° CCC - FMS No./N° VME

ATTACHMENT 2 TO PART 3
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)

**ATTACHMENT 1 TO PART 4
POINT RATED EVALUATION CRITERIA**

4A.1. TECHNICAL AND MANAGEMENT CRITERIA AND RATINGS

The Bidder must achieve the minimum score requirements as indicated in Table 4A.1: *List of Evaluation Criteria and Associated Ratings*. The bid will be evaluated according to the point-rated criteria as specified in Table 4A.1 and as described in section 4A.3: *Evaluation Criteria and Benchmark Statements*

Section 4A.3 "Evaluation Criteria and Benchmark Statements" of the current attachment contains a series of evaluation criteria, each supported by a set of 5 benchmark statements, where each corresponds to percentage of the maximum point rating.

As an example, the maximum point rating for the *Team Experience and Capability* criterion is 15 points. If a Bid receives a "75" for this criterion in the evaluation process, the score attributed will be:

$$75\% \text{ of } 15 \text{ points} = 11.25 \text{ points (score)}$$

Table 4A.1 identifies:

- a) The maximum point rating assigned to each criterion;
- b) The minimum point rating required for the criterion #1: *Understanding the technology to fulfill mission objectives*
- c) The minimum point rating required for the criterion #4: *Feasibility of proposed solution in meeting the scientific and technical objectives*;
- d) The maximum point rating possible for the overall technical score; and
- e) The minimum point rating required for the overall technical score.

Technical Evaluation Criteria and Ratings		
	Max. Ratings	Minimum required
1. Understanding the technology to fulfill mission objectives	15	7.5
2. Team Experience and Capability	15	N/A
3. Implementation Plan	30	N/A
4. Feasibility of proposed solution in meeting the scientific and technical objectives	40	20
Overall Technical Score	100	70

Table 4A.1: - List of Evaluation Criteria and Associated Ratings

4A.2. BIDDER'S CRITERIA SUBSTANTIATION

The Bidder is requested to provide a substantiation (supporting evidence), which should be submitted as an appendix to their Section I (see section 3A.6.1: *Appendices required with the bid* of Attachment 1 of Part 3: *Technical and Managerial Bid Preparation Instruction*).

For each of the applicable evaluation criteria, provide the substantiation and summarized cross-reference(s) to the bid.

The substantiation should be concise yet sufficiently comprehensive to ensure that the evaluators get a good overall appreciation of the bid's merit relative to the specific evaluation criterion. Cross-references to appropriate sections of the bid should be provided and the essence of the referenced information should be summarised in the substantiation.

For convenience, a Substantiation Table is provided in Table 4A.2 below. Enter each evaluation criterion section number, and the substantiation. It is expected that approximately half a page should be sufficient to make the Bidder's case for the rating chosen in the substantiation column.

Company:	
Project Title:	
Concept Studies and Technology Developments for Lunar Surface Autonomous Science Payloads (LSASP)	
Criteria	
Substantiation	
<i>Ex.: 1</i> <i>(criterion number)</i>	<i>Understanding the technology to fulfill mission objectives - It is expected that 300 words or so should be sufficient to make your case.</i>

Table 4A.2: Substantiation Table

4A.3. EVALUATION CRITERIA AND BENCHMARK STATEMENTS

The evaluation criteria benchmark statements are used by the evaluators as guidelines to justify their score. Bidders should use them to appropriately focus the relevant information to be provided.

4A.3.1 CRITERION 1: UNDERSTANDING THE TECHNOLOGY TO FULFILL MISSION OBJECTIVES

This criterion assesses the degree to which the bid exhibits clear mission objectives as per the SOW and demonstrates an understanding of the fundamental concepts of:

- the technology;**
- the technology's associated systems level design tradeoffs;**
- the technology's usage in the proposed application to meet the identified objectives.**

MINIMUM SCORE OF 50 REQUIRED

<u>Score</u>	<u>Benchmark Statements</u>
0	The bid does not define clear mission objectives in line with the SOW nor exhibit an understanding of the fundamental concepts to meet these objectives.
25	The bid defines a limited set of objectives in line with the SOW and demonstrates only a limited understanding of the fundamental concepts to meet these objectives.
50	The bid defines a general set of objectives in line with the SOW and demonstrates a general understanding of the fundamental concepts to meet these objectives.
75	The bid defines a detailed set of objectives in line with the SOW and demonstrates a detailed understanding of the fundamental concepts to meet these objectives.
100	The bid defines a very detailed set of objectives in line with the SOW covering many or critical aspects of the mission and broadens the review of technological concepts involved as well as of the associated systems level design tradeoffs and of the technology's usage in its application to meet these objectives.

4A.3.2 CRITERION 2: TEAM EXPERIENCE AND CAPABILITY

This criterion assesses the combined technical capability and experience of the key project Scientists/Engineers identified to carry out the work as well as the qualifications and experience of the Project Manager.

<u>Score</u>	<u>Benchmark Statements</u>
0	The bid does not demonstrate that the proposed team has the required skill-set to fulfill all areas of the SOW.
25	The bid demonstrates that the proposed team is missing key capability or expertise to fulfill all areas of the SOW; OR The roles and responsibilities of the team members are not defined.
50	The bid demonstrates that the proposed team is lacking some expertise, but is capable of fulfilling the statement of work; AND Some team members have experience related to design, development and/or operation of related spaceflight software or hardware.
75	The bid demonstrates that the expertise of the proposed team is complementary and that the team is capable of fulfilling the statement of work; AND The roles and responsibilities for key team members, including sub-contractors, are defined; AND Some key personnel have experience related to design and development and/or operation of related spaceflight software or hardware; AND The science team includes representation from at least one Canadian university.
100	The bid clearly substantiates the complementary skills and expertise of the proposed team and demonstrates that it is highly capable of fulfilling the statement of work with the potential of delivering an authoritative concept; AND The roles and responsibilities of all the team members, including all sub-contractors, are defined; AND Some key personnel have significant experience related to design and development and/or operation of related spaceflight software or hardware; AND, The science team includes representation from at least one Canadian universities; AND The bid involves at least one student to perform science, technical, engineering and/or mathematical (STEM) tasks.

4A.3.3 CRITERION 3: IMPLEMENTATION PLAN

This criterion evaluates the project's underlying methodology and the thoroughness of the Implementation Plan. The plan will be evaluated for its completeness, credibility, effectiveness and efficiency.

The Implementation plan required content is specified in Section 3A.5.3 of Attachment 1 of Part 3.

<u>Score</u>	<u>Benchmark Statements</u>
0	The bid has no concrete Implementation Plan and thereby instills no confidence that the project will successfully meet the project objectives.
25	The bid does not provide an adequate Implementation Plan as more than one of the elements are missing or are improperly addressed. Consequently, doubts remain regarding the likelihood of the project achieving successful completion.
50	The bid provides an Implementation Plan with some elements improperly addressed. Consequently, the likelihood of achieving successful completion is marginal OR the plan reveals serious inefficiencies.
75	The bid provides a credible Implementation Plan with all elements covered. Conditions and criteria to be met for each TRL are defined and elaborated. Consequently, the likelihood of achieving successful completion is good. The plan demonstrates a somewhat efficient implementation approach.

- 100 The bid provides a coherent and comprehensive Implementation Plan with all elements covered. Conditions and criteria to be met for each TRL are well defined and elaborated. The plan instills confidence that the project will achieve successful completion. The plan demonstrates an efficient implementation approach.

4A.3.4 CRITERION 4: FEASIBILITY OF PROPOSED SOLUTION IN MEETING THE SCIENTIFIC AND TECHNICAL OBJECTIVES

The criterion assesses the overall feasibility of the proposed technical approach and the degree to which the solution will satisfy the scientific and technical objectives.

MINIMUM SCORE OF 50 REQUIRED

<u>Score</u>	<u>Benchmark Statements</u>
0	The feasibility of the proposed solution or the capability to satisfy the scientific and technical objectives is not demonstrated.
25	The proposal presents a solution which is unlikely to meet either the scientific or the technical objectives.
50	The proposal presents an adequate solution that can meet the scientific and technical objectives.
75	The proposal presents a credible solution that will likely meet the scientific and technical objectives.
100	The proposal presents a sound and convincing solution that can most likely meet the scientific and technical objectives.

ANNEX A STATEMENT OF WORK

A.1 SPACE TECHNOLOGY DEVELOPMENT PROGRAM BACKGROUND

The Space Technology Development Program (STDP) mandate is to formulate, implement and manage contracted out research and development (R&D) projects in response to identified needs. Its objectives are to develop and demonstrate strategic technologies that have a strong potential for reducing technical uncertainties for future Canadian space activities.

The STDP will therefore support the development of technologies to meet the current and future needs of the Canadian Space Program.

A.2 OBJECTIVES

The objective of this Statement of Work (SOW) is to enable the development of Space Technologies that are in line with the Canadian Space Agency's (CSA) priorities and mission roadmaps. For the Priority Technology (PT) specified herein (see APPENDIX A-5 of ANNEX A). The work solicited is the development and advancement of the technology up to potentially TRL 6 (Technology Readiness Levels), (see APPENDIX A-1 of ANNEX A) to reduce technical uncertainties and support approval and implementation of specific potential future space missions of interest to Canada.

A.3 SCOPE

This document provides the requirements and deliverables for projects selected to develop and advance technologies that are critical for the approval and implementation of potential or planned future Canadian space missions.

A.4 PRIORITY TECHNOLOGIES

Priority Technologies are those that have been established by the CSA as the critical or strategic technologies to be developed to meet the objectives of the CSA. Each contract to be awarded is to respond to the Priority Technology specific Statement of Work detailed in APPENDIX A-5 of ANNEX A.

A.5 DOCUMENT CONVENTIONS

A number of 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 rather than a requirement. Such goals or alternatives are to be treated on a 'best efforts' basis, and are subject to verification as requirements are. The actual performance achieved must be included in the appropriate verification report, whether or not the performance goal 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 other than those listed at a-c above.

A.6 GENERIC TASKS DESCRIPTION

This section presents the potential activities that might take place during typical STDP projects and are deemed appropriate within the required TRL range. Tasks will vary for different projects according to targeted TRLs and may include, but are not limited to, the standard project activities listed below in Table A-1: Guideline of Activities. Contractor should use the following guideline table to select the appropriate required activities in order to satisfy the conditions for the targeted TRLs. Technology Readiness Levels (TRLs) describe the standard language of the maturation process for technology development and evolution. TRLs are described in APPENDIX A-1 of ANNEX A.

List of Activities
Project Management *
1. Meetings
▪ Progress Monitoring
▪ Finance Management
▪ Reporting
▪ Preparation of Final Data Package
▪ Risk Management
▪ Configuration management
Sub-Contractor Management
▪ Procurement Plan
Needs Analysis
2. Mission Definition
▪ Definition of Mission Requirements
▪ Environment Definition
3. Technology Drivers and Constraints
▪ Requirements
Obtain Current Mission Documentation, and Technology Requirements
Define further Technology Requirements in terms of functional and performance characteristics
Conceptual Design
▪ Functional Analysis and Allocation
▪ Develop Operations and Development Concepts
▪ Cost Estimates
▪ Schedule Estimates
▪ Risk Analysis
▪ System Studies and Trades
▪ Identify Driving Requirements and Associated Risks
▪ Modeling and Prototyping
Design and Development Plan
Analysis
Simulation
Documentation / technical writing

Concept Design Review
Preliminary Design Review
Critical Design Review
Breadboard Development Plan
Algorithm Development
Define System Failure Modes
Failure Modes Effects and Analysis
Assembly processes development
Process and Test Documentation
Test Data Preparation
Evaluation of Performance
Test System Development
Component test
Acceptance test
Stand-alone functional test
Test procedures and reports
Develop formal specifications and interface control
Fabrication
Assembly and Test
Integration, Testing, Verification & Validation
Compliance
Field Trials and Demonstrations

* CSA considers that nominal project management effort should not exceed 15% of total effort.

Table A-1: Guideline of Activities

A.7 CONTRACT DELIVERABLES AND MEETINGS

This section reviews and describes the contract deliverables and meetings.

Figure A-1 is a guideline, which provides a master Milestone Schedule for typical contract duration of twelve (12) months. The figure highlights a sample schedule for the major meetings and deliverables.

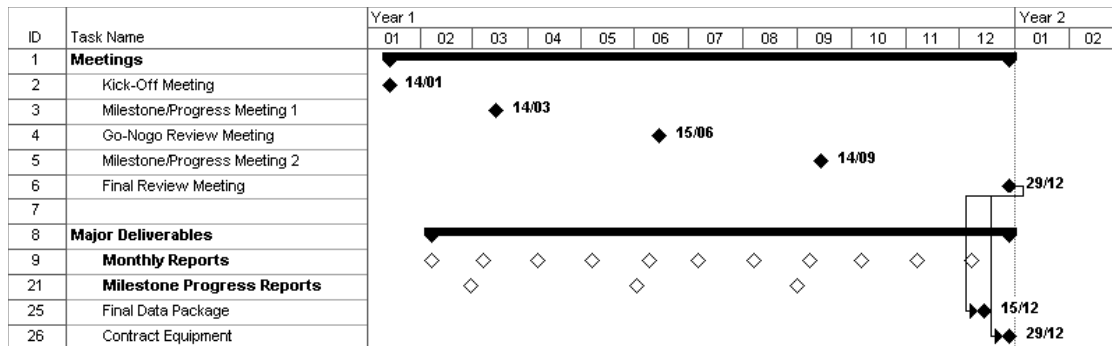


Figure A-1: Sample Meetings and Deliverables Master Schedule

Table A-2 contains the list of meetings, expected items to be covered during those meetings, and the associated contract deliverables. In addition to the mandatory deliverables (CDRL 1 to 16), Priority Technology specific deliverables are identified in APPENDIX A-5 of ANNEX A. All applicable deliverables should be clearly identified in the bid.

CDRL No.	Deliverable	Due Date	Version
1	Meeting Agendas	Meeting – 2 week	Final
2	Kick-off Meeting Presentation	Meeting – 1 week	Final
3	Quarterly or Milestone/Progress Review Meeting Presentation	Meeting – 2 week	Final
4	Final Review Meeting Presentation	Meeting – 2 week	Final
5	Meeting Minutes	Meeting + 1 week	Final
6	Action Items Log (AIL)	Meeting + 1 week	Final
7	Monthly Progress Reports	7 th of each Month	Final
8	Milestone/Progress Technical Report	Meeting – 2 weeks	Final
9	Disclosure of Intellectual Property	End of contract – 2 weeks	Final
10	Executive Report	End of contract – 2 weeks	Final
11	Final Milestone/Progress Technical Report	End of contract – 2 weeks	Final
12	Prototypes *	At Final Review Meeting	Final
13	Equipment (purchased under the contract)	At Final Review Meeting	Final
14	Software	Meeting – 2 weeks	Final
15	Government Furnished Equipment/Data	At contract end	Final
16	Final Data Package	Final review meeting + 1 week	Final
17	Asset Declaration Form – Prototypes and Equipment (APPENDIX A-4 to ANNEX A)	End of contract – 2 weeks	Final

Table A-2: Schedule of Contract Items

* The decision regarding the actual delivery of any prototype is to be made by the CSA upon completion of each contract. Unless the contractor is specifically instructed otherwise, prototypes are, by default, deliverables.

A.7.1 DOCUMENTATION, REPORTING AND OTHER DELIVERABLES

This section contains the lists of deliverables and describes their respective content and format. All documents must be typed and all diagrams must be clearly drawn and labeled. The Contractor must submit an electronic copy of each of the deliverable documents.

Each electronic file must be named in a meaningful manner so as to be easily identified. No specific format is imposed. However, the following element should be considered to ease the identification of the contents in a wider context:

1. Contract reference number;
2. Short project name or acronym
3. Nature of the document (e.g., progress report)
4. Version and/or date

Non-Disclosure

The documents will not be placed in the public domain, except for the Executive and Executive Slides (see A.7.1.3 and A.7.1.4). The Contractor must indicate the following proprietary notices in the Executive Report:

On the cover:

© Contractor, 20XX

RESTRICTION ON USE, PUBLICATION OR DISCLOSURE OF PROPRIETARY INFORMATION

This document is a deliverable under contract No._____. This document contains information proprietary to *Contractor*, or to a third party to which *Contractor* may have legal obligation to protect such information from unauthorized disclosure, use or duplication. Any disclosure, use or duplication of this document or any of the information contained herein for other than the specific purpose for which it was disclosed is expressly prohibited except as Canada may otherwise determine. When the Intellectual Property (IP) is disclosed for government purposes, Canada will take every effort to protect information that is proprietary.

On all internal pages:

Use, duplication or disclosure of this document or any of the information contained herein is subject to the Proprietary Notice at the front of this document.

A.7.1.1 MONTHLY PROGRESS REPORT

On a monthly basis, no later than the seventh (7th) of each month, the contractor must provide monthly progress reports. It is requested that an electronic copy of this report be sent to the Project Authority (PA) and the Technical Authority. Acceptable electronic formats are: MS Word, PDF and HTML. Refer to Section A.7.1 for instructions on how to name electronic documents. Monthly Reports are used by the PA to monitor the work, these reports should be kept as brief as possible, should discuss the progress of the work and should include, but not be limited to, the following information:

- Statement indicating whether or not the project is on schedule and, if not, an explanation for any delays and/or a recovery plan. The report must include an updated schedule showing progress of work and modifications, if any;

Statement indicating whether or not the project is within budget and, if not, an explanation for the deviation from the budget and a proposed recovery plan. The report must include an updated cash flow table showing, for each activity/milestone/Work Package, with start and end dates as well as actual cash flow with actual start and end dates;

- Brief summary of the technical progress of the work for each work package, including:
 - Description of major items developed, purchased or constructed during the reporting period, and
 - List of internal engineering reports produced during the reporting period;
- Summary of the proposed work for the following month, including:
 - Description of major items to be purchased during the next reporting period, including any software packages;
- Summary of problems encountered, their impact on the project and the subsequent solutions proposed or effected; and
- Trip reports for each conference attended or facilities visited in the course of this contract (and only if funded by the contract).

An overall assessment of the project health must be provided at the start of each report. The aim is to have an overview of the project status.

The following information should be included in the following format:

Project Element	Status	Trend	Comment
Cost	Green	↑	
Schedule	Green	↓	
Results / PEC	Red	↔	
Programmatic	Yellow	↑	

The first column identifies the project performance metrics to be assessed, namely **Project Element**. The four metrics to assess are:

- Cost,
- Schedule,
- Results against Performance Evaluation Criteria (PEC), and
- Programmatic.

The Cost, Schedule and Results/PEC metric are quantitative indicators, while the Programmatic metric is qualitative.

The second column of the table is the status for each project element.

The following table provides a definition of the different status with respect to the first three Project Elements.

Status Indicator	Interpretation		
	Cost	Schedule	Technical
Green	On or under planned project total budget	On or ahead of baseline schedule	Meets Performance Evaluation Criteria (PEC)
Yellow	Between 0 and 5% overrun	Between 0 and 5% behind schedule	Does not meet PEC but has approved recovery plan
Red	Greater than 5% overrun	Greater than 5% behind	Does not meet PEC and does not have approved recovery plan

As for the Programmatic element, the status is evaluated based on the status of the three other elements. Although the Programmatic metric takes into account Cost, Schedule and Results/PEC indicators, it is mostly influenced by the most critical element at that point in time in the project.

The third column is an assessment of the trend of the Project metric. The choices are:

Trend Indicator	Interpretation
↑	The status has improved since the last review
↓	The status has worsened since the last review
↔	The status has not changed since the last review

The Fourth column is to provide the opportunity to comment the status and trend of the project element or to provide a general statement.

A.7.1.2 MILESTONE/PROGRESS TECHNICAL REPORTS

The Contractor must submit to the PA and the TA at least two (2) weeks prior to the due date of Milestone and/or Progress Review Meetings, a draft Milestone and/or Progress Report. The PA will review the report and may request changes, as appropriate. The Contractor will then submit the revised version.

The Milestone and/or Progress Report, which must be protected, is to contain a complete description of the work undertaken and results obtained. As such it should include all pertinent technical documents that support engineering, fabrication and/or testing tasks. It should also include an updated version, if applicable, of the Technical and Managerial Plans initially submitted. Moreover, it must provide sufficient details of the work performed to date to enable the PA and TA to perform a full and accurate progress evaluation.

The description of the work undertaken and the results obtained should include:

- Review of technical results and accomplishments;
- Assessment of results with respect to the PEC provided in the bid (supported with the necessary design documents, engineering drawings, test plans, test results and the like);
- A clear identification of the technology advancements required to meet the objectives;
- A detailed description of all equipment purchased during this period;
- All other Contractor's findings prior to the milestones; and
- Changes to the team, Work Breakdown Structure (WBS), level-of-effort, schedule, resource assignment matrix,

A.7.1.3 EXECUTIVE REPORT

The Executive Report will be placed in the public domain (e.g., CSA's library, publication and/or website, to promote the transfer and diffusion of space technologies). The report should not exceed ten (10) pages. Any confidential information concerning potential spin-off and commercialization, or any information that would constitute a public disclosure of the FIP should be placed in the Technical Report.

A recommended structure for the Executive Report is as follows:

- Covering page (as per APPENDIX A-2 to ANNEX A);
- Introduction;
- Technical Objectives;
- Approach / Project Tasks;
- Accomplishments;
- Technology:
- Description / Status of Technology (Initial TRL, Targeted TRL and Actual TRL at completion),
- Innovative Aspects, and
- Application Fields
- Business Potential, Benefit and Impact on Company;
- Ownership of Intellectual Property; and
- Publications / References.

The CSA and the Contractor, or others designated by them, have the right to unrestricted reproduction and distribution of the Executive Report. The report must include the following proprietary notice ("Owner of FIP" being either the CSA or the Contractor):

Copyright ©20XX "Owner of FIP"

Permission is granted to reproduce this document provided that written acknowledgement to the "Contractor name" or the Canadian Space Agency is made.

A.7.1.4 EXECUTIVE SLIDES

The information provided in these summary slides is intended to be placed in the public domain (e.g., CSA's publication and/or website) to promote the transfer and diffusion of space technologies. A two slide PowerPoint template will be provided prior to the end of the project, requesting essentially the following information or material in a succinct form:

- High resolution picture(s)
- Project highlights
- Project value
- Project duration
- Project scope / TRL
- Project Outcomes
- Staff/student involvement
- Supplier contact name
- Consent for publication
- Photo/image credit

A.7.1.5 TECHNICAL REPORT

The report must contain a detailed account of all work performed under the contract. This will enable a full and accurate evaluation of the work by the PA. The report should include, as appropriate, the following:

- a) Covering page (as per APPENDIX A-2 to ANNEX A);
- b) Summary;
- c) Background information and references to relevant documentation;
- d) Review of results and accomplishments;
Where applicable, the following items should be included:
 - A summary of the literature search, with copies of the main publications supplied in an appendix (without infringing upon any copyrights),
 - The system requirements specification and the interface requirements specification,
 - Feasibility studies and identification of technological risks, alternatives approaches, and trade-off analysis results,
 - Design documents,
 - Implementation documents,
 - Test plan and procedures, and
 - Concept demonstration results;
- e) Assessment of results with respect to the Performance Evaluation Criteria. This should support a statement qualifying and/or quantifying three aspects:
 - Performance: the project successfully met and/or exceeded none/few/some/most or all the Performance Evaluation Criteria
 - Impact: the project identified none/few or several potential and/or actual impacts/benefits
 - Success: the project has none/some or significant potential of becoming, or already is, a success story
- f) Technology Readiness Assessment (TRL reached);
- g) Detailed description of all equipment purchased during this period;
- h) All other Contractor findings;

- i) Recommendations including the potential for any further R&D of a follow-on nature;
- j) Conclusion;
- k) Supporting tables, technical drawings and figures;
- l) Any additional relevant information deemed important by the Contractor.

A.7.1.6 CONTRACTOR DISCLOSURE OF INTELLECTUAL PROPERTY

At the end of the contract, a list and descriptions of all BIP required for CSA use of the FIP must be provided at the Final Review Meeting. A list and description of all FIP resulting from project work must also be provided. Furthermore, the Contractor will complete and submit as a stand-alone document entitled "Contractor Disclosure of Intellectual Property", provided in APPENDIX A-3 of ANNEX A. The Contractor must submit an electronic copy of the Contractor Disclosure of Intellectual Property.

A.7.1.7 PROTOTYPES AND EQUIPMENT

All prototypes developed during the Contract must be disclosed to Canada (see Form in APPENDIX A-4) and reviewed by the PA who will advise on their final disposal and/or delivery. Unless and until the contractor is specifically instructed otherwise, prototypes, samples and remaining consumables are, by default, deliverables.

The Contractor should also maintain a list of all non-consumable items procured or fabricated under the contract and/or provided by the government. The Contractor must complete and submit the Asset Declaration Form found in APPENDIX A-4 of ANNEX A. The Contractor will be notified as to how the assets (equipment) should be handled after the PA and TA have reviewed the list.

A.7.1.8 SOFTWARE

The Contractor must provide an electronic copy of all Contractor documents describing the software development cycle, including user, maintenance and operation manuals. The developed software must also be provided in the form of well-documented source code in computer compatible format, with run-time libraries and executable files.

A.7.1.9 FINAL DATA PACKAGE

The Final Data Package is an assembly of final versions of all identified deliverables, technical and programmatic documents, plans and specifications, schematics, part lists, software and engineering data developed during the project. Such package must be delivered at the end of the contract.

A.7.2 MEETINGS

As per Table A-3 below, the Contractor will schedule and co-ordinate with all the relevant stakeholders the following meetings:

- Kick-Off Meeting,
- Milestone Review Meetings,
- Progress Review Meetings,
- Work Authorization Meeting,

- Technical Interchange Meeting, and
- Final Review Meeting.

Meeting	Date	Location
Kick-off Meeting (KOM)	No later than 2 weeks After Contract Award (ACA)	Per specified in specific statement of work of ANNEX A-5
Milestone Review Meetings (MRM)	When specified in specific statement of work (Annex A-5) , typically no more than 4 months apart.	Per specified in specific statement of work of ANNEX A-5
Progress Review Meetings (PRM)	To be held if the maximum interval between Milestone reviews exceeds 4 months	Per specified in specific statement of work of ANNEX A-5
Work Authorization Meeting (WAM)	At the Contract Mid-point. May be held before if deemed critical/relevant. Occurs concurrently with a regular milestone review meeting	Per specified in specific statement of work of ANNEX A-5
Technical Interchange Meeting (TIM)	Variable	Per specified in specific statement of work of ANNEX A-5
Final Review Meeting (FRM)	End of Contract	Per specified in specific statement of work of ANNEX A-5

Table A-3: Meetings and Decision Schedule

For all meetings, the Contractor will:

- Suggest the meeting content and deliver the suggested meeting agenda to the PA and the TA at least ten working days before the meeting;
- Deliver to the PA and the TA, all required reports and technical documents relating to the work about which the meeting is about;
- Record the minutes of the meeting; and
- Deliver one (1) electronic copy of the minutes of the meeting to the PA within five working days after the meeting.

In support of the project meetings, viewgraphs and supporting presentation materials should be prepared. One (1) electronic copy should be presented to the PA. Documented video materials should be prepared by the Contractor along with the supporting visual presentation material to support any demonstration of the technology. A copy of the supporting visual material should be delivered to the PA.

The Contractor may request Ad-hoc Meetings with CSA whenever required to resolve unforeseen and urgent issues. The CSA may also request such Ad-hoc Meetings with the Contractor. The selection of participants will depend on the nature of the issue.

The PA and the TA reserve the right to invite additional knowledgeable people (Public Servants or others under Non-disclosure Agreement) to any meetings. Key Contractor personnel involved in the work under review will attend the following meetings.

The exact location, date and time of the various Meetings will be mutually agreeable to by the PA and the Contractor, while meeting Section A.7.2 MEETINGS.

A.7.2.1 KICK-OFF MEETING

Within two weeks of the contract award (or at a date mutually agreeable to by the PA and the Contractor) a Kick-Off Meeting (KOM) must be held per Section A.7.2 MEETINGS to:

- Submit and review the proposed **Performance Evaluation Criteria (PEC)**. This is a list of criteria that will be used throughout the project to evaluate the Contractor's technological progress. It should be provided in the Contractor's bid, but in any case must be presented for acceptance at the KOM.
- Review contract deliverables;
- Review the requirements of the work;
- Review the work schedules;
- Review risk assessment and mitigation plan;
- Review Work Breakdown Structure and Work Packages;
- Review capability to deliver work packages at agreed cost and schedule;
- Discuss the BIP and review the provided list;
- Discuss the expected FIP and review the provided list (review Disclosure of FIP issues);
- Review basis of payment, and claim format;
- Review reporting requirements;
- Discuss any licensing issues; and
- Meet the personnel assigned to the work.

A.7.2.2 MILESTONE AND PROGRESS REVIEW MEETINGS

Milestone and Progress Review Meetings will be held periodically throughout the life of a Contract to provide formal opportunities for face-to-face information exchanges as well as for progress monitoring discussions and decision making. Nominally, a Milestone Review Meeting will be held at the end-point of each milestone. Between milestones, Progress Review Meetings should also be held if the maximum interval between Milestone reviews exceeds 4 months. These meetings will be scheduled by the Contractor per Section A.7.2 MEETINGS.

The Milestone Meetings and Progress Review Meetings are intended to provide an opportunity for the Contractor, the PA, the TA, and other invited attendees to review and discuss the following in detail:

- The contents of the Milestone and/or Progress Report;
- The current % of completion and accomplishments;
- The technical work of each task;
- The performance results with respect to the PEC;

- Discuss Work Authorization Decisions by CSA, if applicable;
- Discuss relevant results achieved;
- Project management issues; and
- Other items as deemed appropriate.

A.7.2.3 WORK AUTHORIZATION MEETING

A Milestone or Progress Review Meeting will also serve as a Work Authorization Meeting to be held approximately mid-way through the Contract (i.e., when approximately 50% of the contract value has been reached) or as specified in ANNEX A-5. This Work Authorization Meeting will serve as a basis for a decision to be made about whether or not to proceed with the follow-on activities of the Contract. This decision will be based primarily on the review of the achieved PEC in comparison with the PEC accepted at the Kick-Off Meeting and/or as revised at previous Milestone or Progress Review Meetings.

A.7.2.4 TECHNICAL INTERCHANGE MEETING

The Technical Interchange Meetings are meetings occurring on a recurring or sporadic basis with the specific intent to discuss matter of technical nature (mainly). These are particularly suitable for activities that require higher degree of coordination between the Contractor and CSA due to the need for quick practical or technical decisions during the design or construction phases.

These meetings are required only when indicated in the specific statement of work of ANNEX A-5, but can be proposed by the Contractor in any other cases, as deemed appropriate.

A.7.2.5 FINAL REVIEW MEETING

The Final Review Meeting will be held at the end of the contract. The specific intent of this meeting will be to discuss in detail the results obtained (as compared to the PEC agreed-upon at the KOM) and the proposed follow-on activities.

The Final Review Meeting is intended to provide an opportunity for the Contractor, the PA, the TA, and other invited attendees to review and discuss in detail:

- The contents of the Final Data Package;
- The Executive and Technical Reports;
- Contractor Disclosure of Intellectual Property;
- Meeting presentation material;
- Prototypes, technical drawings, hardware, software, equipment, as applicable
- Asset declaration form; and
- Other items as deemed appropriate.

A.7.3 FORMS

The Report Documentation Page (see APPENDIX A-2 of ANNEX A) should be included in both the Executive Report and Technical Report.

Also, the Disclosure of Intellectual Property (APPENDIX A-3 of ANNEX A) must be completed and submitted by the Contractor to reflect the actual status at the end of the contract.

The Contractor must complete and submit the Asset Declaration Form in APPENDIX A-4 of ANNEX A, for which CSA will issue inventory bar codes at the end of the contract. The Contractor will be notified as to how the assets (prototypes and equipment) should be handled after the PA and TA have reviewed the list.

List of Appendices

APPENDIX A-1	Technology Readiness Levels (TRLs)
APPENDIX A-2	Report Documentation Page
APPENDIX A-3	Contractor Disclosure of Intellectual Property
APPENDIX A-4	Asset Declaration Form - Prototypes and Equipment
APPENDIX A-5	Priority Technology and associated specific statement of work

**APPENDIX A-1
TECHNOLOGY READINESS LEVELS (TRLs)**

Source: (CSA-ST-GDL-0001 Revision A - Technology Readiness Assessment Guidelines)

Readiness Level	Definition	Explanation
TRL 1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development.
TRL 2	Technology concept and/or application formulated	Once basic principles are observed, practical applications can be invented and R&D started. Applications are speculative and may be unproven.
TRL 3	Analytical and experimental critical function and/or characteristic proof-of-concept	Active research and development is initiated, including analytical / laboratory studies to validate predictions regarding the technology.
TRL 4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together.
TRL 5	Component and/or breadboard validation in relevant environment	The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.
TRL 6	System/subsystem model or prototype demonstration in a relevant environment (ground or space)	A representative model or prototype system is tested in a relevant environment.
TRL 7	System prototype demonstration in a space environment	A prototype system that is near, or at, the planned operational system.
TRL 8	Actual system completed and "flight qualified" through test and demonstration (ground or space)	In an actual system, the technology has been proven to work in its final form and under expected conditions.
TRL 9	Actual system "flight proven" through successful mission operations	The system incorporating the new technology in its final form has been used under actual mission conditions.

Table A-1-1: Definition of Technology Readiness Levels

APPENDIX A-2


<p>Canadian Space Agency Agence spatiale canadienne</p>	<p>REPORT DOCUMENTATION PAGE</p>	
Report Date:		
Title:		
Author(s):		
Performing Organization(s) Name and Address(es):		
Contract # and Title:		
Sponsoring Agency Name(s) and Address(es): Canadian Space Agency 6767 Route de l'Aéroport Saint-Hubert, Québec, Canada J3Y 8Y9 Tel: (450) 926-4800		
Scientific Authority:		
Project Manager:		
Abstract:		
Key Words:		
Supplementary Notes:		
Distribution/Availability:		

Table A-2-1: Template for Report Documentation Page

APPENDIX A-3
Contractor Disclosure of Intellectual Property

Instructions to the Contractor

Identification

The Contractor must respond to the 7 following questions when Foreground Intellectual Property (FIP) is created under the Contract with the CSA.

1. Contractor Legal Name:
2. Project Title supported by the Contract:
3. CSA Project Manager of the Contract:
4. Contract #:
5. Date of the disclosure:
6. Will there be Contractor's Background Intellectual Property brought to the project:
 - Yes - Complete Table A-3-1 attached (Disclosure of Background Intellectual Property)
 - No
7. For Canada's owned IP, are there any IP elements that, to your opinion, would benefit from being patented by Canada?
 - Not applicable, FIP resides with the Contractor
 - Yes - Complete Table A-3-3 attached (Canada's Owned Additional Information)
 - No

<p><i>For the Contractor</i></p> <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p><i>Signature</i></p>	 <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p><i>Date</i></p>
<p><i>For the CSA Project Manager</i></p> <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p><i>Signature</i></p>	 <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p><i>Date</i></p>

BIP

- At the end of the Contract, the Contractor must review and update the BIP disclosure (Table A-3-1 Disclosure of Background Intellectual Property (BIP) brought to the project by the Contractor) when applicable before closing of the Contract. Only the BIP elements that were used to develop the FIP elements should be listed.

FIP

- At the end of the Contract, the Contractor must complete Table A-3-2 (Disclosure of the FIP developed under the Contract).
- 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 A-3-3 (Canada's Owned FIP Additional Information).
- The Contractor must sign below and deliver the completed Contractor Disclosure of Intellectual Property to the CSA Project Authority of the Contract for his/her approval before closing the Contract.

General Instructions for BIP and FIP tables

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

<u>Definitions</u>
<u>Intellectual Property (IP)</u> : means 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.
<u>Background Intellectual Property (BIP)</u> : IP that is incorporated into the Work or necessary for the performance of the Work and that is proprietary to or the confidential information of the Contractor, its subcontractors or any other third party.
<u>Foreground Intellectual Property (FIP)</u> : IP that is first conceived, developed, produced or reduced to practice as part of the Work under the Contract.

Table A-3-1. Disclosure of Background Intellectual Property (BIP) brought to the project by the Contractor

1 BIP ID#	2 Project Element	3 Title of the BIP	4 Type of IP	5 Type of access to the BIP required to use/improve the FIP	6 Description of the BIP	7 Reference documentation	8 Origin of the BIP	9 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 prime contractor.

Table A-3-2. Disclosure of the Foreground Intellectual Property (FIP) developed under the Contract

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

Table A-3-3. Canada's Owned FIP Additional Information

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

**APPENDIX A-4
ASSET DECLARATION FORM - PROTOTYPES AND EQUIPMENT**

Equipment Declaration: The Contractor must fill out the following form so as to identify all equipment procured under this contract.

Equipment #	Equipment description	Inventory #	Acquisition Value	Currency	Acquisition date	Manufacturer	Country	Model #	Serial #

Table A-4-1: Equipment Declaration Form

Prototype List: The Contractor must provide a list of all prototypes developed under this contract.

Prototype Name	Prototype description

Table A-4-2: Prototype Declaration Form

The decision regarding the delivery of any prototype is to be made by the CSA at the end of each contract completion.

APPENDIX A-5

PRIORITY TECHNOLOGY AND ASSOCIATED SPECIFIC STATEMENT OF WORK

Priority Technology Title
Lunar Surface Autonomous Science Payloads (LSASP)

Table A-5-1: Priority Technology

Priority Technology (PT)

Lunar Surface Autonomous Science Payloads (LSASP)

Lunar Surface Autonomous Science Payloads

1. List of Acronyms

BIP	Background Intellectual Property
CDRL	Contract Data Requirement List
CSA	Canadian Space Agency
CTE	Critical Technology Element
DDR	Detailed Design Review
EDU	Engineering Development Unit
ESA	European Space Agency
FTP	File Transfer Protocol
GER	Global Exploration Roadmap
GSE	Ground Support Equipment
HERACLES	Human Enhanced Robotic Architecture and Capability for Lunar Exploration and Science
KOM	Kick-Off Meeting
IR	Initial Release
ISRU	In Situ Resources Utilization
ITAR	International Traffic in Arms Regulations
LIBS	Laser Induced Breakdown Spectroscopy
LiDAR	Laser Imaging, Detection And Ranging
LSASP	Lunar Surface Autonomous Science Payloads
LSM	Lunar Surface Mobility
NASA	National Aeronautics and Space Administration
NIR	Near InfraRed
PDR	Preliminary Design Review
RFP	Request For Proposal
RSI	Remote Standoff Instrument
SIPs	Scientific Investigation Priorities
SOW	Statement of Work
TIM	Technical Interchange Meetings
TL	Technology Readiness Level
TRM	Technology Road Map
TRR	Test Readiness Review
TRRA	Technology Readiness and Risk Assessment
UVIS	Ultra Violet & Infrared Spectrometer
VCM	Verification Compliance Matrix
WAM	Work Authorization Meeting
WP	Work Package

2. Applicable documents

This section lists the documents that are required for the bidder to develop the proposal. The applicable documents listed below can be obtained from the following File Transfer Protocol (FTP) sites:

AD No.	Document Number	Document Title	Rev. No.	Date
AD-1	CSA-ST-GDL-0001	Technology Readiness and Risk Assessment Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/	D	March 2019
AD-2	CSA-ST-FORM-0003	CTE Identification Workbook ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/	B	March 2019
AD-3	CSA-ST-FORM-0003	CTE Identification Workbook – Example ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/	B	March 2019
AD-4	CSA-ST-FORM-0004	TRRA Summary Report ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/	Rev 2	March 2019
AD-5	CSA-ST-RPT-0003	Technology Roadmap (Excel) ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRM/	A	Sept 2012

3. Reference documents

This section lists documents that provide additional information to the bidder, but are not required to develop the proposal.

RD No.	Document Number	Document Title	Rev. No.	Date
RD-1	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6th Edition	2017
RD-2	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard ftp://ftp.asc-csa.gc.ca/users/TRP/pub/SE-STD/CSA-SE-STD-0001%20A%20Technical%20Reviews%20Standard%20Signed%20(EN).pdf	A	Nov 7, 2008
RD-3	CSA-SE-PR-0001	CSA Systems Engineering Methods and Practices ftp://ftp.asc-csa.gc.ca/users/TRP/pub/SE-STD/CSA-SE-PR-0001-RevB.pdf	B	Mar 10, 2010
RD-4	CSA-SPEX-GDL-001	CSA SE Scientific Readiness Level Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Science-Definition-Studies/2017	Draft 2.0	June, 2017
RD-5	N/A	Global Exploration Roadmap (GER) https://www.globalspaceexploration.org/wordpress/	3rd Edition	Feb 2018
RD-6	JPL D-26359	NASA Planetary Data System Proposer's Archiving Guide https://pds.nasa.gov/home/proposers/Mission-Proposers-Archive-Guide-v4-r5.pdf	Version 1.4	21 September, 2016
RD-7	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/		2018
RD-8	N/A	Eclipse Official Web Site http://www.eclipse.org/	N/A	2018
RD-9	N/A	Mylyn WikiText https://wiki.eclipse.org/Mylyn/WikiText	N/A	2018

RD No.	Document Number	Document Title	Rev. No.	Date
RD-10	MTB-8-41028 (545)	9F050-170986/A LSM PHASR Phase 0 RFP https://buyandsell.gc.ca/cds/public/2018/06/20/a4ced8c91deaa3accf2aaa841fefe b7a/ABES.PROD.PW_MTB.B545.E1492 1.EBSU000.PDF	IR	June 2018
RD-11	ISBN 0-521-33444-6	Lunar Source Book: A User Guide To The Moon, Grant H. Heiken, David T. Vaniman, Bevan M. French	IR	April 1991

4. Background

Robotics and in-situ human exploration of the surface of the Moon is a high priority topic in the context of beyond Low Earth Orbit. Space Agencies around the world are collaborating in fostering the next steps for the global exploration strategy to explore the Moon robotically and through a series of crewed missions to learn about the formation of the solar system, the Moon itself and the Earth as described in the Global Exploration Roadmap (GER) (RD-5).

Planetary sciences are a well-established priority for the CSA and the Canadian space exploration stakeholder community. In 2017, the CSA conducted consultations with the stakeholders from the Canadian space community to document Canadian scientific priorities. The outcomes of these consultations were highlighted in the report: *Canadian Space Exploration: Science & Space Health Priorities for Next Decade and Beyond* (RD-7). Based upon these distilled Canadian priorities and in the context of this Statement of Work (SOW), the CSA is focusing on lunar related Science Investigation Priorities (SIPs) and objectives. In parallel with these activities, a suite of missions are being planned internationally over the next decade; offering flight opportunities for Canada to provide payloads. These opportunities include smaller payload contributions on commercial flights to larger robotics contributions on Lunar Surface Mobility (LSM) robotics missions.

5. Targeted Missions

As introduced in section 4, a number of government and commercially led missions to the Moon are planned before the end of the 2020s. For planning purposes, a launch as early as 2021 could be considered, but a target before 2025 launch should be planned. Target landing sites anywhere on the lunar surface can be considered. Missions will have planned lifetimes ranging from several Earth days to extended missions lasting several years (i.e. capability to survive the lunar night). In this context, the contractor must provide the referenced mission and demonstrate how the proposed capability(ies) will meet critical objectives of the mission.

6. Scope of Work

The scope of work defined herein complements Section A.6 Generic Tasks Description of Annex A, and it consists first in producing a concept for one or multiple science mission enabling capabilities that respond to the identified needs and priorities of the CSA and the Canadian space science community. Then, upon delivery of a sound and approved concept, proceed with related technology development, prototyping or customize an existing proven technology to advance its Technology Readiness Level (TRL).

For the purpose of this request for proposals (RFP), the Lunar Surface Autonomous Science Payloads (LSASP) are defined as highly visible science mission enabling capabilities in the form of payload, instrument or mission sub-systems or component either static or mobile further detailed in section 7 with the proper level of autonomy to successfully perform its key contribution to a clearly identified mission on the surface of the Moon. This implies that the LSASP must comply with the lunar environment in accomplishing its mission such as being subject to extreme temperature variations, permanently shadowed area throughout the lunar night and; regolith and radiation exposure of the lunar surface. Either equatorial or polar landing sites are possible, but for the benefit of the majority of the currently planned missions: focusing on scientific exploration of the Moon and In-Situ Resource Utilization (ISRU), polar destinations, in particular, the far side south pole destination are the most likely destinations of interest and the primary targets according to the GER (RD-5).

Critical aspects of LSASP are their capability to fulfill mission requirements while minimizing mass, volume and power. It is then very important to consider the capabilities and SIPs that the proposed LSASPs will address versus their footprint on the mission. Another important element is to assume that a communication relay (e.g. Gateway as of 2024) will be provided for LSASP to communicate with the Earth on a given schedule that depends on the host mission. Other commercial missions also offer the capability to use the lander as a relay station and a direct to Earth telecommunication scenario. An end-to-end concept of the LSASP must include a detailed description of the proposed capability(ies) either it is a static or provides its own mobility implementation, the interfaces to the applicable platform, science payload, ground segment (as applicable) and science data analysis from pre-phase A through to disposal of the spacecraft. As mentioned, mass, volume and power are the critical constraints and must be specified as requirements for the study and prototyping.

The overall scope of work for this RFP is that the contractor must perform the following:

- a. Demonstrate the link between the proposed concept and technology development and the list of objectives and how the proposed element will contribute in fulfilling the SIPs for Lunar exploration as outlined in RD-7 and proposed a significant impact for Canada on the selected mission or suite of mission opportunities. At least one concretely planned mission must be referenced and the contractor must demonstrate that the LSASP will contribute in a significant manner to the mission for Canada inline with the SIPs.
- b. Develop a detailed concept for the identified targeted SIPs and describe the proposed solution, its operational concept and how it fits into the targeted mission(s) objectives, its feasibility, cost, schedule, constraints, business case, TRL assessment and up to a flight implementation.
- c. Upon approval of the concept, develop a design for the selected LSASP prototype including trade studies and rationale for the selection of the option that will be implemented.
- d. The resulting proposed design will be substantiated by complete thermal analysis, modeling and validation in laboratory.

- e. Implement the design into a functional prototype.
- f. Test the prototype in a lunar representative laboratory environment in accordance with the mission definition and targeted TRL.
- g. Demonstrate its usage in a relevant operational scenario (operational demonstration in a relevant environment).
- h. Produce any documentation, supporting simulations, analyses, modeling, etc. and deliver these to the CSA in accordance with the DIDs (Section 11 – Data Item Descriptions) throughout the project.

In addition to the above mentioned elements, the contractor must perform a Technology Readiness and Risk Assessment (TRRA) of key technologies foreseen to be used in the proposed system in accordance with the requirements of CSA Technology Readiness and Risk Assessment Guidelines (AD-1) and prepare a TRRA Summary Report (AD-4), using the Critical Technology Elements (CTE) Identification Criteria Workbook (AD-2 and AD-3) for each CTE, and must describe the performance characteristics of the technology with respect to the needs of the targeted mission for the given target environment.

The contractor must provide a Technology Development Plan, a.k.a. Technology Roadmap (TRM), including the required technology developments to meet targeted mission needs, and a plan and timeline to reach TRL 6 and 8. The Technology Roadmap must be provided in the format of the Technology Roadmap Worksheet (AD-5).

The purpose is to fully understand where current progress technologically towards creating this system, and what the technology path to flight looks like, its different phases, and the expected implementation cost and schedule.

6.1. Concept Study Tasks Description

The initial set of tasks is to perform a detailed concept study that can be subdivided into four major Work Packages (WPs). Each WP has one or more associated major tasks. Figure A-5-1 describes the Work Breakdown Structure (WBS):

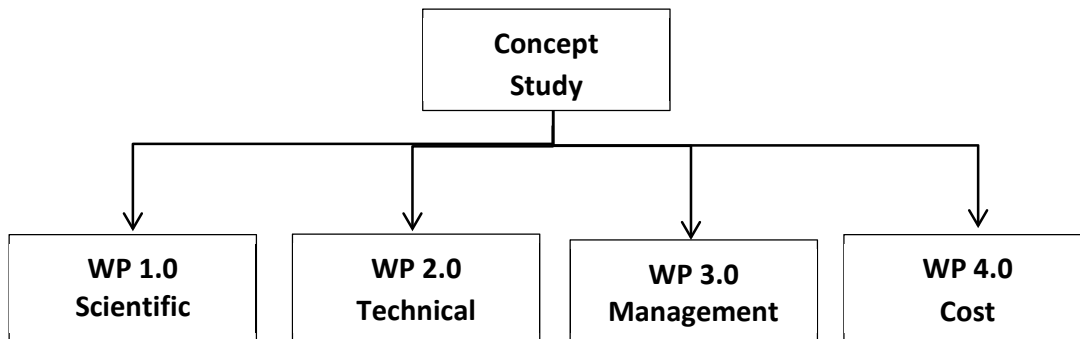


Figure A-5-1: Work Breakdown Structure (Top Level)

6.1.1. WP 1.0 Scientific

This WP must include the development and documentation of:

1) Scope of the proposed investigation with respect to the mission

- a) Science investigation goals and objectives that address CSA program goals and Canadian scientific objectives identified in Table A-5-2.
 - i) Reference landing site information is required.
- b) Preliminary measurement and operations concept:
 - i) Nominal science operations timeline
 - ii) Nominal commissioning and calibration operations activities
- c) Mission success criteria

2) Traceability of proposed investigation

- a) The flow-down from the science investigation goals and objectives, to measurement objectives that constitute the baseline investigation, to the data to be returned, and the instrument or experiment complement to be used in obtaining the required data.
 - i) To be presented in a science traceability matrix and supported by narrative discussion.
- b) The mission requirements that the science investigation goals and objectives impose on the mission design elements, including mission design, instrument accommodation, spacecraft design, required launch vehicle capability, ground systems, communications approach, and mission operations plan. Specific information that describes how the science investigation imposes unique requirements on these mission design elements must be included, including contamination control and planetary protection requirements if applicable to the proposed mission capability (ies).
 - i) To be presented in a Mission traceability matrix and supported by narrative discussion.
Examples of a Science Traceability Matrix and a Mission Traceability Matrix are given in Table A-5-3 and Table A-5-4, along with examples for elements in such matrices.

Table A-5-2: List of Scientific Objectives

Topic	Objective
Planetary Atmospheres (PAT)	PAT-04 Understand atmospheric and exospheric aerosols
Planetary Geology, Geophysics and Prospecting (PGGP)	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)	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 effects which create hazards to space exploration

Table A-5-3: Example Science Traceability Matrix

Science Goals	Science Objectives	Science Measurement Requirements		Instrument Functional Requirements		Projected Performance	Mission Functional Requirements (top level)
		Observables	Physical Parameters				
Goal 1	Objective 1	Absorption line	% abundance of absorber	Vertical resolution	XXkm	ZZ km	Observing strategies: requires yaw and elevation manoeuvres (orbiter), or, traverse and instrument positioning (rover)
		Morphological feature	Size of feature	Horizontal resolution	XX deg x XX lat x XX lon	ZZ deg x ZZ lat x ZZ lon	
		Rate of change of observable phenomenon	Duration of event	Temporal resolution	XX min	ZZ min	
				Precision	XX K	ZZ K	
					Accuracy	XX K	ZZ K
	Objective 2 to N			Repeat above categories			
Goal 2	Repeat above categories						

Table A-5-4: Example Mission Traceability Matrix

Mission Functional Requirements	Mission Design Requirements	Spacecraft Requirements	Ground System Requirements	Operations Requirements
From Table X	Launch date Mission length Landing site requirements and rationale Spatial coverage and how it drives surface mobility system range Other	Robotic surface system Pointing or Position Control: knowledge, stability, jitter, drift, other Mass Volume Power Data rate Autonomy Detector radiation shielding Other	Passes per day & duration Data volume per day Transmit frequency Power available for communication Downlink data rate Number of data dumps per day Spacecraft data destination (ground control centre) Science data destination (science operations centre)	General robotic surface system manoeuvre reqts Special manoeuvre reqts and rationale Changes in operations modes over time: by day, season, other, and rationale Target planning on 3 day centres
Instrument X precision of 5K		Thermal stability of 1 degree /hr Bus stability of 0.01degree /10 s	Bit error rate better than 1e-5 Time correlation of 1 msec over 1 week	Weekly time correlation

3) Investigation objectives and requirements

4) Baseline and threshold investigations

- a) Baseline and threshold science investigations with a clear description of the loss of science on de-scope from baseline to threshold requirements. Threshold investigations represent a minimum science return below which it is not worth flying the mission.
- b) Augmented science investigations which describe enhancements that add capabilities to the mission, should resources be available, may be described.

5) Preliminary science plan

- a) Including science development needed to calibrate, analyze, publish, and archive the returned data, and plans forward for this work.
- b) The data plans must discuss and justify any period of exclusive access to the data. The Government of Canada and international partners subscribe to open data policies and it is a requirement that data be publically archived.
 - i) Approach to science requirements validation/verification
 - ii) Approach to calibration and characterisation
 - iii) A schematic of the data product development plan, including data products to be archived to the NASA PDS standard (RD-6).
 - iv) An assessment of the feasibility of the data product development plan
 - v) Pre-phase A preparatory activities for science development and data analysis
 - vi) Preliminary description and schedule of phase A-E science development activities
 - vii) Preliminary budget phase A-E for science activities sufficient to carry out the science plan
 - viii) Assessment of current science capability in Canada, and needs for capacity building
- c) Approach to science dissemination
- d) Science Readiness Level self-assessment, based on RD-4.

The work to complete this WP may include science development activities such as data analysis or modelling. All the results must be documented in the Concept Study Report.

6.1.2. WP 2.0 Technical

This WP includes the development and documentation of the technical aspects of the study. The contractor must provide the following information in the Concept Study Report.

- a. Science Payload Conceptual Design: The contractor must ensure that key and driving functional and performance requirements necessary for the baseline mission are captured and that the concept is designed to meet these requirements. A description of the proposed mission architecture must be provided, including high level schematics of:
 - Mechanical system and interfaces
 - Electrical system and interfaces
 - Flight software
 - Ground segment for baseline mission

The contractor must detail preliminary system budget estimates for mass, volume, power, thermal, software/processing, and, data communications for the baseline mission. Additionally, to the extent possible, preliminary environmental requirements assumed in this study, for operations and qualification, should be provided with justification.

- 1) Preliminary environmental requirements assumed in this study, for operations and qualification, with justification.
- b. Preliminary Concepts and Options: The contractor must provide an initial concept including potential options in accordance with the requirements provided and derived. The overall mission operations concept must be provided which clearly addresses the assumptions and constraints related to:
 - 1) Planetary environment
 - 2) Mission interfaces and architecture
 - 3) Life cycle and mission duration
 - 4) Prescribed launch envelope and allocation
 - 5) Preliminary design reference mission and overall mission conceptThis must include the production and delivery of analyses, simulations, and related inputs and their delivery, as part of the concept study to substantiate the concept being proposed.
- c. Development, Manufacturing and Qualification Approach
 - 1) The contractor must provide an overview of the development approach, potential key subcontractors, and the general strategy best suited for this approach. The contractor must also list the major tasks required in the development and manufacturing cycles and identify the potential long lead items. The contractor must provide the preliminary verification plan, qualification approach, and any assumptions made.
- d. Simulation of the proposed concept and associated prototype
 - 1) The contractor must provide a simulation of the proposed concept and its prototype to be used in the context of the Apogy system as described in DID-0012.
- e. Technology Readiness and Risk Assessment (TRRA) and Technology Roadmap (TRM).
 - 1) The TRRA is used to assess project status and technical risks, and to guide definition of risk reduction work in the current and following phases. The contractor must perform a TRRA in accordance with the requirements of the CSA Technology Readiness and Risk Assessment Guidelines to formally document the technology status. The same TRRA must be updated during the prototyping phase as applicable.
 - 2) The contractor must also provide a Technology Development Plan, also known as Technology Roadmap (TRM), including the required technology developments to meet component needs, and a plan and timeline to reach TRL 6 and 8. The TRM must be updated during the prototyping phase as applicable.

6.1.3. WP 3.0 Management

The management work package includes work needed to complete the following tasks:

- a. A preliminary schedule for the overall life cycle of the concept
The contractor must prepare a preliminary schedule relative to the overall life cycle of the concept. The project schedule prepared by the contractor must provide a graphical representation of predicted tasks, milestones, dependencies, resource requirements, task duration, and deadlines.
The timeline must include key milestones corresponding to, for instance, Preliminary Design Review (PDR), Detailed Design Review (DDR), hardware delivery, readiness for integration

and launch. The project’s master schedule must inter-relate all tasks on a common time scale and be in the form of a Gantt chart.

The project schedule must be detailed enough to show each WBS task to be performed, the resources required for completing the task, the start and end date of each task, the deliverables, the long lead items, the expected duration of the task, and finally the critical path. The flight project schedule must be presented in the management report with a Gantt Chart and with a table with all significant milestone dates.

b. A Preliminary Mission Risk Assessment

The contractor must provide a preliminary technical, schedule, cost and programmatic risks assessment. For each risk identified, the contractor should identify the phase of the components to which the risk applies, the likelihood of occurrence, the impact should the risk occur, and any possible mitigation actions that may be taken to decrease either the likelihood or the impact before the components or the phase starts. Specific mitigation actions must be identified for high risks at this time. Contingency plans (i.e., identifying alternative strategies) must also be developed for high risks, or when it is uncertain that mitigation plan will be effective. This general risk assessment must also consider access to information issues, like Export Control (International Traffic in Arms Regulations (ITAR)) and others as potential risks.

c. A Preliminary Business Case

The contractor must provide a narrative cost/benefit analysis that could justify government investment in the proposed contribution. This should include a discussion on future business opportunities and benefits to Canada, industry and academia directly derived from the work, quantitative estimates of number of HQP whose expertise would be enhanced as a result of the mission broken down by type: engineering staff, faculty, postdoctoral fellows, PhD students, MSc students; quantitative estimate of scientific journal articles produced as a result of this mission, and a discussion on possible spin-off products, including markets. A brief commercialisation plan should be provided where further commercial business opportunities and/or spin-off products are identified, including an estimate of the potential market and markets that would purchase their product. Finally, the contractor should compare the baseline mission option with several (e.g. 2) possible mission implementations with varied life cycle costs, cost vs. benefit, risk, spaceflight heritage, attainment of desired business outcomes, etc. The options analysis discussion should be accompanied by a table such as the representative one displayed in Table 4 and the contractor should the use of other relevant factors which demonstrate differences or similarities amongst the options being compared (additional criteria will also be defined in collaboration with CSA over the course of the study).

Table A-5-5: Representative Options Analysis Table

Option	Business Outcomes	Cost (Life Cycle)	Cost vs. Benefit	Development Timeline	HQP	Risk	Heritage	Other
1	Strong, weak...	\$	Low, high...	Short, long...	Low, high...	High, low...	None, some...	

2								
3								

- d. A proposed high level plan for public engagement
The contractor must propose a plan to promote the science and engineering accomplishments of the mission in a manner that can be understood by the general public. It must also demonstrate how the involvement of all the Canadians can be maximised and direct and subsequent benefits be implemented.
- e. Canadian Capabilities Development
 - 1) The contractor must provide an overview of its strategy to develop and maintain Canadian capabilities. This includes an assessment of current science and industrial capability in Canada, and needs for capacity building.
 - 2) If the overall approach of the contractor implies technology transfer and partnership with foreign entities to develop the Canadian capabilities, the contractor must specify teaming arrangements, Intellectual Property (IP) ownership issues, royalties, etc., as well as opportunities that this partnership would open.
- f. Intellectual Property Management
The contractor must identify the Background Intellectual Property (BIP), the IP that will be generated, and the owners of these BIP and IP and how it will be managed and coordinated among the various collaborators and entities involved. This must be documented per Appendix A-3 instructions.

6.1.4. Cost Estimates

The contractor must provide cost estimates as per Table A-5-6 for all phases leading to the development, qualification, implementation, launch, operation and disposal of the hardware/software/instruments resulting from the concept. Each cost estimate must be substantiated by describing the methodology used for each (e.g., bottom-up, analogous, parametric, etc.) and any assumptions made for the derivation. The cost estimates must include planned activities.

Table A-5-6: Cost

		Prior to Mission	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
Labour	Management							
	Science Team (instrument support)							
	Technology Development							
	Design							
	Documentation							
	Reviews							
	Manufacturing							

		Prior to Mission	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
	Assembly							
	Testing							
	Product Assurance							
	Operations							
	Total Labour							
Non-Labour	Hardware/Software Procurement							
	Tools, Equipment & Facilities							
	Science Team equipment & supplies							
	Travel & Living							
	Overhead							
	Total Non-Labour							
Risk	Risk Contingency							
Science team (grants including overhead)								
Total								
Total all Phases								

The contractor must provide an estimate of the anticipated percentage of Canadian content relative to the overall cost. The contractor should recommend options that could be undertaken to maximize the Canadian content, and their corresponding impacts and benefits.

6.2. Prototyping Tasks Description

Once the concept study is completed and accepted by CSA, the contractor must build a prototype of the proposed LSASP. The standard phases are to be followed as described previously in section 6. The bid should therefore cover all relevant technical, management and financial aspects required in this RFP.

The prototype will be developed and tested in accordance with the established requirements defined in the concept phase and in accordance with the SOW. Supporting analyses and simulations data are considered deliverables to the contract along with the prototype and supporting equipment as described in the DID's section of this SOW.

7. Functional Characteristics & Performance Requirements

As an initial criteria or requirement, the Lunar Surface Autonomous Science Payloads (LSASP) initiative, as introduced previously, must address one or more of the scientific objectives

presented in Table A-5-2. In addition, it must address technologies and mission priorities that respond to one or multiple of the following areas:

- a. Remote Stand-off Instruments or Payloads (RSI) referred as the LSASP RSI:
This category denotes an instrument mounted either on a lander or a rover deck or a mast that enables remote and non-contact scientific and/or technological data gathering that will contribute to significantly advancing the topics listed in Table A-5-2. The rationale for such an instrument is direct scientific data collection or the capability to improve the efficiency of an overall mission timeline by interrogating the environment from a distance to provide a rapid assessment for the science and operations team to take efficient and timely mission decisions. For instance, in the context of the employment of a rover for a sample return mission, if remote stand-off instruments can be used to select the most suitable samples for collection (rather than direct-contact instruments which would require the positioning of the rover and the subsequent positioning of a manipulator to assess all potential samples) then considerable operations time and efficiencies can be gained. Instrument types should consider, but not be limited to, the following categories: remote imagers, spectrometers (UVIS, NIR), laser spectroscopy, such as, RAMAN, LiDAR, LIBS. Recent technology developments have demonstrated that data fusion of a multi-sensor system augmented with traditional navigation systems would provide significant advancements in determining the best target and optimizing mission timelines.

- b. LSASP Lunar Rover (LR), referred as LSASP LR:
LSASP LR denotes a micro or nano rover system equipped with smart capabilities and instruments to maximise science outcomes either as part of a core mission or additional capabilities as secondary payload for the landed mission. The contractor must provide at least one complete micro or nano rover science payload suite as part of the proposed mission concept. This should include the concept of minimum threshold, baseline and augmented payloads.

- c. LSASP Advance Data processing Package (ADP), referred as LSASP ADP:
LSASP ADP denotes advanced data processing systems including data fusion, autonomous target selection, autonomous navigation and application of artificial intelligence techniques that would significantly improve the operations efficiency and scientific outcomes. The contractor must describe the data set to be used during prototyping development and relationship of the target advanced data products to the science objectives of the RFP. If the intent is to develop a stand-alone data processing package, the contractor must also discuss the feasibility of integrating a stand-alone advanced data package with a mission sensor suite that has been selected in advance from other providers.

For any of these categories, the contractor must demonstrate the context of the selected capability (ies) and how it will fulfill the objectives of a given mission or suite of missions. Multi-mission usage and adaptability is also an important factor to consider.

7.1. Environmental Requirements

As introduced, the targeted environment is the lunar surface and includes the equatorial or polar regions. The requirements in this section will then reflect this reality and are to be applied with respect to the mission objectives and be refined as part of the study.

- LSASP-PRF-01** **LSASP ops:** The LSASP should operate a minimum of 1 year at the surface of the Moon at the pole.
- LSASP-PRF-02** **LSASP shadow ops:** The LSASP should be fully operational with sufficient power and thermal resources for a minimum of 3 consecutive hours in a permanently shadowed lunar environment.
- LSASP-PRF-03** **LSASP Extended Lunar survival:** The LSASP should survive multiple lunar day and night cycles as per its operational life requirements.
- LSASP-PRF-04** **LSASP Sun and shadow:** The LSASP must survive while having a portion subjected to direct sunlight and another part exposed to the cold surface of the lunar environment.
- LSASP-PRF-05** **LSASP Regolith:** The LSASP must withstand bombardment and accumulation of small-particle dust/lunar simulant.
RATIONALE: Lunar regolith has at minimum the following negative impacts:
1. Accumulates onto surfaces;
 2. Changes/degrades thermo-optical properties of thermal control designs;
 3. Impinges on movable parts and clogs/damages moving mechanisms;
 4. Prevents seals from closing properly;
 5. May cause false reading of sensors;
 6. Remains in spots and may be impossible to clean off completely.
- There is a wide range of particle sizes in the regolith down to nano-particle sized dust. Regolith and dust can have magnetic properties and electrostatic charges (e.g. they can be charged by the solar wind). The particle shapes are very different from those typical of Earth, being more extended and jagged due to a lack of weathering.*
- LSASP-PRF-06** **LSASP Vacuum Environment:** The LSASP must be proved capable of operating in a vacuum environment at a pressure not higher than 10^{-7} Torr.
- LSASP-PRF-07** **LSASP Radiation Environment:** The LSASP must be able to achieve its mission withstanding radiation exposure at the targeted mission locations.

7.2. Systems Requirements

- LSASP-SYS-01** **LSASP Volume Allocation** The LSASP must be contained in the volume allocation prescribed by the mission selected.
A clear volume allocation must be defined as part of the concept phase and will become a requirement for the flight unit and prototype development.
- LSASP-SYS-02** **LSASP Mass Allocation:** The LSASP mass must be within the allocation prescribed by the mission selected.
A clear mass allocation must be defined as part of the concept phase and will become a requirement for the flight unit and prototype development.
- LSASP-SYS-03** **LSASP Power Allocation:** The LSASP required power must be within the allocation prescribed by the mission selected and compatible with terrestrial assets, e.g. rovers for the prototype.
A clear power allocation must be defined as part of the concept phase and will become a requirement for the flight unit and a terrestrial compatible power must be established for the prototype development.

- LSASP-SYS-04** **LSASP Data Allocation:** The LSASP required data budget must be within the allocation prescribed by the mission selected and compatible with terrestrial assets, e.g. rovers for the prototype. *A clear data budget allocation must be defined as part of the concept phase and will become a requirement for the flight unit and a terrestrial compatible data interface must be established for the prototype development.*
- LSASP-SYS-05** **LSASP Science Performance:** The LSASP must perform its function in compliance to Science Traceability Matrix requirements for the selected mission. The Science Traceability Matrix requirements will be approved upon confirmation of the concept (at the WAM).
- LSASP-SYS-06** **LSASP RSI Distance:** The LSASP RSI must be capable of accomplishing its function up to a distance of 3 m away from the instrument base as a minimum.
- LSASP-SYS-07** **LSASP LR Functions:** The LSASP LR must provide the mobility requirements to accomplish the selected mission objectives. Mobility requirements includes but not limited to: speed, obstacle traversing capability, payload accommodation, lander or rover egress capability, life, distance and related subsystems.
- LSASP-SYS-08** **LSASP ADP Functions:** The LSASP ADP must support the selected scientific goals by providing its capabilities based upon a clearly defined dataset applicable to the identified investigation(s).

7.3. Verification of the Requirements:

Once all of the requirements have been precisely defined from the guidance provided in this RFP, identification of a Verification Compliance Matrix (VCM) is required. The method selected for verification must be specified in terms of flight unit planned and prototype, to be in a position to identify the gaps.

All requirement must be verified by one or more of the following verification methods:

- 1) Analysis (including simulation);
- 2) Review of design;
- 3) Demonstration;
- 4) Inspection; and
- 5) Test all

8. Targeted TRL

The targeted TRL for this technology development is TRL 4 as a minimum within the contract period and must be aligned with the proposed mission timeline. For instance, TRL 6 for a 2025 mission should be achieved in 2022, an earlier or less complicated propose element should be at a higher TRL and then advance as a minimum to the next level.

9. Specific Deliverables

The deliverables defined here complement Section A.7 Contract Deliverables and Meetings of Annex A.

Table A-5-7: Specific deliverable

ID	Due Date	Deliverable	Type	DID
1	M2 (Prel.) M3 (Final)	Concept Study Report	Technical Document/Report	0007
2	M3 (Concept) M6 (Final)	Technology Readiness and Risk Assessment	Technical Document/Report	0010
3	M3 (Concept) M6 (Final)	Technology Roadmap	Technical Document/Report	0011
4	M3 (Concept) M4 (Design) M6 (Final)	Mechanical Model and Analysis	Technical Data and Analysis	0604
5	M4 (Final) M6 (Update)	Design Document	Technical Document/Report	0701
6	M4 (Draft) M5 (IR) M6 (Update)	Verification Plan	Technical Document/Report	0262
7	M4 (Draft) M5 (IR) M6 (Update)	Test Procedure	Technical Document/Report	0754
8	Test completion + 1 week M6 (FAR)	Test Report	Technical Document/Report	0759
9	M3 (Concept) M4 (Draft Proto) M5 (IR) M6 (Update)	Verification Compliance Matrix	Technical Document/Report	0531
10	M5 (IR) M5 (Update)	Operating Procedures & User Guide	Technical Document/Report	0301
11	M6 (Final)	APOGY Integration Support Products	Technical Document/Report	0012
12	M6	Hardware End Item Data Package (EIDP)	Technical Document/Report	0010
13	M6	Software EIDP (SW EIDP)	Technical Document/Report	0011

10. Schedule & Milestones

The anticipated duration of this contract is a maximum of 6 months to complete the concept study portion of the work. The technology development phase may take place after the Work

Authorization Meeting approval. A suggested schedule appears in Table A-5-8. An alternative schedule can be proposed with a maximum duration of 18 months that maintains a Work Authorization Meeting (WAM) at the end of the concept study phase. As the contract progresses, CSA may elect to advance the WAM to allow an earlier start of the prototyping activities.

Table A-5-8: Schedule & Milestones

Milestone	Meeting	Date	Location
M1	Kick-off Meeting (KOM)	No later than 2 weeks after contract award	CSA or Telecon
M2	Preliminary Concept Review Meeting	Contract award + 3 months	Telecon
M3	Concept Review Meeting (Work Authorization Meeting for prototyping phase)	Contract award + 6 months	CSA
M4	Detailed Design Review (DDR)	Contract award + 9 months	CSA or Telecon
M5	Test Readiness Review (TRR)	Contract award + 16 months	Telecon
M6	Final review meeting (FR)	Contract award + 18 months	CSA

11. Data Item Descriptions (DIDs)

This section lists the DIDs applicable to this specific Priority Technology.

DID-0007 – CONCEPT STUDY REPORT

DID-0010 – END ITEM DATA PACKAGE (EIDP)

DID-0011 – SOFTWARE END ITEM DATA PACKAGE

DID-0012 – APOGY INTEGRATION SUPPORT

DID-0217 – TECHNOLOGY READINESS WITH TRRA WORKSHEET AND ROLLUP

DID-0218 – TECHNOLOGY ROADMAP WORKSHEET & REPORT

DID-0262 – VERIFICATION PLAN

DID-0301 – OPERATING PROCEDURES AND USERS GUIDE

DID-0531 – VERIFICATION AND COMPLIANCE MATRIX

DID-0604 – MECHANICAL MODELS AND ANALYSES

DID-0701 – DESIGN DOCUMENT

DID-0754 – TEST PROCEDURE

DID-0759 – TEST REPORT

DID-0007 – Concept Study Report

PURPOSE:

To fully describe the technical work done, problems encountered and achieved objectives.



(The author may define and organize additional sub-sections as deemed appropriate to present the comprehensive results of the concept study.)

PREPARATION INSTRUCTIONS:

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

- 1) Executive summary. The one-page public summary drafted for the proposal submission should be updated and included here (reference Table A-5-9). Additional, free form text can be added to accompany the table to provide additional context (this additional info will not to be used for public dissemination).

Table A-5-9: Template for Public Summary

		CSA Lunar Surface Autonomous Science Payloads Public Summary	
		This is meant to go public: if images are subject to copyright, obtain permission to reproduce and publish.	
Title			
Team			
Contractor:		Contact Email:	
Science Team	Name 1, Affiliation 1 (PI) Name 2, Affiliation 2 <i>Please reduce long lists of team members to team leads</i>	Engineering Team Leads	Name 1, Affiliation 1 Name 2, Affiliation 2
Team Experience			
Description of Mission Concept			
Text		<i>Insert representative image here</i> <i>Indicate photo credit to be used, if needed</i>	
Study Objectives			
<ul style="list-style-type: none"> • Objective 1 • Objective 2 • ... • Objective n 			
		Agence spatiale canadienne	Canadian Space Agency

2) Science Investigation

a) Scope of the proposed investigation

- i) Science Investigation goals and objectives for baseline and augmented mission scenarios
- ii) Preliminary measurement and operations concept

b) Traceability of proposed investigation

- iii) Science Traceability Matrix

3) Technical Implementation

a) Preliminary Systems Requirements

- a. Key systems requirements including reliability and performance for baseline requirements case.
- b. Preliminary environmental requirements assumed in this study, for operations and qualification, with justification
- c. Planetary protection categorisation and requirements

b) Mission concept description, including technical approach and possible options:

- a. Schematics of a) mechanical system b) electrical system c) flight software d) ground segment for baseline mission. Schematics must clearly identify payload(s) and critical subsystems/development packages.
- b. System budget estimates for mass, volume, power, thermal, software/processing, and, data communications for baseline mission
- c. A detailed description of baseline rover, payload(s), and critical subsystems and development packages including schematics of a) mechanical system b) electrical system c) flight software d) ground segment.
- d. Detailed analyses and description of the concept including the key aspects such as : thermal, tele-communications and data usage, interfaces, assumptions, key systems elements (e.g. mobility, tele-communications, guidance and control, etc.).
- e. Preliminary plan for implementation of contamination control requirements, including planetary protection.
- f. Preliminary mission operations plan
- g. Identification and discussion on design trades relevant to baseline mission
- h. Discussion on options related to augmented mission requirements

c) Interface definition – desired interface with Host Mission

- a. Identification of possible host missions if known.

d) Feasibility & Technology development needs, including

- a. Technology Readiness and Risk Assessment (TRRA) as per DID-0217
- b. Technology development roadmap as per DID-0218
- c. Identification of Canadian Key Industrial Capabilities
- d. Development, manufacturing and qualification approach

4) Management, Schedule and Risk

a) Proposed Management Approach, including team roles and responsibilities

- i) Phase A-D
- ii) Phase E
- b) Proposed collaboration, if applicable
- c) Preliminary Business Case

The preliminary business case should address the items referred to in the previously described section on *WP 3.0 Management*.

- d) Proposed Mission Schedule
- e) Estimated Mission Costs for Phases A through D
- f) Preliminary Mission Risk Assessment identification and mitigation:
 - i) Technical risks
 - ii) Schedule risks
 - iii) Cost risks
 - iv) Programmatic risks

DID-0010 – End Item Data Package (EIDP)

PURPOSE:

Data to document the design, fabrication, assembly, integration and testing of the deliverable hardware.

PREPARATION INSTRUCTIONS:

An EIDP must be prepared for each deliverable assembly. The EIDP must be delivered in electronic format with a search function or interface. Upgrade changes performed as a result of the first phase deployment must be clearly identified. The contents of the package must include, but not be limited to, the following information:

- 1) All hardware prototype and GSE including cables
- 2) As-Built data: "As-Built" hardware documentation is a compilation of items describing exactly the configuration of a fabricated serialized assembly including:
 - a) Part number and revision letter of each item
 - b) Part description (title) of each item
 - c) Electronic part reference designation
 - d) Manufacturer
 - e) Procurement specification or Source Control Drawing (SCD) number and SCD revision letter.
- 3) A complete list of the tests performed including a compilation of test data and test results for each test.
- 4) A list of open work/tests
- 5) Listing of the As-Designed drawings & parts list, with reconciliation of As-Designed vs. As-Built for any deltas between them, for each indentured line item of the end item deliverable.
- 6) A summary and copies of all deviations and waivers applicable to the deliverable items.
- 7) A one time delivery, with updates as required:
 - a) A complete and up-to-date top assembly drawing of each type of delivery.
 - b) Complete and up-to-date mechanical and electrical Interface Control Documents (ICDs) (interface drawings and specifications), for each delivery.
 - c) For electronic assemblies, a complete set of circuit schematics and circuit data sheets available for review at the contractor's premises.

DID-0011 – Software End Item Data Package

PURPOSE:

Data to document the design, development, assembly, integration and testing of the deliverable software.

PREPARATION INSTRUCTIONS:

An EIDP must be prepared for each deliverable software. The contents of the package must include, but not be limited to, the following information:

- 1) As-built product identification, including:
 - a) Identification of software release by program ID, phase, version, date, and build,
 - b) Operating system name and version,
 - c) Programming language name, compiler name, and version,
 - d) Supporting development environment name and version (if any);
- 2) Final VDD;
- 3) List all required software related documentation (under CM control), including the software design documentation, users' manuals, test procedures, scripts and test results;
- 4) All software source codes, executables, configuration and parameter files, reloadable FPGA configuration files;
- 5) All third party software; third party software must be accompanied by a license that allows the software to be archived and copied as necessary for all future CSA operations;
- 6) A list of all COTS software and computers purchased under this contract;
- 7) All COTS software purchased under this contract (original disk or file with license to CSA), GSE software etc.; and
- 8) A list of all open/closed anomalies or liens against this delivery. All flagged or major anomalies should be closed prior to the delivery.

All software must be delivered on media that is directly compatible with the delivered hardware. One set of software must be installed on the delivered hardware. A second set must be supplied on a CD-ROM, DVD disk, USB key or through an appropriate downloadable site.

DID-0012 – APOGY Integration Support

PURPOSE:

Over the last years, the CSA has initiated a centralized initiative called Apogy, a multi-mission software framework that simplifies the integration and operations of assemblies of modular systems in different environments (RD-8). Apogy provides a single expandable tool that supports the operation cycle (development, test, execution and monitoring). The framework only uses open-source software and in particular the Eclipse platform. Apogy exploits modern model based software development tools and techniques such as the Eclipse Modeling Framework (EMF). This approach inherently promotes a highly modular and extendable software architecture that allows customization of functionalities with reduced effort. The usage of Eclipse provides state-of-the-art user interface experience that reflects today's best user interface technologies.

PREPARATION INSTRUCTIONS:

The Apogy deliverables are Eclipse plugins and must be compliant with Table A-5-10 definition. Also, the following acronyms are used for the plugins qualifier definition:

lsasp	Lunar Surface Autonomous Science Payloads
<prefix>	Organisation (ex : <i>com.companyname</i>)
<suffix>	LSASP Type : <ol style="list-style-type: none"> 1. RSI 2. LR 3. ADP 4. Or combination (ex : <i>RSI_ADP, LR_ADP</i>)

Table A-5-10: Apogy CDRL Definition

Eclipse Plugins Qualifier	Content
<prefix>.lsm.CDRL suffix>.doc	1) Tutorials 2) Javadoc 3) Technical Documentation All documentation must be embedded and accessible through the Eclipse Documentation Extension Point (org.eclipse.help.toc). The source documentation must be written in mediawiki format; Mylyn WikiText (RD-9) is recommended.
<prefix>.lsm.lsasp_<suffix>	4) Fully documented Abstract LSASP meta-model (.xcore format). 5) Implementation Classes XCore meta-models and implementation classes must be documented using Javadoc annotations.
<prefix>.lsm.lsasp_<suffix>.apogy	LSASP Apogy plugin <ul style="list-style-type: none"> • LSASP topology • LSASP VRML Models
<prefix>.lsm.lsasp_<suffix>.edit	Automatically LSASP generated UI support classes
<prefix>.lsm.lsasp_<suffix>.ui	Custom User Interfaces LSASP UI Implementation Classes. Classes must be documented using Javadoc annotations.
<prefix>.lsm.lsasp_<suffix>.simulator	6) Fully documented LSASP Simulator meta-model (.xcore format). This model extends the Abstract LSASP model. 7) Implementation Classes XCore meta-models and implementation classes must be documented using Javadoc annotations.
<prefix>.lsm.lsasp_<suffix>.simulator.edit	Automatically LSASP Simulator generated UI support classes
<prefix>.lsm.lsasp_<suffix>.examples	Workspace that includes an Apogy Session to control the simulated LSASP on a simulated terrain available in Apogy.
<prefix>.lsm.lsasp_<suffix>.feature	Eclipse feature that includes all the LSM plugins.

DID-0217 – Technology Readiness with TRRA Worksheets and Rollup

PURPOSE:

Referring to AD-1, the Technology Readiness and Risk Assessment (TRRA) Guidelines, the TRRA describes 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 or environment, the criticality of the constituent technologies, and the expected degree of difficulty to achieve 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.

Agreement on the appropriate PBS level and identification of the CTEs is required prior to the TRRA.

PREPARATION INSTRUCTIONS:

The Technology Readiness and Risk Assessment must be carried out in accordance with the CSA Technology Readiness and Risk Assessment Guidelines (AD-1) using the CSA provided worksheets the Critical Technologies Elements Identification Workbook (AD-2 and AD-3. All the completed worksheets must be provided to CSA along with a Technology Readiness and Risk Assessment Summary Report (AD-4).

DID-0218 – Technology Roadmap Worksheet & Report

PURPOSE:

The Technology Roadmap provides an overview of the required technology developments to meet mission needs and the plan and timeline to reach TRL 6 and 8.

PREPARATION INSTRUCTIONS:

The Technology Roadmap must be done using the format of the Technology Roadmap Worksheet AD-5 (CSA-ST-RPT-0003) and include a summary report of what are the key elements and challenges to be addressed and that have been addressed for each of the steps.

DID-0262 – Verification Plan

PURPOSE:

The verification process is defined by the Verification Plan. The plan also defines the planning policies, methods of controls, and organizational responsibilities. From the Verification Plan, the verification procedures are developed. The procedures provide the instruction, including configurations, constraints, and prerequisites, for obtaining data that show compliance with the requirements.

PREPARATION INSTRUCTIONS:

The Verification Plan must:

- 1) define the verification activities that will prove that the system and subsystems meet the all the imposed requirements including functional, performance, interface, environmental, etc.,
- 2) define all verification activities at each phase of the project, including test, analysis, and inspection,
- 3) describe the methods and techniques to be used to measure, evaluate, and verify the system. This is to include characterization of the system behaviour that is not controlled by requirements but is important for understanding of the system, and establishing the actual values of parameters that exceed requirements,
- 4) use an appropriate combination of simulation and analytical tools, mock-ups, laboratory models, engineering models and prototype models,
- 5) define the requirements for supporting facilities, analysis tools and test equipment, both existing and needing to be constructed. Assumptions on the use of Government-Furnished Equipment (GFE) in testing are to be documented, including:
 - a) the specific equipment and materials needed,
 - b) the configuration of the equipment to be used,
 - c) any requirements on modification or upgrade of the GFE,
 - d) the location in which it is to be used,
- 6) define the schedule for verification activities and the schedule requirements for the Government furnished facilities (e.g. David Florida Laboratory).

Requirements on GFE must be highlighted or summarized so that an integrated request can be given to the provider.

For each defined test and analysis activity, the plan must contain:

- 1) a description of the activity,
- 2) the objective, including requirements to be verified,
- 3) supporting hardware and software,
- 4) assumptions and constraints that apply to the activity,
- 5) plans to install, setup, and maintain items in the test or analysis environment,
- 6) a description of the data recording, reduction, and analysis activities to be carried out during and after the activity.

VERIFICATION METHODS DEFINITIONS

The verification program must be accomplished by employing one or more of the methods described in the following sub-sections.

Test

Verification by test is the actual operation of the system, in clearly defined environmental conditions, to evaluate its performance.

Functional Tests

Functional testing is an individual test or series of electrical or mechanical performance test(s) conducted on the system's hardware and/or software at conditions equal to or less than design specifications. Its purpose is to establish that the system performs satisfactorily in accordance with design and performance specifications. Functional testing is generally performed at ambient conditions. Functional testing is performed before and after each environmental test or major move in order to verify system performance prior to the next test/operation.

Environmental Tests

Environmental testing is an individual or series of test(s) conducted on the system's hardware to ensure that the rover hardware must perform satisfactorily in an analog environment. Examples of environmental tests are vibration, acoustic, thermal, vacuum and EMC. Environmental testing may or may not be combined with functional testing depending on the objectives of the test.

Analysis

Verification by analysis is a process used in lieu of, or in addition to, testing to verify compliance to specification requirements. (e.g. stress, thermal, materials). The selected techniques may include systems engineering analysis (structural, environmental, electrical, etc.), statistics and qualitative analysis, computer and hardware simulations, and analog modelling.

Analysis may be used when it can be determined that:

- a) Rigorous and accurate analysis is possible;
- b) Test is not feasible or cost-effective;
- c) Similarity is not applicable; and
- d) Verification by inspection is not adequate.

Demonstration

Verification by demonstration is the use of actual demonstration techniques in conjunction with requirements such as serviceability, accessibility, transportability and human engineering features. In general, demonstration is specified as the method of verification for physical attributes which have no numerical requirements associated with them. This includes qualitative features such as comfort, accessibility, suitability and adequacy. Demonstration may also be specified for presence or compatibility of shipping containers, handling fixtures, etc.

Inspection

Verification by inspection is the physical evaluation of equipment and associated documentation to verify design features. Inspection is used to verify construction features, workmanship, dimensions and physical condition, such as cleanliness, surface finish and locking hardware.

Often inspections are conducted in conjunction with a test or as part of assembly operations documented by manufacturing instructions (MIS).

Similarity

Verification by similarity is the process of assessing by review of prior test data or hardware configuration and applications that the article is similar or identical in design and manufacturing process to another article that has previously been qualified to equivalent or more stringent specifications.

Review of Design Documentation

Verification by review of design documentation is the process of reviewing the design against the requirements, which as stated may or may not contain specifics to be met by a test, analysis, etc. but must be present in the design. This method is used during the preliminary design and critical design reviews of the development phase.

DID-0301 – Operating Procedures and Users Guide

PURPOSE:

To provide detailed step-by-step procedures and guidance for the operation of the system (payload or rover). In the case of the rover, this must include procedures for the rover by itself as well as when integrated.

PREPARATION INSTRUCTIONS:

General Requirements

The Operating Procedures and Users Guide must be provided in Microsoft Word. Drawings and pictures must be included in these Word documents, not in separate documents.

The Operating Procedures and Users Guide must contain an appendix that analyses End-to-End Operations Workflow, including the real-time operations as well as the offline pre-and post-missions analysis work and the operator training process, including training session preparation, execution and the use of tools to evaluate operator performance and achieve their certification.

The Users' Guide must contain the following information:

- 1) Description and principles of operation, including configuration for:
 - a) Transportation
 - b) Field Deployments (if different)
- 2) Assembly procedure (if required):

NOTE: this is internal to a rover or a payload, NOT the installation of a payload on a rover; the latter is to be presented in the Integration Procedures.

 - a) Mechanical Interfaces (including cooling/heating connections)
 - b) Electrical Interfaces
 - c) Command and Data Handling (C&DH) Interfaces
 - d) Scenario Setup Instructions (software & hardware)
 - e) Scenario Analysis Instructions
- 3) Disassembly procedure
- 4) Operational modes
- 5) Operational procedures:
 - a) Identification of all operations for which the system was designed
 - b) Specification of all constraints pertinent to each procedure, with references to technical documents for justification
 - c) Power On/Off and initiation of the software and termination of system operation
 - d) Calibration
 - e) Routine operating procedures
 - f) Monitoring of the operation of the system including: fault identification, evaluation, and conditions requiring computer shutdown
 - g) Detection, analysis and correction of anomalous behaviour
 - h) References to baseline configuration database for each parameter used in each procedure
 - i) Operating rules
- 6) C&DH Procedures
 - a) Methods of commanding the system and/or experiment (computer, manual, other)

- b) Methods of collecting and disposing of H&S data
- 7) Software User Procedure
 - a) information and user instructions necessary for user interaction with the CSCI(s) including:
 - i) step-by-step operating procedures, including the use of all pre and post missions analyses tools, and operator training, evaluation and certification tools,
 - ii) identification of all options available to the user,
 - iii) initialization procedures,
 - iv) required user inputs and options,
 - v) identification and description of system inputs and effects on user interface,
 - vi) termination methods and indicators,
 - vii) restart procedures, and
 - viii) expected outputs.
 - b) a listing of all error messages including definition and action to be taken.
- 8) Maintenance Procedures and Troubleshooting
 - a) Recovery from faults or interrupts including restart and the collection of information concerning the fault
 - b) Description of diagnostic features available to the operator of the system including: available tools, and step-by-step diagnostic procedures
 - c) Trouble-shooting table
 - d) Periodic maintenance required, including tasks and frequencies
 - e) Test equipment and special tools required

Operational Data Base

The Operational Data Base (ODB) must contain definitions for the following data:

- 1) Telemetry database format;
- 2) Telecommand database format;
- 3) System (rover or payload) Baseline Configuration:
 - a) Definition of all parameters determining on-board database configuration at any time, including conversions and constraints, as installed in real-time, planning, and analysis platforms;
- 4) Remote Control Station (RCS) Baseline Configuration:
 - a) Definition of all parameters determining the RCS database configuration at any time, including conversions and constraints;
 - b) Values of all system (rover or payload) related parameters in the ODB pertinent to procedure execution and on-board system maintenance;
 - c) Constraints on telemetry values for status and health verification; and
 - d) Software configuration status for the system (rover or payload) and the RCS.

DID-0531 – 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.

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.

DID-0604 – Mechanical Models and Analyses

PURPOSE:

To support the design of mechanisms and fluid systems (such as heat exchangers), establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

All CAD models developed must be delivered. All CAD models developed in accordance with the requirements stipulated in the DID for Computer-Aided Design (CAD) Models.

Analysis documents must contain all analysis work that is performed in support of the design. 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, as a minimum, the following information:

- 1) Objectives of the analysis;
- 2) Reference to the relevant requirements;
- 3) Description of the analysis tools used;
- 4) Description of the model developed to aid the model user;
- 5) Identification of the assumption(s) made;
- 6) Description of the main analysis steps and intermediate results;
- 7) Results of the analysis and compatibility with the requirements;
- 8) Identification of potential problem areas and presentation of alternative design solutions;
- 9) Conclusion.

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

SPECIFIC CONTENTS

The analysis must include torque margin, lubricant loss and contact stress, including external loads and thermally induced stresses. Examples of other issues to be covered are preload analysis, binding and jamming, and mechanism life. Deployment mechanisms must be included in this analysis.

DID-0701 – Design Document

PURPOSE:

To document the design of a system or major subsystem (e.g. payload) and the supporting analyses and trade-offs, and to provide an integration of the individual analyses and tests presented in supporting documents, showing how they affected the design.

PREPARATION INSTRUCTIONS:

The Design Document must be first presented at the PDR, updated at the CDR and the final version must be presented at the SAR. Its content must be adapted to the phase of the project for which it is reporting.

The Design Document acts as an “answer” to the Requirements Document for the system or subsystem. The requirements state what is needed and the Design Document describes what is provided to meet these needs. The Design Document serves as the main reference text for users after delivery of the system, describing the full range of performance and functional capabilities of the item, as verified during the test/verification program.

The Design Document comprehensively presents the technical results of a design or test phase. It describes all technical analyses and trade-offs performed in support of the design and operational concept. It is not intended that other documents' material be repeated, rather referenced and summarized.

The Design Document must contain as a minimum:

1. Introduction

This section must present a system overview, recall the major objectives and guidelines for the project and summarize the main results of the phase.

2. Architecture, design and interfaces

This section must give a detailed description of the architecture and design of the system and its subsystems, including internal and external interfaces.

3. Drawings and schematics

This section must include architectural diagrams for the main aspects of the system (software, communication, electronics, power, structure, etc.); it must describe and reference important design drawings such as functional block diagrams, activity flow diagrams, ICDs.

4. System Analysis and Trade-offs

This section must present the evaluation of the design approaches, including the accomplishment of trade-off studies supporting design decisions. Trade-off studies must include criteria definition, criteria results and decisions. System analysis is accomplished through the appropriate use of various operations research methods to assist in problem resolution (simulation, queuing theory, linear and dynamic programming, optimization, mathematical models etc.). The system analysis must include rationales for design decisions.

5. Analyses

This section must summarize the analyses performed, main results and problems encountered; this is a summary of each full analysis report presented separately.

6. Budgets:

This section must present a summary of the TPM budgets including discussion of significant decisions regarding allocations, challenges in achieving budgeted values, and important changes in the budgets through the life of the project.

7. Tests

This section must summarize tests performed and main results and problem areas; this is a summary of each full test report presented separately.

8. Operations

This section must describe the operational and support environments and the operational modes, and must summarize the operations of the system in both nominal and contingency conditions.

9. Maintenance approach

This section must describe the maintenance approach and the proposed spares, especially for maintainable items such as flight software and ground systems.

DID-0754 – Test Procedure

PURPOSE:

To define the procedure to be followed for each test to be performed on Space Segment and Ground equipment, at unit level and higher.

PREPARATION INSTRUCTIONS:

This DID is applicable to systems, hardware and software.

The test procedures must contain the following information, as a minimum:

1. SCOPE

This section must include a brief description of the test and the objectives of the test.

2. TEST REQUIREMENTS

This section must define the measurements and evaluations to be performed by the test, including test cases.

3. TEST ARTICLE

This section must define in detail the test article configuration that is to be tested.

4. TEST FACILITIES

This section must identify the test facilities to be used, including their physical location, coordinates and contact points.

5. PARTICIPANTS REQUIRED

This section must provide a listing of the individuals (position titles, trade or profession) required to conduct or witness the test.

6. TEST SET-UP AND CONDITIONS

This section must include description/sketches of test articles in test configuration illustrating all interfacing test/support equipment. Instrumentation/functional logic must be shown where applicable. The section must include any environmental and cleanliness requirements.

7. INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE

This section must provide a listing of the instrumentation, test equipment and software that are to be used during the test.

8. PROCEDURE

This section must define the step-by-step procedure to be followed, starting with the inspection of the test article, and describing the conduct of the test up to and including post-test inspection. Each test activity must be defined in sequence and task-by-task, including test levels to be used and measurements/recordings to be made. It must include any necessary malfunction and abort procedure.

9. DATA ANALYSIS

This section must define the methods to be used in the analysis of the results, along with the uncertainty range in the results. Data presentation format must be defined.

10. ACCEPTANCE/REJECTION CRITERIA TABLE

This section must provide data sheets needed during execution of the test specifying acceptance/rejection criteria, including identification of the associated requirements from the Requirements Documents or Specifications. These sheets will be in a tabular form allowing columns for measured values and deviations to be recorded. A computer printout generated by test software is acceptable provided it supplies the same information, however the test criteria must be stated in the Test Procedure.

DID-0759 – Test Report

PURPOSE:

To document the results of all tests done on a hardware unit or software CSCI.

PREPARATION INSTRUCTIONS:

This DID is applicable to systems, hardware and software.

The test report must document all tests performed to verify that the unit or software will meet the functional and operational requirements specified in the Requirements Documents or Specifications applicable to the unit.

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

1. APPLICABLE DOCUMENTS

This section must include test procedures and system requirements/specifications being tested.

2. TEST ARTICLE OR SYSTEM UNDER TEST:

This section must define in detail the test article configuration tested.

3. PURPOSE:

This section must describe the purpose of the test and the specific requirements/specifications that it is intended to verify.

4. SUMMARY OF TEST RESULTS

This section must present a summary of test results, including non-conformances, where applicable.

5. TEST FACILITIES

This section must identify the test facilities used, including their physical location, coordinates and contact points.

6. TEST SET-UP AND CONDITIONS:

This section must include descriptions/photos/sketches of test articles in test configuration illustrating all interfacing test/support equipment. Instrumentation/functional logic must be shown where applicable. The section must describe the environmental and cleanliness conditions present, as well as operating conditions (e.g. supply voltage).

7. INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE:

This section must provide a listing of the instrumentation, test equipment and software used during the test.

8. DETAILED TEST RESULTS:

This section must record actual test data obtained on tabular sheets prepared in the Test Procedure (or software-generated) during the test performance, and deviations from the criteria.

9. TEST DATA ANALYSIS:

This section must document analyses required to relate the detailed results to the requirements to be verified.

10. NON-CONFORMANCES:

This section will provide all Non-Conformance Reports generated during the tests. The Non-Conformance Reports will be dated and stipulate the latest dispositions.

11. CONCLUSIONS AND RECOMMENDATIONS:

This section must identify deficiencies, limitations or constraints and propose alternative design solutions to be evaluated in order to resolve problems encountered in testing.