

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:
Travaux publics et Services gouvernementaux
Canada
Place Bonaventure, portail Sud-Est
800, rue de La Gauchetière Ouest
7^{ème} étage
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 ExCore Concept Studies	
Solicitation No. - N° de l'invitation 9F052-130241/A	Date 2013-10-17
Client Reference No. - N° de référence du client 9F052-13-0241	
GETS Reference No. - N° de référence de SEAG PW-\$MTB-545-12450	
File No. - N° de dossier MTB-3-36113 (545)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2013-11-18	
Time Zone Fuseau horaire Heure Normale du l'Est HNE	
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Niquette, Caroline	Buyer Id - Id de l'acheteur mtb545
Telephone No. - N° de téléphone (514) 496-3730 ()	FAX No. - N° de FAX (514) 496-3822
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: AGENCE SPATIALE CANADIENNE 6767 ROUTE DE L AEROPORT Space Exploration 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-Est
800, rue de La Gauchetière Ouest
7^{ème} étage
Montréal
Québec
H5A 1L6

Delivery Required - Livraison exigée	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

Item Article	Description	Dest. Code Dest.	Inv. Code Fact.	Qty Qté	U. of I. U. de D.	Unit Price/Prix unitaire FOB/FAM	Destination	Plant/Usine	Delivery Req. Livraison Req.	Del. Offered Liv. offerte
1	ExCore Concept Studies	9F052	9F052	1	Chaque	XXXXXXXXXXXX				

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PART 1 - GENERAL INFORMATION

1. Introduction

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

- Part 1 General Information: provides a general description of the requirement;
- Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation;
- Part 3 Bid Preparation Instructions: provides bidders with instructions on how to prepare their bid;
- Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, and the basis of selection;
- Part 5 Certifications: includes the certifications 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 Annexes include the Statement of Work, the Basis of Payment, the Bid Preparation Instructions and the Point Rated Criteria.

2. Summary

Project Title

2013 CSA Exploration Core Concept Studies for Space Exploration

Description of Project

Requirement Development is part of the Exploration Core program of the Canadian Space Agency. Through Requirement Development, Exploration Core supports CSA's exploration planning activities and defines the science and technology developments most likely to be required in future space exploration missions of interest to Canada, and assesses potential contributions that Canada could make to such missions. Concept Studies are part of the Requirement Development activity

This requirement requests Concept Studies proposals in the following areas of space exploration and detailed in Appendix 4 and 5 of Annex A:

- ∅ Asteroid Rendezvous Sensor for the Asteroid Redirect Mission
- ∅ Deep Space Exploration Robotics

Period of Contracts

The Contracts will be for a period of eight (8) months each.

Actual Available Budget

The actual budget available for the two (2) Contracts resulting from the bid solicitation is 800 000.00\$ as detailed below, applicable Taxes are extra.

The budget available for each Concept Study is as follows:

Concept Study Title	Number of Contracts	Maximum funding per Contract	Maximum funding Option
CS1-Asteroid Rendezvous Sensor for the Asteroid Redirect Mission	1	Up to 300 000.00\$	N/A
CS2-Deep Space Exploration Robotics	1	Up to 300 000.00\$	Up to 200 000.00\$

Security Requirements

No security requirements apply to this requirement.

Trade Agreements

This requirement is not subject to the trade agreements.

Intellectual property

Ownership of Intellectual Property will vest with Canada.

Canadian Content

This requirement is limited to Canadian good and services.

Controlled Goods Program

This requirement is subject to the Controlled Goods Program.

Location of Work

The majority of the work is expected to be performed at the Contractor's facilities. There may be a requirement to travel. The Contractor is encouraged to propose a methodology which will facilitate the completion of all the requirements of the work while minimizing the need to travel. Modern

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communications techniques (e-mail, fax, telephone, Internet, etc.) should be used to maintain a reasonable budget for the project. The location of meetings will be arranged between the Contractor and the Project Authority. The final project review meeting is likely being held at the John H. Chapman Space Centre (CSA's main facilities) in Saint-Hubert, Quebec.

The contractor must have access to suitable facilities to host and/or join teleconferences and optionally video conferences of good quality as they will be used as main mode of communication.

3. Debriefings

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

PART 2 - BIDDER INSTRUCTIONS

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>) 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 (2013-06-01) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

Subsection 5.4 of 2003, Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: sixty (60) days

Insert: two hundred and forty (240) days

1.1 SACC Manual Clauses

A7035 (2007-05-25), List of Proposed Subcontractors

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.

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

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.

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:

an individual;

an individual who has incorporated;

a partnership made of former public servants; or

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:

name of former public servant;

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:

name of former public servant;

conditions of the lump sum payment incentive;

date of termination of employment;

amount of lump sum payment;

rate of pay on which lump sum payment is based;

period of lump sum payment including start date, end date and number of weeks;

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.

4. Enquiries - Bid Solicitation

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

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the questions or may request that the Bidder do so, so that the proprietary nature of the question is eliminated, and the enquiry can be answered with copies to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

5. 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.

6. Basis for Canada's Ownership of Intellectual Property

The Canadian Space Agency has determined that any intellectual property rights arising from the performance of the Work under the resulting contract will belong to Canada, on the following grounds: the main purpose of the contract, or of the deliverables contracted for, is to generate knowledge and information for public dissemination.

7. Maximum funding

The maximum funding available for the two (2) Contracts resulting from the bid solicitation is \$800K\$ (applicable Taxes extra, as appropriate). Bids valued in excess of this amount will be considered non-responsive, refer to Part 1 Section 2 for details. This disclosure does not commit Canada to pay the maximum funding available.

PART 3 - BID PREPARATION INSTRUCTIONS

1. Bid Preparation Instructions

Canada requests that bidders provide their bid in separately bound sections as follows:

Section I: Technical and Managerial Bid and Executive Summary (1 hard copy and 2 soft copies on CD or DVD)

Section II: Management Bid (1 hard copy and 2 soft copies on CD or DVD)

Section III: Financial Bid (1 hard copy and 1 soft copy on CD or DVD)

Section IV: Certifications (1 hard copy)

The acceptable electronic formats are: Microsoft Word, Corel WordPerfect, Microsoft Excell and HTML.

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

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 their bid:

(a) the total number of pages for Section I should not exceed 60 pages including bid appendices;

(b) font size should be at least 11pt. including bid appendices;

(c) use 8.5 x 11 inches (216 mm X 279 mm) paper;

(d) the bid should use a numbering system that corresponds to the bid solicitation;

(e) each electronic file should be named by using the Bid reference number and the applicable Bid Section;

(f) the cover pages of the Bid (Sections I, II and III) should include the following table duly filled:

Company Name	Company Address
Project Title	
Project Summary (8 lines of text)	

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

(<http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html>).

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 Bid

In their technical 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 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.

The structure and content requested is detailed in Annex C: Bid Preparation Instructions.

Section II: Management Bid

The management bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. In their management bid, bidders must describe their capability and experience, the project management team and provide client contact(s) as detailed in Annex C: Bid Preparation Instructions.

Section III: Financial Bid

- 1.1 Bidders must submit their financial bid in accordance with the Basis of Payment in Annex "B". The total amount of Applicable Taxes must be shown separately.

1.1.1 Price Breakdown

Bidders are requested to detail the cost elements for each work package of the Contract Work Breakdown Structure (CWBS). At a minimum, the following information shall be provided for each work package:

- (a) Labour: For each individual and (or) labour category to be assigned to the Work, indicate:
 - i) the hourly rate, inclusive of overhead and profit; and
 - ii) the estimated number of hours.

(b) Equipment: Specify each item required to complete the Work and provide the pricing basis of each one, Canadian

customs duty and excise taxes included, as applicable. These items will be deliverable to Canada upon completion of the contract.

(c) Materials and Supplies: Identify each category of materials and supplies required to complete the Work and provide the pricing basis.

(d) Travel and Living Expenses: Indicate the number and cost of journeys, together with the basis of these costs. Refer to Appendices B, C and D of the National Joint Council (NJC) Travel Directive (<http://www.njc-cnm.gc.ca/directive/travel-voyage/index-eng.php>), and with the other provisions of the directive referring to "travellers", rather than those referring to "employees".

(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) GST, QST and HST: Identify any applicable GST, QST or HST separately.

The bidder should use a Microsoft Excell spreadsheet to present the cost breakdown for each work package.

1.2 Cash Flow Estimates

The Bidder shall provide in its proposal a Cash Flow estimate for the work to be carried out based on the Table below:

Milestones	Fiscal Year	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
	2013-2014				
	2014-2015				

1.3 Exchange Rate Fluctuation

C3011T (2010-01-11), Exchange Rate Fluctuation

Section III: Certifications

Bidders must submit the certifications required under Part 5.

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

1. Evaluation Procedures

(a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical, management and financial evaluation criteria.

(b) An evaluation team composed of representatives of Canada will evaluate the bids.

1.1 Technical and Management Evaluation

1.1.1. Point Rated Technical and Management Criteria

Point rated Technical and Management Evaluation Criteria are described in Annex D-Point Rated Criteria.

1.2 Financial Evaluation

1.2.1 Mandatory Financial Criteria

The maximum funding available for the two (2) Contracts resulting from the bid solicitation is listed in Part 2, Section 7 (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.

1.2.2 SACC Manual Clause

A0220T (2013-04-25), Evaluation of Price

2. Basis of Selection

To be declared responsive, a bid must:

- (a) comply with all the requirements of the bid solicitation;
- (b) meet all mandatory evaluation criteria;
- (c) obtain the required minimum of 15 points on a scale of 20 points for the Evaluation Criterion #1 "Merit of the Concept " as indicated in Table 1 of Annex D; and
- (d) obtain the required minimum of 70 points for the overall Point Rated Criteria (Impact Criteria, Technical Criteria and Management Criteria) subject to ratings.

Bids not meeting (a) or (b) or (c) or (d) will be declared non responsive. The responsive bids will be grouped within the categories in which they belong (CS-1 or CS-2) and each category will be evaluated separately. For the category CS-2: Deep Space Exploration Robotics, the bids will be evaluated on the basis of the work for the concept study only, excluding the optional work. The contractor will have to submit a separate proposal for the "option" portion of the work in the event that CSA decides to exercise the "option".

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Responsive bids will be ranked within their categories, in a descending order of overall scores, the bid with the highest overall score being ranked first.

The overall score will be obtained by adding the scores for each of the following group of criteria: "Impact Criteria", "Technical Criteria" and "Management Criteria".

The responsive bid with the highest number of points in each category will be recommended for award of a contract.

If more than one responsive bid has the same overall score in a category, the bid which obtained the highest number of points for the point rated criteria "Technical Criteria" will be recommended for award of a contract.

In the event where there are no responsive bids in a category, Canada may at its sole discretion, elect to award a second contract in the other category if there are sufficient receivable bids. In the present process, if applicable, the bid that received the second highest overall score will be recommended for award of a contract.

If two contracts would eventually be awarded in the category CS-2 and if Canada decides to exercise the "option", the "option" will be exercised only for the bid with the highest overall score.

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PART 5 - CERTIFICATIONS

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

The certifications provided by bidders to Canada are subject to verification by Canada at all times. 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 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 with this request will also render the bid non-responsive or will constitute a default under the Contract.

1. Mandatory Certifications Required Precedent to Contract Award

1.1 Code of Conduct and Certifications - Related documentation

By submitting a bid, the Bidder certifies that the Bidder and its affiliates are in compliance with the provisions as stated in Section 01 Code of Conduct and Certifications - Bid of Standard Instructions 2003. The related documentation therein required will assist Canada in confirming that the certifications are true.

1.2 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 (http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml) available from Human Resources and Skills Development Canada (HRSDC) - Labour's website

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.

2. Additional Certifications Precedent to Contract Award

The certifications listed below should be completed and submitted with the bid but may be submitted afterwards. If any of these required certifications is not completed and submitted as requested, the Contracting Authority will so inform the Bidder and provide the Bidder with a time frame within which to meet the requirement. Failure to comply with the request of the Contracting Authority and meet the requirement within that time period will render the bid non-responsive.

2.1 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.

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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.

2.1.1. SACC Manual clause

A3050T(2010-01-11) Canadian Content Definition.

2.2 Status and Availability of Resources

2.2.1 SACC Manual clause

A3005T (2010-08-16), Status and Availability of Resources

2.3 Education and Experience

2.3.1 SACC Manual clause

A3010T (2010-08-16), Education and Experience

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PART 6 - FINANCIAL AND OTHER REQUIREMENTS

1. Financial Capability

1.1 SACC Manual clause

A9033T (2012-07-16), Financial Capability

2. Controlled Goods Program

2.1 SACC Manual Clause

A9130T (2011-05-16), Controlled Goods Program

PART 7 - RESULTING CONTRACT CLAUSES

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

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 _____.

1.1 Optional Goods and/or Services: for CS2-Deep Space Exploration Robotics only

The Contractor grants to Canada the irrevocable option to acquire the goods, services or both described in Appendix 5 to Annex A of the Contract under the same conditions and at the prices and/or rates stated in the Contract. The option may only be exercised by the Contracting Authority and will be evidenced, for administrative purposes only, through a contract amendment.

The Contracting Authority may exercise the option at any time before the expiry of the Contract by sending a written notice to the Contractor.

2. Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual

(<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

2.1 General Conditions

2040 (2013-06-27), General Conditions - Research & Development, apply to and form part of the Contract.

2.2 SACC Manual Clauses

K3410C (2008-12-12), Canada to Own Intellectual Property Rights in Foreground Information

3. Term of Contract

3.1 Period of the Contract

The Contract period starts on the Contract date for a maximum of eight (8) months.

4. Authorities

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MTB-3-36113

CCC No./N° CCC - FMS No/ N° VME

4.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Caroline Niquette
 Title: Supply Specialist
 Public Works and Government Services Canada
 Acquisitions Branch
 Address: Place Bonaventure, Portail South-East
 800, de la Gauchetière Street, West
 Suite 7300
 Montreal, Quebec H5A 12L6
 Telephone: 514-496-3730
 Facsimile: 514-496-3822
 E-mail address: caroline.niquette@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.

4.2 Project Authority

The Project Authority for the Contract is: (will be identified at Contract award)

Name: _____
 Title: _____
 Organization: _____
 Address: _____
 Telephone: ____-____-_____
 Facsimile: ____-____-_____
 E-mail address: _____

The Project Authority named above 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 evaluation, recommendations and approvals of Progress claims, Schedule or Cost and Acceptance of the deliverable items of the Work under this Contract. Such Progress claim, scheduling, cost or acceptance of deliverables matters may be discussed with the Project Authority, however the Project Authority has no capacity 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.

4.3 Contractor's Representative

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

Telephone: _____ - _____ - _____

Facsimile: _____ - _____ - _____

E-mail address: _____

5. Payment**5.1 Basis of Payment- Firm Price**

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

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

5.2 Limitation of Price**5.2.1 SACC Manual clause**

C6000C (2007-05-25) Limitation of Price

5.3 Method of Payment**5.3.1 Milestone Payments- Firm Price**

Canada will make milestone payments in accordance with the Schedule of Milestones detailed in the Contract and the payment provisions of the Contract if:

(a) an accurate and complete claim for payment using PWGSC-TPSGC 1111, Claim for Progress Payment, and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;

(b) 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.

5.3.2 Schedule of Milestones- Firm price

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

5.4 SACC Manual Clauses

A9117C (2007-11-30), T1204 - Direct Request by Customer Department
C0305C (2008-05-12), Cost Submission

6. Invoicing Instructions

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

Each claim must show:

- (a) all information required on form PWGSC-TPSGC 1111;
- (b) all applicable information detailed under the section entitled "Invoice Submission" of the general conditions;
- (c) the description and value of the milestone claimed as detailed in the Contract.

2. The Goods and Services Tax or Harmonized Sales Tax (GST/HST), as applicable, must be calculated on the total amount of the claim before the holdback is applied. At the time the holdback is claimed, there will be no GST/HST payable as it was claimed and payable under the previous claims for progress payments.

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

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

and,

- b) one (1) copy of the original progress claim to the Contractor Authority specified herein.

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. Certifications

7.1 Compliance

Compliance with the certifications and related documentation provided by the Contractor in its bid is a condition of the Contract and subject to verification by Canada during the term of the Contract. If the Contractor does not comply with any certification, provide the related documentation or if it is determined that any certification made by the Contractor in its bid is untrue, whether made knowingly or unknowingly, Canada has the right, pursuant to the default provision of the Contract, to terminate the Contract for default.

7.2 SACC Manual Clauses

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

8. Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in _____.

9. 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 (2013-06-27), General Conditions - Research and Development;
- (c) Annex A, Statement of Work;
- (d) Annex B, Basis of Payment;
- (e) the Contractor's bid dated _____.

10. Foreign Nationals (Canadian Contractor)

10.1 SACC Manual clause

A2000C (2006-06-16) Foreign Nationals (Canadian Contractor)

11. Insurance

11.1 SACC Manual clause

G1005C (2008-05-12) Insurance

12. Controlled Goods Program

12.1 SACC Manual Clause

A9131C (2008-12-12), Controlled Goods Program

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Annex A
Statement of Work

Solicitation No. - N° de l'invitation

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**Annex B
Basis of Payment**

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

Milestone No.	Deliverable	Firm Amount	Delivery Date
1	Specify		
2	Specify		
3	Specify		
Etc			

Total Firm Price \$ _____ (GST,QST/HST Extra if applicable)

OPTION: CS-2 - Deep Space Exploration Robotics (only)

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

Milestone No.	Deliverable	Firm Amount	Delivery Date
1	Specify		
2	Specify		
3	Specify		
Etc			

Option: Total Firm Price \$ _____ (GST,QST/HST Extra if applicable)

Solicitation No. - N° de l'invitation

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ANNEX C
BID PREPARATION INSTRUCTIONS

Solicitation No. - N° de l'invitation

9F052-130241/A

Client Ref. No. - N° de réf. du client

9F052-13-0241

Amd. No. - N° de la modif.

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MTB-3-36113

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ANNEX D
POINT RATED CRITERIA

Annex A – Statement of Work

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A.1 Background

The exploration of space is a highly visible endeavour, a powerful driver for scientific and technical innovation, a magnet for world-class talent, and an incentive for young Canadians to pursue careers in science and technology. To shape and determine the nature of Canada's contribution to potential future international space exploration and astronomy missions CSA's Exploration Core program was created in 2007. Exploration Core engages in three types of activities: (i) requirement development; (ii) prototyping and deployment; and (iii) building and maintaining operational infrastructure required to support prototype integration and deployment. Through (i) requirement development, Exploration Core supports CSA's exploration planning activities and defines the science and technology developments most likely to be required in future space exploration missions of interest to Canada, and assesses potential contributions that Canada could make to such missions.

This requirement requests proposals in the areas define in Section A.2, Table 1 in support of the requirement development activity of CSA's Exploration Core Program.

A.2 Objective

Requirement Development is part of the Exploration Core program of the Canadian Space Agency. Through Requirement Development, Exploration Core supports CSA's exploration planning activities and defines the science and technology developments most likely to be required in future space exploration missions of interest to Canada, and assesses potential contributions that Canada could make to such missions. Concept Studies are part of the Requirement Development activity

This requirement requests Concept Studies proposals in the areas of space exploration identified in Table 1 and detailed in Appendix 4 and 5 of Annex A.

Table 1: Requirement categories, classes and titles.

Category CS #	Concept Study Title	Detailed SOW
CS 1	➤ Asteroid Rendezvous Sensor for the Asteroid Redirect Mission	➤ Appendix 4
CS 2	➤ Deep Space Exploration Robotics	➤ Appendix 5

A.3 Scope

This document provides the requirements and deliverables for the categories identified above to inform the decision process when selecting Canadian-led missions or contributions to international space exploration missions by providing in general:

- 1) Definition of mission/technology goals
- 2) Conceptual design and feasibility

- 3) User requirements
- 4) Mission requirements
- 5) System/payload requirements
- 6) ROM cost (including detailed cost breakdown to level of subsystems)
- 7) Technology readiness and risk assessment
- 8) Technology development plan and qualification approach
- 9) Programmatic aspects

Detailed scopes for each category are given in Appendix 4 and 5.

A.4 Master Reference Documents

The documents identified in Table 2 provide additional information or guidelines that either may clarify the contents or are pertinent to the history of this document. They are applicable to all Categories given in Table 1.

Table 2: Reference Documents.

MRD No.	Document Number	Document Title	Rev. No.	Date
MRD-1.	CSA-ST-GDL-0001	CSA Technology Readiness Levels and Assessment Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA	Rev A	October 2010
MRD-2.	ESTEC TEC-SHS/5574/MG/ap	Technology Readiness Levels Handbook for Space Applications ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA	Iss. 1 / Rev. 6	March 2009
MRD-3.	CSA-SE-STD-0001	CSA Technical Reviews Standard ftp://ftp.asc-csa.gc.ca/users/TRP/pub/SE-STD/	A	Nov 7, 2008
MRD-4.	CSA-ST-GDL-0002	CSA Technology Tree ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Technology-Tree/	IR	December 2009
MRD-5.		Roadmap Framework: ExCore Concept Study Technology Roadmapping Workbook.xlsx at ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRM/		

MRD No.	Document Number	Document Title	Rev. No.	Date
MRD-6.		Technology Readiness and Risk Assessment Worksheet: TRA Assessment Worksheet.pdf at ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA/		
MRD-7.		Technology Readiness and Risk Assessment Rollup: TRA_Assessment_Tool.xlsm at ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA/		

A.5 Project Duration

Duration of eight (8) months after Contract Award.

A.6 Generic Task Description

This section presents the activities that apply to all Categories listed in Table 1. The work to be performed by the Contractor under this concept study is divided into four major Work Packages (WPs). Each WP has one or more associated major tasks. Figure 1 describes the Work Breakdown Structure (WBS):

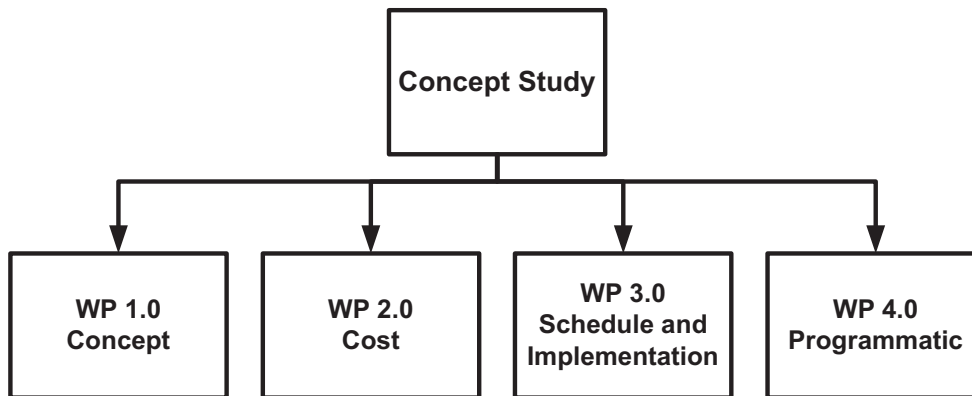


Figure 1: Work Breakdown Structure (Top Level)

A.6.1 Concept

Detailed scope, requirements, concept and task descriptions for each category are given in Appendix 4 and 5.

A.6.2 Cost

The cost is subdivided into the following elements.

- Rough Order of Magnitude (ROM) cost
- Estimate of Canadian content

A.6.2.1 Rough Order of Magnitude of Cost

The Contractor must provide cost estimates as per Table 3 below, for all phases leading to the development, qualification, implementation, launch, operation and disposal of the hardware/software/instruments resulting from the concept.

Table 3: ROM Cost

		Prior to Mission	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
Labour	Management							
	Technology Development							
	Design							
	Documentation							
	Reviews							
	Manufacturing							
	Assembly							
	Testing							
	Product Assurance							
	Science Team Support							
	Operations							
	Total Labour							
	Non-Labour	Hardware / Software Procurement						
Tools, equipment & facilities								
T&L								
Overhead								
Total Non-Labour								
Risk	Risk Contingency							

		Prior to Mission	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
Total								

Total all Phases:

A.6.2.2 Estimate of Canadian Content

The Contractor must provide an estimate of the anticipated percentage of Canadian content relative to the overall cost presented in Table 3, what options could be undertaken to maximize the Canadian content, and their corresponding impacts and benefits.

A.6.3 Schedule and Implementation

A.6.3.1 Schedule

The Contractor must suggest a preliminary schedule relative to the overall life cycle of the Concept. The timeline must include key milestones corresponding to Preliminary Design Review (PDR), Critical Design Review (CDR), and readiness for integration onto the mission, launch, and landing.

A.6.3.2 Technology readiness and risk assessment

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 MRD-1 and in MRD-2, and must describe the performance characteristics of the concept’s technology with respect to the needs of the mission for the given target environment.

A.6.3.3 Roadmap

The Contractor must provide a Technology Development Plan, aka. Technology Roadmap (TRM), including the required technology developments to meet mission needs, and a plan and timeline to reach TRL 6 and 8. The Technology Roadmap must be provided as well in the format of MRD-5.

A.6.3.4 Development, Manufacturing and Qualification Approach

The Contractor must provide an overview of the development approach, specifying subsystem providers, 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. The Contractor must provide the V&V and qualification approach and assumptions made.

A.6.4 Programmatic

A.6.4.1 Preliminary Mission Risk Assessment

The Contractor must provide a preliminary technical, schedule, cost and programmatic risks assessment. This assessment must also consider access to information issues, like Export Control (International Traffic in Arms Regulations (ITAR) and others).

A.6.4.2 Business Potential

The Contractor must provide information on the minimum business, in the field, required to maintain the necessary expertise in the long run.

A.6.4.3 Canadian Capabilities Development

The Contractor must provide an overview of its strategy to develop and maintain Canadian capabilities. 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.

A.6.4.4 Intellectual Property Management

The Contractor must identify the Background Information (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 (DID-0008).

A.6.4.5 Preliminary Commercialisation Plan

The Contractor must provide a preliminary commercialization plan to support further Canadian positioning beyond the scope of the proposed CSA program. This must include an analysis of who the competitors are (national and international) for the proposed subsystem/technology/concept and for the overall mission. It must identify who are the stakeholders and how Canada and/or the bidder are positioned.

This must also include potential spin-offs (space and non-space).

A.7 Concept Study Project Schedule

The project schedule prepared by the Contractor must provide a graphical representation of predicted tasks, milestones, dependencies, resource requirements, task duration, and deadlines. 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 name of the person responsible for completing the task, the start and end date of each task, the deliverables and the expected duration of the task. A sample WBS is provided in Table 1 of Attachment 1 "Technical Bid Preparation Instructions. The Contractor must also provide all WPs.

Important Notice: The estimated contract start date is December 2013.

A.8 Contract Meetings and Deliverables

This section reviews and describes the contract meetings and deliverables.

A.8.1 Contract Meetings

The Contractor must organize the meetings listed in Table 4.

Table 4: Meeting Schedule

Meeting	Date	Location
---------	------	----------

Kick-off Meeting	2 weeks After Contract Award (ACA)	CSA's HQ
Mid-term Review Meeting	After 4 months	CSA's HQ
Final Review Meeting	End of contract	CSA's HQ
CSA-Contractor technical team tag-up	Monthly	Telecon

All key participants under the contract, including at least one representative from each subcontractor, must attend all the meetings. This can be done in person or via teleconference.

The Mid-term Review Meeting must cover elements typically found in a Mission Concept Review (MCR) and the Final Review Meeting must cover a typical content of a Mission Requirement Review (MRR). See MRD-3 CSA-SE-STD-0001 for a description of the MCR and MRR.

The specific intent of the Final Review Meeting will be to discuss in detail the results obtained and the proposed follow-on activities. This meeting is intended to provide an opportunity for the Contractor, the Project Authority (PA), the Scientific Authority (SA), and other invited attendees to review and discuss the project. Canada reserves the right to invite additional knowledgeable people [Public Servants or others under Non-Disclosure Agreement (NDA)] to this meeting. Key Contractor personnel involved in the work under review must attend the meetings. The exact date and time of the review meeting will be mutually agreed to by the PA, the SA, and the Contractor.

The Contractor may request Ad-hoc Meetings with the 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.

A.8.2 Documentation, Reporting and Other Deliverables

The Contractor must submit the documentation as defined and at the date stipulated in the Contract Data Requirements List (CDRL), Table 5, to the PA. All diagrams must be clearly drawn and labelled.

In addition to any paper copy of all project documentation and reports, the Contractor must also provide the PA with an electronic copy in a format acceptable to the CSA. Both the PDF and original version, e.g. Microsoft Word or PowerPoint, must be provided to CSA. Original version of any figures or tables part of these documents must also be provided to CSA, e.g. Visio file of a figure created in Microsoft Visio, STEP file for models and drawings in CAD software. Thermal FEMs/FEAs must be delivered in formats that can be read by NX SPACE SYSTEMS Thermal Version 7.5 or NX I-DEAS 5/6, Structural FEMs and FEAs must be delivered in formats that can be read by NX version 7.5. Instructions on how to name electronic documents are provided in Appendix 2 of Annex A.

The cover page of each document must include the following text:

© CANADIAN SPACE AGENCY 2013

RESTRICTION ON USE, PUBLICATION OR DISCLOSURE OF PROPRIETARY INFORMATION

This document is a deliverable under contract no. _____. This document contains information proprietary to the Crown, or to a third party to which the Crown may have legal obligation to protect such information from unauthorized disclosure, use or duplication. Any disclosure, use or duplication of this document or any of the information contained herein for other than the specific purpose for which it was disclosed is expressly prohibited except as the Crown may otherwise determine.

Then, on all internal pages each document must include the following text:

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.

The Contractor must not publish or have published any information contained within this, without the prior written approval of the CSA.

All documents must identify the organisation's name, contract number and title and document name and must be structured in accordance with the Data Item Description (DID) referenced in the CDRL.

In addition to the disclosure obligation under Section 28 of the general conditions 2040, any Foreground Information must be fully disclosed and documented by the Contractor in the technical reports delivered by the Contractor to the Technical Authority under this Contract.

Table 5: CDRL

CDRL No.	Deliverable	Due Date	Version	DID No.
1.	Meeting Agendas	Meeting – 1 week	Final	0001
2.	Kick-off Meeting Presentation	Meeting – 1 week	Final	0002
3.	Mid-term Review Meeting Presentation	Meeting – 1 week	Final	0003
4.	Final Review Meeting Presentation	Meeting – 1 week	Final	0004
5.	Meeting Minutes	Meeting + 1 week	Final	0005
6.	Action Items Log (AIL)	Meeting + 1 week	Final	0013
7.	Monthly Progress Reports	Monthly	Final	0006
8.	Technical Report	Draft at each milestone End of contract – 2 weeks	Draft Final	0007
9.	Contractor Disclosure of Intellectual Property	End of contract – 2 weeks	Final	0008
10.	Executive Report	End of contract – 2 weeks	Final	0009
11.	Final Data Package	End of contract – 2 weeks End of contract	Draft Final	0010
12.	Contractor Performance Evaluation	End of contract – 2 weeks	Final	0011
13.	Video script Video	Video production start – 1 week End of contract – 2 weeks	Final Final	0012
14.	Technology Readiness and Risk Assessment Worksheets and Rollup	Draft copy at milestone End of contract – 2 weeks	Draft Final	0014

CDRL No.	Deliverable	Due Date	Version	DID No.
15.	Technology Roadmap Worksheet	Draft at each milestone End of contract – 2 weeks	Draft Final	0015
16.	Cost	Draft at each milestone End of contract – 2 weeks	Draft Final	0016

A.8.3 Data Items Description (DIDs)

A.8.3.1 DID-0001 – Meeting Agenda

PURPOSE:

To specify the purpose and content of a meeting.

PREPARATION INSTRUCTIONS:

The Meeting Agendas must contain the following information, as a minimum:

1) Document Header:

- a) Title;
- b) Type of meeting;
- c) Project title, project number, and contract number;
- d) Date, time, and place;
- e) Chairperson; and
- f) Expected duration.

2) Document Body:

- a) Introduction;
- b) Opening Remarks: CSA;
- c) Opening Remarks: Contractor;
- d) Review of previous minutes and all open action items;
- e) Project technical and/or scientific issues;
- f) Project management issues;
- g) Other topics; and
- h) Set or confirm dates of future meetings.

A.8.3.2 DID-0002 – Kick-off Meeting Presentation

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

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

A.8.3.3 DID-0003 – Mid-Term Review Meeting Presentation

PURPOSE:

To present the results of the work done to date in the contract, and in particular since the previous meeting. The mid-term review must cover elements typically found in a Mission Concept Review (MCR). See CSA-SE-STD-0001 for a description of the MCR.

PREPARATION INSTRUCTIONS:

The Mid-Term Review Meeting Presentation must contain the following information, as a minimum:

- 1) Review current status of the work, discuss orientation and preliminary results;
- 2) Elements of a Mission Concept Review;
- 3) Technical and programmatic issues if any;
- 4) Review of contract deliverables;
- 5) Work requirements, WBS status and schedule;
- 6) FIP and BIP;
- 7) Licensing issues if any;
- 8) Project's funding and expected cash-flow;
- 9) Other items as deemed appropriate;
- 10) Presentation's slides to include the required copyrights and intellectual property disclosure

A.8.3.4 DID-0004 – Final Review Meeting Presentation

PURPOSE:

To present the overall results of the work done in the project including the elements of a Mission Requirement Review (MRR). See CSA-SE-STD-0001 for a description of the MRR.

PREPARATION INSTRUCTIONS:

The Final Review Meeting Presentation must contain the following information, as a minimum:

- 1) Detailed presentation of the work conducted (presentation of the content of the technical and/or science report, concept, design, interface, feasibility, etc.)
- 2) Elements of a Mission Requirement Review;
- 3) Technical and programmatic issues if any;
- 4) Contract deliverables;
- 5) FIP and BIP;
- 6) Licensing issues if any;
- 7) Final Funding and cash-flow;
- 8) Discuss project management issues;
- 9) Other items as deemed appropriate;
- 10) Presentation's slides to include the required copyrights and intellectual property disclosure

A.8.3.5 DID-0005 – Meeting Minutes

PURPOSE:

To provide a record of decisions and agreements reached during reviews/meetings.

PREPARATION INSTRUCTIONS:

The Meeting Minutes must contain the following information, as a minimum:

- 1) Title page containing the following:
 - a) Title, type of meeting and date,
 - b) Project title, project number, and contract number,
 - c) Space for signatures of the designated representatives of the Contractor, the CSA and the Public Works and Government Services Canada (PWGSC), and
 - d) Name and address of the Contractor;
- 2) Purpose and objective of the meeting;
- 3) Location;
- 4) Agenda;
- 5) Summary of the discussions, decisions and agreements reached;
- 6) List of the attendees by name, position, phone numbers and e-mail addresses as appropriate;
- 7) Listing of open action items and responsibility for each action to be implemented as a result of the review, numbered per the AIL (see CDRL No. 6, and DID-0013);
- 8) Other data and information as mutually agreed; and
- 9) The minutes must include the following statement:

“All parties involved in contractual obligations concerning the project acknowledge that minutes of a review/meeting do not modify, subtract from, or add to the obligations of the parties, as defined in the contract.”

A.8.3.6 DID-0006 – Monthly Progress Report

PURPOSE:

To record the status of the work in progress during the previous calendar month. The Progress Report is used by the Government to assess the Contractor's progress in performance of the work.

PREPARATION INSTRUCTIONS:

The Monthly Progress Report must list each deliverable and contain the following information, as a minimum:

- 1) Current % of completion
- 2) Planned and actual completion date
- 3) Brief summary of the work performed in the current month
- 4) The work planned for the following month
- 5) A highlight of problems, if any, and the proposed corrective approach
- 6) A table showing current financial status (cash flow planned vs. actual)
- 7) Any other relevant information deemed necessary.

Based on the above, the Monthly Progress Report should not exceed 3 pages.

This report is required even in the case of a fixed firm price contract.

A.8.3.7 DID-0007 – Technical 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 concepts study.)

PREPARATION INSTRUCTIONS:

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

- 1) Technical
 - a) Overall Concept:
 - i) Mission selected (including orbit, launch options, mission duration), if applicable,
 - ii) Contribution to mission, if applicable,
 - iii) System level approach,
 - iv) Innovation,
 - v) Critical aspects, and
 - vi) Traceability to mission requirements;
 - b) Conceptual Design:
 - i) Technical approach and possible options,
 - ii) Preliminary layout,
 - iii) Functional block diagram,
 - iv) Related subsystems identification,
 - v) Subsystems trade-offs,
 - vi) Preliminary Concept of Operation, and
 - vii) Potential system operator identification;
 - c) Interface Definition;

- d) Feasibility:
 - i) Intrinsic technical constraints,
 - ii) External operating constraints, and
 - iii) Potential solutions;
 - e) Compatibility with Target Mission(s);
 - f) User/Mission Requirements:
 - i) Mission needs,
 - ii) Key system parameters,
 - iii) Expected performance,
 - iv) Reliability, and
 - v) Technical Performance Measures:
 - (1) Functional requirements,
 - (2) Preliminary performance targets,
 - (3) Resource budgets (mass, power, thermal, processing power, etc.);
- 2) Schedule and Implementation
- a) Schedule;
 - b) Collaboration, if applicable:
 - i) Identified national and international collaboration potential,
 - ii) Types of agreements,
 - iii) Mechanisms, and
 - iv) Potential difficulties;
 - c) Technology readiness and risk assessment
 - i) Current technology readiness level (TRL) and technology development risk (R&D3) as per MRD-1
 - d) Technology Development Roadmap

The framework of the technology roadmap is defined in MRD-5

- i) Proposed roadmap for technology developments
 - (1) Required technology developments to meet mission needs, and
 - (2) Plan and timeline to reach TRL 6 and 8;
 - e) Development, Manufacturing and Qualification Approach:
 - i) Development approach,
 - ii) Subsystem providers,
 - iii) Subsystem Qualification Status (if applicable)
 - iv) Key subcontractors,
 - v) General strategy,
 - vi) Development tasks, and
 - vii) Manufacturing tasks;
 - viii) Qualification plan
- 3) Programmatic
- a) Preliminary Mission Risk Assessment identification and mitigation:
 - i) Technical,
 - ii) Schedule,
 - iii) Cost, and
 - iv) Programmatic;
 - b) Business Potential;
 - c) Canadian Capabilities Development;
 - d) Intellectual Property Management:
 - i) BIP, and
 - ii) FIP;
 - e) Preliminary Commercialisation Plan:
 - i) Targeted market,

- ii) Potential sales,
- iii) Competition, and
- iv) Marketing strategy.

A.8.3.8 DID-0008 – Contractor Disclosure of Intellectual Property

PURPOSE:

To list all Foreground and Background Intellectual Property related to the project, to be reviewed at the Final Review Meeting.

PREPARATION INSTRUCTIONS:

The Disclosure must address the questions listed in Appendix 2 to ANNEX A.

A.8.3.9 DID-0009 – Executive Report

PURPOSE:

To fully describe the entire project for dissemination in the public domain.

PREPARATION INSTRUCTIONS:

The Executive Report will be placed in the public domain (e.g. CSA's library, publication and/or website). The report should not exceed ten (10) pages.

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

1) Introduction (~2 pages);

Presentation of overall concept and main objectives. Illustrative picture(s) should be included.

2) Concept Overview (2-3 pages);

Discussion on main user/mission requirements, feasibility and compatibility with target mission.

3) Technology (~1 page);

Description of the innovative technologies requiring development and summary of the application fields.

4) Technology Development Roadmap, Cost and Implementation (2-3 pages);

Schedule, Technology Development Roadmap with TRL and R&D3, overall cost category, collaboration. For the cost, the following categories must be used:

- > \$200M
- \$75M - \$200M
- \$20M - \$75M
- \$10M - \$20M
- \$5M - \$10M
- \$1M - \$5M
- <\$1M

5) Business Potential (~1 page);

Business potential, Canadian capabilities development

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):

© CANADIAN SPACE AGENCY, 2013

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

A.8.3.10 DID-0010 – Final Data Package

PURPOSE:

The Final Data Package is a collection of all documents to be presented by the Contractor at the end of the contract.

PREPARATION INSTRUCTIONS:

The Final Data Package must consist of the final/revised version of all deliverables requested under the present contract (electronic copy). For example, with no limitation, the final data package should include presentations, minutes, monthly progress reports and other required deliverables in their final revision. It must also include the contractor disclosure of intellectual property and project evaluation sheet.

A.8.3.11 DID-0011 – Contractor Performance Evaluation

PURPOSE:

To provide an evaluation of the overall success of the project.

PREPARATION INSTRUCTIONS:

The Contractor Performance Evaluation must contain the following information, as a minimum:

- 1) Was the project completed on schedule (list deliverables with planned and actual delivery date)?
- 2) How many man-hours of highly qualified personnel (by category) did this work create or maintain?
- 3) New opportunities created by the work conducted under the study.

A.8.3.12 DID-0012 – Video

PURPOSE:

To provide a graphical representation of the project.

PREPARATION INSTRUCTIONS:

This video representation will be used to better appreciate and understand the proposed concept. The CSA will not commit more than \$10,000 (ten thousand) dollars for this deliverable (this amount is included in the value of the future contract). Cost in excess of this amount will be at the expense of the bidder. The duration of the sequence should be no shorter than 90 seconds and no longer than 3 minutes.

For detailed requirements refer to Appendix 3 to ANNEX A – Technical Specifications for Video Distributed on the Internet

A.8.3.13 DID-0013 – Action Items Log

PURPOSE:

The Action Item Log (AIL) lists, in chronological order, all items on which some action is required, allows tracking of the action, and in the end provides a permanent record of those Action Items (AI).

PREPARATION INSTRUCTIONS:

The Action Item Log (AIL) must be in a tabular form, with the following headings in this order:

- 1) Item Number;
- 2) Item Title;
- 3) Open Date;
- 4) Source of AI (e.g. PDR meeting, RID, etc.);
- 5) Originator;
- 6) Office of Prime Interest (OPI);
- 7) Person responsible (for taking action);
- 8) Target/Actual Date of Resolution;
- 9) Status (Open or Closed); and
- 10) Remarks.

The date in column 8) will be the target date as long as the item is open, and the actual date once the item is closed.

A.8.3.14 DID-0014 – Technology Readiness and Risk Assessment Worksheets and Rollup

PURPOSE:

The Technology Readiness and Risk Assessment provides for all the elements of the proposed concept, as per Product Breakdown Structure (PBS), a high-level summary of the maturity of the technologies and the technology development risks.

PREPARATION INSTRUCTIONS:

The Technology Readiness and Risk Assessment must be done using MRD-6 for each technology and rolled-up into a summary using MRD-7.

A.8.3.15 DID-0015 – Technology Roadmap Worksheets

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 MRD-5.

A.8.3.16 DID-0016 – Cost

PURPOSE:

The ROM cost and estimated Canadian content is critical for planning and implementation of potential follow on technology and mission developments.

PREPARATION INSTRUCTIONS:

The cost is must provide the following elements

- a) ROM cost, including detailed subsystem-level cost breakdown and justifications; and
- b) Estimate of Canadian Content

Appendix 1 to ANNEX A

Document Naming Conventions

Context

This annex presents the naming convention to follow for any documentation generated under this RFP and any resulting contract.

Documents must contain 3 main components:

Project identifier

Contract Number

Date Tracking number

WXYZ-TYPE-NUM-CIE_ContractNumber_sent2013-03-30

Project Identifier

The project identifier must contain:

WXYZ: A 4-8 letter acronym of the project

TYPE: A 2 letter acronym according for the table below.

Acronym	Description
AG	Agenda
ER	Executive Report
MN	Minutes of meeting
PR	Progress Report
PT	Presentation
TN	Technical Note
MM	Animation/Multimedia

NUM: A three digits sequential number (e.g. 001, 002, etc.)

CIE: Name of Company (no space, no hyphen)

Contract Number

For example: _9F028-07-4200-03

Date Tracking Number

_sentYEAR-MONTH-DAY_draft

The *_draft* mention should be removed on the final version of the document once approved by CSA.

Appendix 2 to ANNEX A Contractor Disclosure - Intellectual Property

Instructions

- *The Contractor must respond to the following questions when Foreground Intellectual Property is created under the Contract with the CSA. The Contractor must also complete Table 1 (Disclosure of the Foreground Intellectual Property (FIP) developed under the Contract).*
- *If Canada or the CSA is the owner of the FIP developed under the Contract, the Contractor must complete Table 2 (Canada's Owned FIP Additional Information).*
- *If the Contractor used or intends to use BIP to develop FIP, the Contractor must complete Table 3 (Disclosure of Background Intellectual Property (BIP) brought to the project by the Contractor).*

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 3 attached (Disclosure of Background Intellectual Property)
- No

7. What was the objective of the project and how the FIP meets this objective?

The representative of the Contractor must sign and date the disclosure form and send the form and tables to the CSA Project Manager. The CSA Project Manager will then forward the documents to Josée Labrecque at the Intellectual Property Management and Technology Transfer office: IPTT@asc-csa.gc.ca

For the Contractor

Signature

Date

Name, title

Table 1. Disclosure of the Foreground Intellectual Property (FIP) developed under the Contract

Element	Title of FIP	Type of FIP (copyright, invention, design, software, know-how, trade secret, algorithms...)	Description of the FIP	Reference documentation (Technical report, design doc)	Owner of the FIP Contractor, Subcontractor, Canada* Provide name of subcontractor

*If Canada is the owner of the FIP, complete Table 2 below

Table 2. Canada's Owned FIP Additional Information

Title of FIP	Aspects of FIP that are novel, useful and non obvious	Limitations or drawback of the FIP	References in literature or patents pertaining to the FIP	Has the FIP been prototyped, tested or demonstrated (e.g. analytically, simulation, hardware)? Provide results	Name, coordinates and company of inventor(s)*	Was the FIP or any element declared, disclosed to other parties? If so, when, where, to whom?

*Inventor means the person who created the FIP

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

Element	Title of the BIP	Types of IP (software, design, algorithms, patent)	Type of access to the BIP required to use/improve the FIP	Description of the BIP	Reference documentation (Technical report, design doc)	Origin of the BIP (internal R&D, project, contract #)	Owner of the BIP

Appendix 3 to ANNEX A

Technical Specifications for Videos for Exploration Core Concept Study

A.1 Final product

A.2 General technical requirements

The picture must be free of excessive noise, grain and digital compression artefacts.

Movement must appear reasonably smooth and continuous, and must not give rise to distortions or break-up to moving objects, or cause large changes in resolution.

The picture must be free of excessive black crushing and highlight compression. Hard clipping of highlights (e.g., by legalisers) must not cause visible artefacts on screen.

There must be no noticeable horizontal or vertical aliasing, i.e. jagged lines, field or frame rate fluctuations in fine detail.

The picture must be stable and continuous - i.e. no jumps, movements, shifts in level or position.

There must be no visible contouring / artefacts caused by digital processing. Quantisation noise must not be apparent.

There must be no noticeable spurious signals or artefacts e.g. streaking, ringing, smear, echoes, overshoots, moiré, hum, cross-talk etc.

Note, exceptions can be made, e.g., when using historical (grainy) footage to illustrate the past.

A.3 File naming

All files produced should conform with Appendix A to ANNEX A Document Naming Conventions.

They should also contain a **unique identical identifier** common to all files ensuring that all files are traceable to the original video editing. Depending of the product suffixes of files may be:

- | | |
|------------------------------------------------|-------------------------------------------|
| a) The source video(s) | (_V00001010EN.avi) |
| b) The compressed video (edited version) | (_V00001010EN-1920x1080-24p_20120931.wmv) |
| c) The text transcription file | (_TR00001010EN.doc) |
| d) The subtitling source file | (_ST00001010EN-source.doc) |
| e) The subtitling sync file | (_ST00001010EN-sync.srt) |
| f) The subtitling Camtasia project file | (_PC00001010EN.camproj) |
| g) The starting image for the the Web player | (_POA00001010EN.jpg) |

The unique identifier will be given with the contract agreement.

The final compressed video name should include **size, rate & date**

A.4 File Structure

Files should be delivered according to the following file structure, e.g. zip file:

- Montage: including
 - Montage files
 - Camtasia sub-title project files (as per naming convention)
- Final: including
 - Compressed final version (e.g., wmv, mp4, mov) and uncompressed final version (e.g., avi, mov) – as per naming convention)
- Sources
 - Sequences
 - Images
 - Sound
- Music
- Associated, including
 - Meta information, sub-titles, transcriptions

A.5 Encoding

The product should be delivered in

- 1) Uncompressed and
- 2) Compressed format.

The compressed format must be encoded in adherence to the technical specifications of one of the options listed in Table 1.

1. TABLE 1: Technical specifications for the final edited video

Output	Option 1	Option 2	Option 3
Format	WMV	MPG4	Quicktime MOV
Codec	Video 9	H.264	ProRes 422
Dimensions	1920x1080¹		
Ratio	16:9		
Frame Rate²	24P (23.976)		

¹ Alternative if 1920x1080 cannot be obtained: 1280x720

² Not change in frame rate over the complete sequence.

Bitrate for compressed final	VBR 8 to 15 MB/S
Audio	48kHz @ 128bit/s

A.6 Transcription of video, dialogues and displayed texts

For all video products, a text transcription in both official languages, i.e., French and English must be provided electronically in Microsoft Word format.

The objective is a chronological text source that describes the action illustrated in the sequence and includes the spoken dialogue. This text is used for the screen-reading software (e.g., JAWS) replacing the animation sequence for visually impaired people.

Note: If applicable, correct errors in speech, such as incorrect diction, syntax and pronunciation. The final product must be provided without spelling errors.

A.7 Thumbnail

An image slide, the same size as the final compressed video, should show the most comprehensive frame of the video. This image will be used as the starting image on our Web video players.

A.8 Logos and Wordmarks

The product must not include any logos or wordmarks, except of department or agencies of the government. However, names of participating organizations can be included, e.g., in the credits section at the end of the animation.

A.9 Rights

The contractor must transfer all copyrights and moral rights to the Crown of the product.

The contractor must deliver all required licences to the CSA for any sequences, sounds, and pictures bought or obtained from third parties (e.g., iStock).

A.10 Safe action and safe title area

All titles, action, graphics must be correctly framed throughout to retain safe picture content. No pillar box blanking or letterboxed footage can be used unless previously approved. Do not place essential information outside of the title safe margin of 10% from right and left edges.

A.11 Product containing written text

If the product contains written text, a French and an English version of the product has to be produced.

A.12 Product containing spoken language

If the product contains spoken language, a French and an English version of the product has to be produced. The following sub-section apply.

A.13 Subtitles (closed captioning)

Then, for both versions (i.e., English, French), the following specifications should be used as guidelines:

- Produce an original a “Source” Word (.doc) document of the spoken text, writing each phrase clearly and separately with a carriage return between each;
- Use that source file to produce the synchronised version. The producer should use **Camtasia** to produce the **.SRT output file**.
- Text must synchronized with the video time-code (00:00:00:00)
- Sentences should be divided into 2 to 4 seconds.
- Display: maximum two lines at a time, without scrolling.
- Special punctuation: the natural pauses of the interlocutor must be marked with dots.

A.14 Audio requirements and description

The product must be produced using industry standards and accepted norms for good practice and workmanship. The audio portion of the master and resulting products and source audio and videotapes must be produced so that no noise, static, dropouts or extraneous distortion is recorded in the audio. The audio mix should be well balanced and equalized, with clear dialog and narration that is not buried by effects or music.

Peak audio levels may not rise above -10dB. Average level of dialog and narration should reach -27dB measured over the length of the product. Audio must have good dynamic range and compression must be kept at an acceptable level so not to deteriorate perceptive audio quality. Audio signal must not peak 8dB above average.

Stereo audio must be capable on mixing to mono without any noticeable phase cancellation.

Relative timing of sound to vision should not exhibit any perceptible error. Typically, this means that the sound shall not lead or lag the vision by more than 5 ms.

Audio sampling rates for masters and resulting products must be at 48 kHz with a 20 bits resolution using Advanced Audio Coding (AAC). Acceptable format is mp3 or wav.

Appendix 4 to ANNEX A

Asteroid Rendezvous Sensor for the Asteroid Redirect Mission

Concept

A.1 List of Acronyms

CW	Continuous Wave
FY	Fiscal Year
LIDAR	Light Detection And Ranging
NASA	National Aeronautics and Space Administration
OLA	Osiris-Rex Laser Altimeter
RFI	Request For Information
SLS	Space Launch System
STS	Space Transportation System
ToF	Time of Flight
TRRA	Technology Readiness and Risk Assessment

A.2 Introduction

The objective of this Exploration Core concept study is to define an Asteroid Rendezvous Sensor System that will perform either operational or scientific tasks as part of the Asteroid Redirect Initiative. Indeed, NASA recently announced plans to capture a small asteroid, redirect it into a stable orbit in translunar space, and explore it with astronauts carried onboard the Orion spacecraft as early as 2021 [MRD-8].

NASA's Asteroid Initiative will be implemented in following three segments [MRD-9]:

- identify
- redirect
- explore

As part of this concept study, the Contractor shall define concepts for an Asteroid Rendezvous Sensor System that will contribute to the redirect segment.

The Asteroid Redirection Systems will consist in robotic spacecraft systems which will enable rendezvous and proximity operations with an asteroid, and redirection of an asteroid of up to 1,000 metric tons into translunar space. System concepts must be available for launch as early as 2017, but no later than June 2018. The complete redirect vehicle will be launched using the Space Launch System (SLS) or preferably a smaller launch vehicle and will be capable of operating over the range of 0.7 AU to 1.3 AU. For a description of early asteroid redirect approaches, see the Keck Institute for Space Studies Asteroid Retrieval Feasibility Study on the references website listed later in the NASA Request for Information (RFI) synopsis [MRD-8].

The Asteroid Capture Systems will capture and de-spin an asteroid with the following characteristics:

- Asteroid size: $5 \text{ m} < \text{mean diameter} < 13 \text{ m}$; aspect ratio $< 2/1$ b.
- Asteroid mass: up to 1,000 metric tons
- Asteroid rotation rate: up to 2 revolutions per minute about any axis or all axes.
- Asteroid composition, internal structure, and physical integrity will likely be unknown until after rendezvous and capture.



A.2.1 Technology Descriptions

LIDAR sensors are commonly used as rendezvous sensors. LIDAR instruments have been used during many flight missions over the last 10 years. Table 6 gives an overview of the Canadian LIDARs flight heritage, and summarizes their uses, types, and characteristics. For the sake of completeness, the Osirix-Rex Laser Altimeter (OLA), which is still in development, was added to the table. In addition, MRD-12 includes a literature review, where multiple references describe how laser-based sensors can be used for capturing free-floating objects in space.

Table 6: Canadian Space LIDARs flight heritage, based on published data.

Aspect	XSS-11	TriDAR		Phoenix	OLA	
		Triangulation	ToF		Low energy laser Similar to XSS-11	High energy laser Similar to Phoenix
Mission year	2005	2009-2011	2013-2014	2008	2017	
Application	Ranging	Ranging, inspection, tracking	Ranging, inspection, tracking	Atmospheric science (study clouds, fogs, dust)	Surface characterization (science)	
Minimum Range	0.5 m	0.6 m	2 m	50 m	2 m (500 m operational limit)	1000 m
Maximum Range	3.5 km	10 m	>2000 m	5 km (1064 nm) 20km (532 nm)	1000 m	7500 m
Laser wavelength	1064 nm	1420 nm	1540 nm	532 nm and 1064 nm	1064 nm	1064 nm
Laser Rep rate	8000-10000 Hz	N/A (CW)	>7000 Hz	100 Hz	8000 – 10000 Hz	100 Hz
Laser Energy	0.010 mJ	95 mW	110 mW	0.4 mJ at 532 nm 0.3 mJ at 1064 nm	0.010 mJ	~1 mJ

Laser Transmitter

Aspect	XSS-11	TriDAR		Phoenix	OLA	
		Triangulation	ToF		Low energy laser Similar to XSS-11	High energy laser Similar to Phoenix
Beam Divergence	0.5 mrad	N/A (collimated)	300 μ rad	0.5 mrad	0.5 mrad	
Period of Use	12-18 months	Used on 3 STS missions		5 months	505 days (surface mapping phase only)	505 days (surface mapping phase only)
Range Accuracy	5 – 20 cm (between 50m and 3 km)	<10 mm	7 mm	N/A	5 – 30 cm	
Range Resolution	1 cm	3 mm (collimated configuration)	7 mm	50 m	1 cm	
Angular Resolution (pointing)	<0.8 mrad	<0.001°	<0.001°	N/A	N/A	
Spatial Resolution (at aperture)	N/A	<3 mm (collimated configuration)	<5 mm	N/A	N/A	
Scanner field of regard	$\pm 10^\circ$ (Az) $\pm 10^\circ$ (EI)	30° x 30°	40° x 30°	N/A (no scanner)	$\pm 10^\circ$ (Az) $\pm 10^\circ$ (EI)	

Scanner/ Receiver

Aspect	XSS-11	TriDAR		Phoenix	OLA	
		Triangulation	ToF		Low energy laser Similar to XSS-11	High energy laser Similar to Phoenix
Field of View (FOV)	N/A (scanner)	N/A (scanner)	N/A (scanner)	2 mrad (532 nm) 1.5 mrad (1064 nm)	Similar to Phoenix	Similar to Phoenix
Instrument Mass	10 kg	25 kg	20 kg	6.0 kg	~20 kg	
Power	<85 W (60W average)	65 W (excluding keep alive power)	60 W (excluding keep alive power)	<30 W (excluding keep alive power)	<85 W (60W average)	
Thermal environment	-40°C to 85°C (storage) -10°C to 45°C (operating)	-20°C to 70°C (storage) -10°C to 60°C (operating)	-20°C to 70°C (storage) -10°C to 60°C (operating)	-60°C to 75°C (storage) -40°C to 0°C (operating)	Similar to Phoenix and XSS-11	
Radiation environment testing	LEO	LEO	LEO	Survival: interplanetary Operations: Surface of Mars	Interplanetary	
Engineering allocations and environment						

A.3 Reference Documents

Reference documents are listed in Table 2.

Table 7: Reference Documents.

RD No.	Document Number	Document Title	Rev. No.	Date
MRD-8.	NNH13ZCQ001L	NASA ASTEROID INITIATIVE REQUEST FOR INFORMATION https://prod.nais.nasa.gov/cgi-bin/eps/synopsis.cgi?acqid=156731 Also see the following link for all the details about this NASA initiative http://www.nasa.gov/mission_pages/asteroids/initiative/asteroid-rfi.html	-	18 June 2013
MRD-9.	-	NASA’S FY2014 Asteroid Strategy – An Integrated Strategy in Support of human Exploration and Protection of the Planet – Presentation http://www.nasa.gov/pdf/740684main_LightfootBudgetPresent0410.pdf	-	April10, 2013
MRD-10.	-	Keck Institute for Space Studies - Asteroid Retrieval Feasibility Study http://www.kiss.caltech.edu/study/asteroid/asteroid_final_report.pdf	-	2 April 2012
MRD-11.	-	Asteroid Redirect Mission Reference Concept http://www.nasa.gov/pdf/756122main_Asteroid%20Redirect%20Mission%20Reference%20Concept%20Description.pdf	-	-
MRD-12.	DOI: 10.2514/1.37129	Aghili, F., Parsa, K., “Motion and Parameter Estimation of Space Objects Using Laser-Vision Data”, <i>AIAA Journal of Guidance, Control, and Dynamics</i> , Vol. 32, No. 2, March-April 2009, pp. 537-549	-	April 2009

A.4 Scope

The Contractor shall develop the concept(s) for an Asteroid Rendezvous Sensor System that will be part of integrated sensing systems to support asteroid rendezvous, proximity operations, characterization, and capture. The sensing systems should be capable of characterizing the asteroid's size, shape, mass and inertia properties, spin state, surface properties, and composition. Some of the same sensors will also be needed in closed-loop control during capture

The study should define:

- Rendezvous Sensor System concept(s), minimizing cost , maximizing re-use for different mission scenarios, and building on flight heritage
- Drawing, images, and videos showing typical operations scenarios
- Cost estimates
- Technology Development Roadmap(s)
- Technology Readiness and Risk Assessments (TRRAs)

The study shall include:

- the complete proposed rendezvous sensor system(s), including the sensor instrument, electronics, and software. The hardware and software shall provide the capabilities to perform science and operational tasks, as well as house keeping tasks specific to the sensor system(s).
- the system(s) architecture trade-offs, and recommendation of the optimal concept(s). One of those trade-offs concerns the allocation of data processing functions to the on-board subsystems versus the ground subsystems. Such trade-offs must take into consideration the hardware and software complexity (hence development time and costs) as well as the engineering resources utilization (for example data bandwidth, data storage etc...).

A.5 Requirements

NASA's RFI [MRD-8] references describe potential asteroid approach, capture, and redirection techniques that can be useful in the context of this work [MRD-10 and MRD-11]. In particular, MRD-5 discusses in more detail typical scientific, operational, and engineering needs associated with a mission to an asteroid. MRD-12 presents a technique using an adaptative Kalman filter to accurately estimate the relative pose of two free-floating objects in nearby orbits. Based on the available information, and for each rendezvous sensor concept, the Contractor shall:

- Develop top-level requirements and constraints (hardware and software), taking into account the criticality of the instrument(s) for the mission success (scientific or operational), the expected mission duration and overall life cycle, the mission environments, and reliability considerations.
- Identify key requirements, design drivers, and validation activities (to refine the requirements definition)
- Define system functionality (hardware and software)

- Elaborate the concept of operations, including examples of operation sequences to illustrate the complete operation process, with a comparison to existing operations methods, showing how the proposed instrument(s) will answer the requirements, and demonstrate that credible and feasible design(s) exist

A.6 Concept

For each proposed Rendezvous Sensor System, as requested in the Statement of Work in Annex A, the Contractor shall:

- Develop the top-level instrument(s) architecture
- Define corresponding evaluation criteria and metrics, technology needs, and risk areas
- Perform and document major trade studies
- Specify instrument(s) characteristics and technical budgets (mass, volume, power etc...)
- Define the top-level WBS from the proposed system architecture (i.e. product based WBS)
- Provide ROM life cycle cost estimates for the proposed concepts based on the WBS and Technology Development Roadmaps.

Appendix 5 to ANNEX A

Deep-Space Exploration Robotics

Concept

A.1 List of Acronyms

CSA	Canadian Space Agency
ARM	Asteroid Redirection Mission
SOW	Statement of Work
SLS	Space launch system
TRL	Technology Readiness Level
ARV	Asteroid Redirect Vehicle
WP	Work Package
MPCV	Multi-purpose Crew Vehicle (formerly known as Orion)
EML-2	Earth-Moon Second Liberation point
DSH	Deep-Space Habitat
EVA	Extra Vehicular Activity
S/C	Spacecraft
NEA	Near Earth Asteroid
ARV	Asteroid Redirect Vehicle
RAO	Robotics and Automation for Orion
NGC	Next Generation Canadarm
EGS	EML-2 Gateway Spacecraft
ROM	Rough Order of Magnitude
TRRA	Technology Readiness and Risk Assessment

A.2 Introduction

The scope of this concept study is to extend the Canadian robotics technology for robotic servicing to applications in deep-space missions. The target missions of this concept study are:

1. Asteroid Redirect Mission (ARM).
2. EML-2 Gateway spacecraft.

The concept study applying robotic technologies has to build on Canadian heritage in space robotics, previous CSA relating concept studies, and R&D projects for boosting the Canadian space robotics technology.

It is cost-effective to develop a single versatile robotic arm system capable of serving in several deep-space missions in the horizon. In this context, a robotic system with modular or reconfigurable structure may be considered if cost-benefit analysis leads to such a solution.

The Asteroid Redirect Mission (ARM) is a NASA initiative to rendezvous with, capture, and redirect an entire Near Earth Asteroid (NEA) with a mass of up to 10-m-class tones into a stable lunar orbit where astronauts can explore and take samples from it. This mission has two phases. In phase 1, an unmanned SEP-powered spacecraft (S/C), called Asteroid Redirect Vehicle (ARV), is directed launch toward moon or to the asteroid using solar electric propulsion through a low thrust trajectory. Methodologies and technologies are developed to provide capabilities to rendezvous with and capture a tumbling asteroid with large mass. The ARV does not have any robotic arm and one concept is to equip it with a novel inflatable capture bag which is big enough to comfortably envelop the target asteroid and then to hold it away from contact with S/C. The captured hundred-ton asteroid is then tugged to near the Moon so that scientists can retrieve and examine, in detail, bulk composition of the asteroid in the phase 2. The phase 2 began by launching the Multi-Purpose Crew Vehicle (MPCV), formerly known as Orion, towards a rendezvous point with ARV, most likely at EML-2. The Orion (MPCV) is could be equipped with a system based on robotic technology that may provide some of the following functionalities:

1. Capture ARV and then attach the vehicle to the Orion;
2. Provide EVA support to retrieve samples from the hundred-ton asteroid;
3. Directly retrieve samples from the captured asteroid using specialized tooling and drills; and,
4. Robotic capturing of free-floater objects.

NASA also seeks missions to utilize systems currently in development, including the MPCV (Orion) spacecraft and Space Launch System heavy launch vehicle. NASA is investigating a proposed station at the second Earth-Moon Libration Point (EML-2) as a gateway to the far side of the moon as well as deep space. Such a "Gateway EML-2 spacecraft" would be fixed relative to the Earth-Moon rotating system, and would serve a variety of functions, including communications access to the far side of the Moon, a base for "radio-quiet" deep-space observations, and as a waypoint and refueling station for manned missions to deep space. Such a station would be also an ideal location for deep space missions to finalize system tests prior to leaving the Earth-Moon system for other locations in the solar system. Additionally, such a station could serve as a communications relay to robotic or crewed missions on the far-side lunar surface. It is envisaged that the EML-2 gateway spacecraft" could be equipped with a robotic arm system to provide the following functionalities:

1. Inspection of the Spacecraft
2. Maintenance
3. Robotic capture of sample return vehicles or canisters (possibly uncooperative)
4. EVA support
5. Docking of visiting vehicles
6. Assembly of modules for future extension of the Deep-Space station

The objective of this concept study is to develop a feasible concept for a generic robotic arm or a combination of robotic systems and tools for deep space missions, based on the Canadian heritage technologies. The concept study must include an estimate of the mass, power, volume of the proposed integrated assembly (system and packaging), transportation via Orion spacecraft to deep space destinations, operations, ROM cost, ROM schedule and implementation. It must also include an assessment of the current performance level of the technology or concept and define the required technology development requirements to bring the technology to a higher Technology Readiness Level (TRL) at the appropriate time (TRL @ date). TRL definitions are provided in MRD-14 and MRD-15.

A.3 Reference Documents

Reference documents are listed in Table 2.

Table 8: Reference Documents.

RD No.	Document Number	Document Title	Rev. No.	Date
MRD-13.	Livelink Number: 12364967	Space Exploration – Discussion Paper for the development of the Canadian Space Exploration Strategic Plan – CSA Signature Technologies	Draft 0.19	November 2010
MRD-14.	CSA-ST-GDL-0001	CSA Technology Readiness Levels and Assessment Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA	Rev A	October 2010
MRD-15.	ESTEC TEC-SHS/5574/MG/alpha	Technology Readiness Levels Handbook for Space Applications ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRL-TRA	Iss. 1 / Rev. 6	March 2009
MRD-16.	CSA-ST-GDL-0002	CSA Technology Tree ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Technology-Tree/	IR	December 2009
MRD-17.		Canadian Space Agency Technology Roadmap Framework ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRM/CSA_TechnologyRoadmappingWorkbook_ver1.xls		
MRD-18.	NASA Asteroid Initiative	http://www.nasa.gov/mission_pages/asteroids/initiative/asteroid-rfi.html		June 2013

A.4 Scope

The CSA needs an investigation of how the Canadian robotic heritage can be leveraged in the most cost effective way to target multiple deep-space exploration missions, with at-least two envisaged mission scenarios Asteroid Redirect Mission (ARM) and Deep-Space Gateway Spacecraft in the horizon. The concept study must address:

- A survey of national and international deep-space robotic missions from a cost-benefit point of view and business opportunities for Canada;
- Cost-benefit analysis of using robotic technologies and tools for potential deep-space missions such as the Asteroid Redirect Mission and the deep-Space habitant in EML-2;
- An assessment of manipulators and robotic servicing technologies and tools for aforementioned deep-space missions. That includes a survey of state-of-art and R&D of related technologies;
- Identification of Canada's niche in robotic technology for supporting the deep-space missions;
- Conceptual design of a cost-effective robotic system(s) to be used for ARM and DSH. That includes cost-benefit analysis for choosing a single multi-purpose arm versus special purpose arms and tools that can serve in a variety of deep-space missions;
- Conceptual design for transporting the robotic systems(s) to deep-space via Orion/SLS (or other candidate cargo vehicles);
- The end-to-end concept operation of for robotic servicing of ARM and Deep-Space Gateway S/C. That includes representative animations;
- Feasibility study of deep-space exploration robotic system for multiple deep-space exploration missions from both technological and economical points of views;
- The end-to-end cost estimate for the missions, including development, launch, and operations;
- Technology Development Roadmap; and,
- TRRAs.

The requirements for this concept study are listed in section A.4.1.

A.4.1 Requirements

The basic requirements are as follows:

1. The Contractor must provide justification for the significant advantage yielded by using the extension of the Canadian space robotics heritage technology to support at least two servicing missions such as the Asteroid Redirect Mission and the Deep-Space Gateway S/C;
2. The Contractor must provide justification based on a cost-benefit analysis for multi-purpose robotic systems versus special purpose ones;
3. The Contractor should take into account the current capabilities of the Canadian robotic system on ISS in addition to recent advancements in robotics systems and tool technologies;
4. The Contractor must take into account the capabilities of the MPCV (Orion) and Deep-Space Gateway S/C regarding operating volume, power, weight, equipment or any other limitations or regulations of the deployment of robotic arm to deep space;
5. Functional requirements of the robotic system stowed to Orion:

- a. Capture the ARV and then attach the vehicle to the Orion;
 - b. Provide EVA support to retrieve samples from the hundred-ton asteroid;
 - c. Robotically retrieve samples from the asteroid; and,
 - d. Vision-based assistance for robotic capture of cooperative/uncooperative space objects;
6. Functional requirements of the robotic arm stowed to the Deep-Space Gateway S/C:
 - a. EVA support;
 - b. Inspection and maintenance of the habitat module;
 - c. Capture of space objects, e.g., planetary or asteroid sample containments; and,
 - d. Capture and berthing of visiting vehicles;
 7. The contractor is responsible to provide such high-level requirements of the arm as the number of degree-of-freedom, joint complex design (e.g., actuators, gearbox, joint sensors), maximum end-effector force and velocity, workspace volume, stowed volume, kinematic configuration, boom design (modular or reconfigurable structure), end-effector and grapple mechanism design, suites of external sensors, and control modes;
 8. The robotic system may have re-locatable capability so as it can be transferred from Orion to the Deep-Space Gateway S/C back and forth; and,
 9. The Contractor must take into account practical limitations such as weight and volume of robotic arm(s) for deployment to deep-space by the SLS or other launch vehicle candidates.

A.5 Concept

The concept is subdivided into the following elements:

- Overall mission concept;
- Mission requirements and analysis;
- Robotic system;
- Weight/energy minimization and fault-tolerant actuators;
- Autonomy;
- End-effector and grapple mechanism;
- Tools;
- Sensors and instruments;
- Operations concept;
- Overall prototyping and testing approach; launch configuration compatibility;
- Feasibility;
- Cost;
- Estimation of Canadian content; and,
- Road map.

A.5.1 Overall mission concept

The Contractor must develop and present an overall concept for robotic servicing capabilities based on the Canadian robotic heritage that can be used to support multiple deep-space exploration missions in the horizon (manned or unmanned). For this concept study, at least the following envisaged mission scenarios must be considered: i) Asteroid Redirect Mission; ii) EML-2 Gateway Spacecraft. The concept must cover all aspects of such robotic missions including a conceptual design of robotic arm; grapple device and specialized end-effector; sensors, instrument and avionics; robotic capture of free-floaters and visiting vehicles; implementation; launch and transportation to stable lunar orbit; operations concept; mission requirements and analysis, and feasibility.

A.5.2 Mission Requirements and Analysis

The Contractor must define mission requirements for the exploration robotic system based on the deep-space mission concepts. The Contractor is also responsible to provide sufficient analysis to validate the high-level arm requirements against the demands of the deep-space missions and the associated environmental constraints.

A.5.3 Robotic System

Both Orion and Deep-Space Gateway spacecraft require a robotic arm to perform a variety of such tasks as capture and docking, EVA support, maintenance and inspection. In the Asteroid Redirect Mission, the exploration arm could be carried on the Orion space in the place of the docking mechanism for grappling the ARV. Once grappled, the exploration arm would remain active to maintain relative distances between the vehicles until separation approximately five days later. The Contractor must identify adequate location and configuration for the exploration arm on the Gateway station to support all designated robot servicing operations as well as possible. The manipulator design must maximize the usage of Canadian content and the robotic heritage such as Canadarm 1, 2, Dextre, as well as the Next-Generation Canadarm (NGC). From a cost-benefit point of view, it is desirable to have a generic robotic arm design concept that can be used for both ARM and the Gateway Spacecraft. The Contractor is responsible for identifying the environmental and operational constraints associated with deep-space operation of a robotic arm stowed on the manned or un-manned spacecraft. In particular, the power, weight, stowed volume budgets in addition to the robot force, velocity and workspace volume requirements must be justified. The challenging problem of transporting a robotic arm with sufficiently large booms to deep space given the weight and volume limitations of MPCV payload must be addressed in the concept design. Novel design concepts such as a re-locatable robot design for transferring the arm back and forth between ARV and DSH or robot with telescopic booms to provide the compactness capability are encouraged. However, the feasibility of such design concepts must be substantiated from both technological and economical point of views. This concept study should also explain how the newly demonstrated technology could be implemented through international collaboration with NASA to reduce the cost and risks for Canada and its international partners in the robotic deep-space missions.

The Contractor must classify the proposed technology using the CSA Technology Tree, as described in MRD-16. The Contractor must provide an assessment of the current performance level of the technology or concept and define the required technology development requirements to bring the technology to a higher Technology Readiness Level (TRL) at the appropriate time (TRL @ date). It should

include a path to TRL 8 or 9. TRL definitions are provided in MRD-14 and MRD-15. CSA is implementing a Technology Roadmapping framework, which provides information that will help to identify linkages of new technologies as they are being developed. Therefore, the Contractor must follow the Technology Roadmapping framework, as defined in MRD-17.

A.5.4 Autonomy

The exploration robotic system can have autonomous capability to minimize human intervention in performing the following robotic manipulations in deep-space environment.

1. Inspection and simple ORU change-out operations; and
2. Robotic capture of uncooperative space objects using vision data.

Autonomy as an augmentation of human operation is also demanded for cost savings via human labor efficiencies and reduced needs, in particular

1. Autonomous self-collision avoidance and object collision avoidance;
2. Autonomous robotic planning and self-tuning capability; and,
3. Robustness to uncertain environments.

Vision guidance for robotic capturing of tumbling space objects is envisaged to support operations in deep-space missions such as capturing sample return canister or even small asteroid.

A.5.5 Weight/Energy Minimization and Fault-Tolerance

It is essential to minimize the weight of the exploration robotic system due to the cost associated with launching a payload to deep-space. Moreover, the power available to operate in the deep space habitat would be limited. The Contractor is responsible to investigate how the power consumption and the weight can be optimized through the following:

1. Boom design and material;
2. Light weight actuator and gearbox; and,
3. Motor drive control to achieve energy-efficiency.

The motors which drive the joints of a space manipulator usually have double windings to achieve fault tolerance in the case of the open-circuit or short-circuit fault. However, this kind of motors tends to be bulky and massive. It is preferable to achieve fault tolerance through intelligent motor drive control.

A.5.6 End-effector and Grapple Mechanism

Docking of ARV and Orion spacecraft may utilize an International Docking System Standard (IDSS) compliant mechanism or other lightweight concepts. However, the end-effector of exploration robotic system used in the asteroid return mission must be equipped with the following:

1. A grapple mechanism to grapple the ARV;
2. Camera for inspection of the captured asteroid; and,
3. Tools to support EVA and for taking samples from the captured asteroid.

The end-effectors should also provide the following capabilities for the deep-space gateway spacecraft:

1. Capturing cooperative/non-cooperative sample return spacecraft or small sample return canister in a planetary or asteroid exploration mission;
2. Inspection of and maintenance of the Gateway station;
3. EVA support; and,
4. Capturing and berthing of visiting vehicles.

The Contractor must develop at least a conceptual design for a grapple mechanism attached to the exploration robotic system. The grapple mechanism must be able to grab onto a variety of vehicles within the scope of this concept study. The conceptual design must be feasible given existing technologies. The functional and performance specifications must be developed. It is the responsibility of the Contractor to investigate the tools or any other relating information needed to support the robotic operations within the scope of this study from reliable sources.

A.5.7 Sensors and Instruments

The Contractor must identify a suite of instruments and space-born sensors or proximity sensors which are essential for performing:

1. Robotic capture of sample return vehicles;
2. Spacecraft inspection; and,
3. Maintenance and possibly ORU change out.

Each instrument must meet the requirements of science (if applicable) in terms of functionality and performance, and meanwhile they have to be compatible with the host vehicle, i.e., Orion and EML-2 Gateway Spacecraft, in terms of mass, volume, power consumption or any other applicable requirements (e.g. deep-space radiation, heat, vacuum environment, etc.). For this purpose, literature search and information collection are required.

A.5.8 Operations concept

The Contractor must develop a complete concept of operations that covers all the aspects of the operations for deep-space robotic servicing in ARM and Deep-Space Gateway. Throughout the EVAs, the crew will interact with Johnson Space Center via Mission Control Center (MCC) over a 3 to 4 second round—trip communications delay.

The control modes of the exploration robotic system include Human-in-the-loop control modes and Automatic control modes. This includes:

1. Preprogram control via high-level scripted commands;
2. Manual control: Tele-operation on-board, i.e., crew on Orion/Deep-Space Gateway spacecraft;
3. Teleoperation from ground, using predictive computer graphics, by a human operator, supported by machine intelligence;
4. Autonomy: i) increased use of autonomy to enable an independent acting system, and ii) automation as an augmentation of human operation; and,
5. Optional: Fault tolerant control, impedance control, etc.

A.5.9 Overall prototyping and testing approach

The Contractor must propose the overall program prototyping and testing approach for end-to-end validation of the deep-space operations involving the exploration arm. Simulation can be partially used for validation. The Contractor must create an animated cartoon to demonstrate the end-to-end robotic servicing operations pertaining Asteroid Redirect Mission and Deep-Space Gateway S/C.

A.5.10 Launch Configuration Compatibility

This asteroid redirect mission is feasible with three launch vehicles: Atlas V 551, Falcon Heavy, and the Space Launch System (SLS). The storage orbit for the redirected asteroid is a stable deep retrograde orbit (DRO) in the Earth--Moon system with an orbit altitude of ~70,000 km above the lunar surface. The DRO is reachable by Orion with two crew members in a 22 to 25 day mission. The deep-space gateway station is to be launched on SLS with Delta IV for a final destination on the EML-2 orbit. The Orion spacecraft can rendezvous and dock to the station.

The contractor must demonstrate that the deep-space exploration robotic system can be transported to these destinations based on specifications of available launch vehicles and the Orion spacecraft (e.g. up-mass capacity, storage volume, power, etc.). For this purpose, literature search and information collection are required.

A.5.11 Feasibility

The Contractor must perform a study to assess the feasibility of the concepts. The scientific (if applicable), technical, and operational feasibility must be assessed on the basis of available capabilities and technologies. Major scientific and technical challenges must be identified, and solutions to these challenges, if available, should be proposed. A risk analysis must be performed to assess the risks inherent to the technology demonstration and to mitigate these risks.

A.5.12 Cost

The cost is subdivided into the following elements.

1. Rough Order of Magnitude (ROM) cost
2. Estimate of Canadian content

A.5.13 Estimation of Canadian Content

The Contractor must provide an estimate of the anticipated percentage of Canadian content relative to the overall cost presented in Table A-2, what options could be undertaken to maximize the Canadian content, and their corresponding impacts and benefits.

A.5.14 Roadmap

The Contractor must perform a Technology Readiness and Risk Assessment (TRRA) of key technologies foreseen to be used in the system, in accordance with the CSA requirements, must describe the current performance level of the technology or concept vs. the needs of the mission and define the required technology development requirements to bring the technology to the proper Technology Readiness Level (TRL) at the appropriate time (TRL @ date).

Concept Study Option: Operational Simulations of the Deep-Space Exploration Robotic System

A.6 Introduction

This section described additional work that could be performed following the concept study if and only if the CSA decides to exercise this option. The purpose optional work is to provide end-to-end simulations of the operational scenarios of several core concepts to be developed under the Deep-Space Exploration Robotic System concept study that are kinematically and visually representative. The operational scenarios of the following missions shall be simulated:

3. Asteroid Redirect Mission (ARM).
4. EM-L2 Gateway spacecraft.

A.7 The operational scenarios shall be developed using high fidelity simulation facilities and hardware facilities if available.Scope

The contractor shall provide end-to-end simulations of the robotic operation concepts of the deep-space exploration arm for mission scenarios i) Asteroid Redirect Mission (ARM) and ii) Deep-Space Gateway Spacecraft. The scenarios will be developed during the concept study and the CSA will select which scenarios will be chosen as the basis for the end-to-end simulations. At minimum, the Contractor shall produce simulations for the following robotic operation concepts:

1. First concept scenario: a deep-space exploration robotic arm is stowed to the Orion S/C:
 - a. Capture ARV and then attach the vehicle to the Orion;
 - b. EVA support to retrieve samples from the hundred-ton asteroid.
 - c. Robotic capture of cooperative/uncooperative space objects
2. Second concept scenario: the deep-space exploration arm is stowed on the Deep-Space Gateway S/C:
 - a. EVA support
 - b. Inspection and maintenance of the habitat module
 - c. Inspection and simple ORU change-out operations
 - d. Robotic capture of uncooperative space objects using vision data
 - e. Capture of space objects, e.g., planetary or asteroid sample containments.
 - f. Capture and berthing of visiting vehicles

A.7.1 Requirements

The basic requirements of the simulations are as follows:

1. The operational scenarios shall be developed using the high fidelity simulation facilities and realistic operations environment; and,
2. The simulation will include high-fidelity graphical rendering and animation (must include rendering of shadows, advanced lighting effects and accurate representation of cameras effects such as depth of field and light flares);

3. The Contractor shall consider the following factors in the development of the simulations and animations of the concept scenarios:
 - a. Representative lighting condition in space;
 - b. Representative kinematics and geometry;
 - c. Representative simulated motion velocities and accelerations that can be arbitrarily scaled up/down by the user; and,
 - d. Representative nominal operation concepts to be developed under the concept study linked to this amendment;
4. In addition to simulation of the nominal operation scenarios, the Contractor shall simulate the following autonomous capabilities to be developed under the concept study:
 - a. Autonomous self-collision avoidance and object collision avoidance;
 - b. Autonomous robotic planning and self-tuning capability; and,
 - c. Robustness to uncertain environments;
5. The Contractor shall produce graphical representation of the deep-space exploration robotic system, robotic tools and grapple fixtures, MPCV (Orion) S/C, and Deep-Space Gateway S/C in the simulations.

Appendix 6 to ANNEX A 2013 Reference Documents

The documents identified hereunder provide additional information.

Link to the reference documents: <ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Concept-Studies/2013/>

Filename: 2013 RFP References for RFP.ize

Password to decrypt that Reference document repository: &Yutg^%\$#kli

To decrypt, one can use the free software "IZArc"

Annex C – Bid Preparation Instructions

Outline and Content of Sections I and II of the Bid

The required outline and content of Sections I and II of Part 3 - Bid Preparation Instructions, is detailed herein. Should clarification be required, it is the responsibility of the Bidder to contact the Contracting Authority prior to submitting the bid.

Sections I and II should address only one project and be contained within a single document/file, not exceeding 60 pages, including 6) Bid Appendices. The information should be organized in the following order:

- 1) Title / Project Identification Page;
 - 2) Executive Summary;
 - 3) Table of Contents;
 - 4) Technical Bid;
 - 5) Managerial Bid;
 - 6) Bid Appendices:
 - 6.1) List of acronyms used in the Bid;
 - 6.2) Bidder's Criteria Substantiation (refer to section 2 of Annex D);
 - 6.3) Résumés or NSERC form 100 or equivalent (including résumés of subcontractors); and
 - 6.4) List of Contacts.
- If applicable:***
- 6.5) Corporate literature;
 - 6.6) Relevant technical papers published by team members;
 - 6.7) Any other Bid appendices deemed appropriate by the Bidder.

Note: The structure of Sections I and II and subsections are described below. Some of the subsection headings are followed by numbers in brackets. These numbers represent the Evaluation Criteria (see Annex D) that are applicable to that specific section/subsection.

1. Title / Project Identification Page

This is the first page of the Bid. It should be laid out in accordance with the requirements specified in Part 3 and should clearly state:

- 1) RFP file number;
- 2) The company's name and address;
- 3) The Category of the proposed project;
- 4) The title of the proposed project (the use of acronyms in the title is discouraged, unless they are described);
- 5) A short summary of the Bid summarizing the Bid in 8 lines (maximum).

2. Executive Summary

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

- 1) Project objectives;
- 2) Targeted Technology;
- 3) Main technical innovations;
- 4) Major milestones and deliverables; and
- 5) Relevance to CSA strategy and programs;

3. 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 electronic version.

4. Technical Bid

The Bid should describe the proposed project as outlined in the following subsections. The bidder should strive to address all items under the letter "D" of each criterion.

4.1 Impact

4.1.1 Merit of the Mission Concept (Evaluation Criterion 1)

This subsection should provide the substantiated evidence describing the relevance and merit of the proposed concept relative to the scope of work. It should address and substantiate how the proposed contribution addresses the scope of the work presented in Section 1.4 Scope of the individual Statements of work Annex A.

International collaboration opportunities should be highlighted and explanations given how they can help to reduce the overall cost to Canada. Letters of intent of potential collaboration partners should be provided.

4.1.2 Canadian Technology Strength (Evaluation Criterion 2)

The proposal should elaborate on the potential Canadian technology content and expertise of the proposed concept. Canadian technology strength should be emphasized. The proposal should assess the relative Canadian technology value based on the estimated total cost of the proposed contribution.

4.2 Technical and Criteria

4.2.1 Understanding the Requirements and Technical Principles (Evaluation Criterion 3)

This section should identify and substantiate in detail the underlying requirements and the technical principles and knowledge necessary for realizing the proposed concept. It should thoroughly demonstrate an understanding of these requirements and principles. The proposal should include a presentation of proposed concept and operations requirements that will be addressed by the proposed activities and objectives, and their relationship to

overall objectives. References to and a thorough discussion of the existing literature relevant to the central theme of the proposed concept is provided.

4.2.2 Feasibility of Achieving Goals and Technical Objectives (Evaluation Criterion 4)

In this subsection the Bidder should provide a description and overall feasibility assessment of the proposed approach and the degree to which it is capable of delivering the goals and technical objectives.

This includes the compatibility of the technology selected and incorporation into the proposed design for addressing the technical requirements and enhancements. The bidder should elaborate on the technical risks associated with the eventual integration and implementation of the concept.

The proposed effort should be well displayed and substantiate. A well thought-out, feasible and valid concept and methods that can obtain the desired technical results should be presented. The bid should show and substantiated that overall scenario is valid. It should be demonstrated that the proposed concept relies on well proven technology.

A preliminary technology development roadmap should be presented in order to meet the technical basic requirements and enhancements of the study.

The CSA Technology Readiness Levels and Assessment Guidelines are provided in MRD-1 and the Technology Readiness Levels Handbook for Space Applications is provided in MRD-2 for further details on technology readiness.

4.2.3 Scope of the Concept (Evaluation Criterion 5)

The section should address the scope and aspects of the proposed concept in relation to what is asked in the statement of work. It should provide a detailed description and substantiation of a relevant approach for the concept development. It should provide a preliminary design of the technology and a description of the operation concept.

5. Managerial Bid

The Managerial Bid should demonstrate the effectiveness and commitment of the Bidder in delivering the project on time and budget. Its sub-sections should address in detail: key-personnel qualifications, team organisation and arrangements, previous project experience, and the Management Plan.

5.1 Team Capability (Evaluation Criterion 6)

5.1.1 Team expertise

This subsection should identify the Principal Investigator, Project Manager and Technical Lead and outline their respective qualifications. It should identify the key members of the project's technical, and management teams and state their specific and relevant qualifications and experience for the work involved. Detailed résumés are to be put in an appendix of Sections I and II of the Bid. Provisions for back-up personnel for key positions are to be stated.

Key personnel include at least the principal investigator, project manager and technical leads for all the top-level technical work packages.

5.1.2 Team Organisation and Arrangements

This subsection should outline the roles and responsibilities of the proposed team members, and discuss and highlight the unique expertise they offer with respect to the capability of the team. This subsection should also provide details on the subcontractors' roles, responsibilities and on the nature of their contractual relationship with the prime contractor. An organisation chart should be included illustrating the structure of the proposed project team.

Letters of Agreement between the prime contractor, subcontractors, and other collaborators should be provided. These Letters of Agreement typically describe the scope-of-work, financial contributions, IP ownership, commercialisation activities, and any other applicable items. For scientific co-investigators, this letter should include the proposed role and time commitment.

5.1.3 Previous Project Experience

The Bidder should identify any previous experience with Research and Development (R&D) projects of a similar scope as the one proposed, including any projects undertaken with the CSA or other government institutions. The Bidder should list previous projects and assignments undertaken, within the last five years, which are relevant to proposed scope of work. The Bidder should identify any team members in the current Bid that participated in those other projects and describe the nature of their contributions to those projects.

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

5.2 Project Management Plan (Evaluation Criterion 7)

This subsection describes the Management Plan that will be retained in order to deliver the project, and to do so in the most effective manner.

The Management Plan should contain, as a minimum, the following information: Work Break-down Structure, WP definitions, personnel allocation, managerial risk assessment, milestones and deliverables, schedule, and project control system.

The Management Plan's presentation should be based on the recognised management tools most applicable to the proposed project, such as a scope planning (WBS), schedule development charts (e.g. Gantt chart, etc.). Equivalent company-developed, project-tailored tools/charts are also acceptable, provided that the information is complete and comprehensive.

5.2.1 Work Package Definition

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

WPs stem from the WBS. The WBS should be taken to a low enough level and the associated WP should be defined in sufficient depth in order for the Bidder to demonstrate a clear understanding of the process that will be followed to perform the project.

As a guideline, Table 1 of this attachment presents a fictitious example of a Work Package Definition Sheet.

The Bidder should provide a detailed SOW for each subcontractor along with a Letter of Agreement in Principle to be included in the Bid appendices. The subcontractors' price information should be included in the **Financial Bid only**.

Table 1: Example of Work Package Definition Sheet

Project: Novel T/R Unit Demonstration	
Work Pack Title:	
TEST SETUP WBS Ref: 2200	
1 of 1 Sheet:	WP Estimated Value: Do not indicate \$ value in Section I of Bid, indicate value 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:	
1. Deliver a functional test setup for the T/R unit	
Inputs:	
1. Test plan and procedure 2. Unit drawings 3. Unit Interface Control Documents	
Tasks:	
1. Review input documentation 2. Define requirements 3. Produce initial concept 4. Design test setup 5. Fabricate test setup 6. Commission and debug	
Outputs and Deliverables:	
1. Fully functional T/R unit test setup 2. Test setup log manual 3. Test setup user manual	

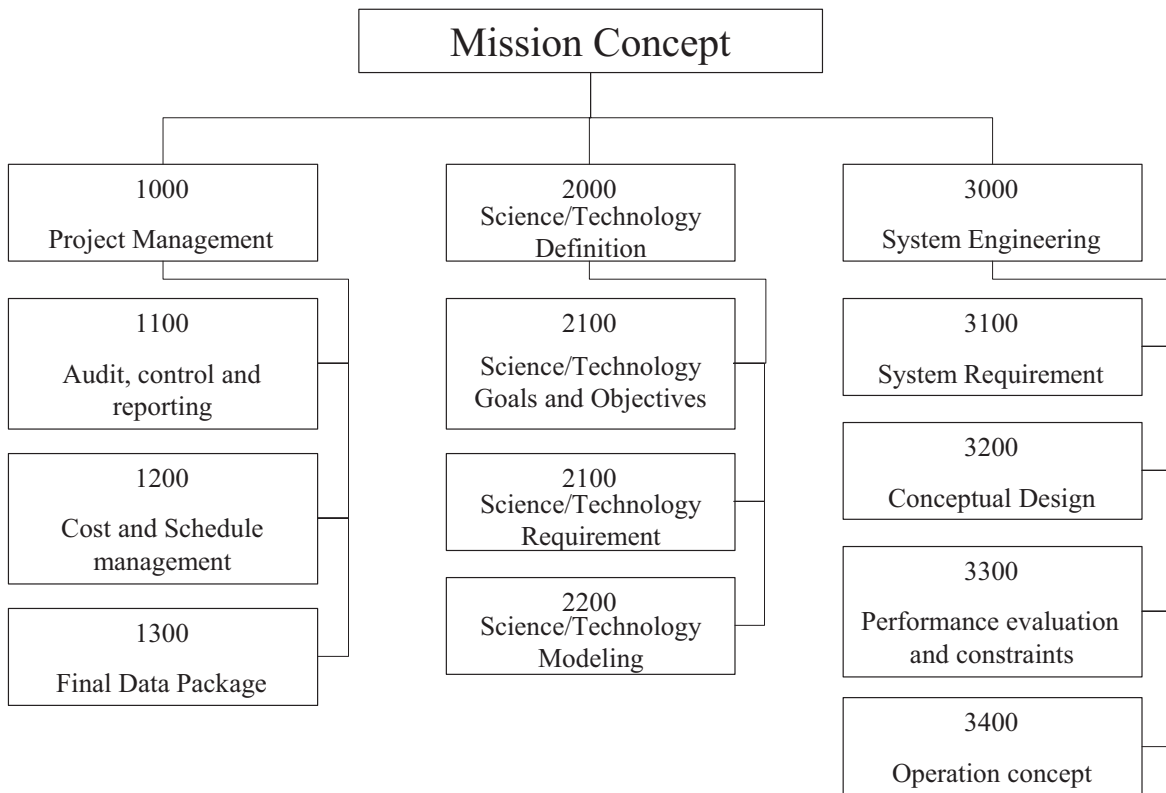


Figure 1: Example of a Work Breakdown Structure

5.2.2 Personnel Allocation

This Management Plan subsection should include a resource assignment matrix showing the level-of-effort for each individual team member that has been allocated to each WP. The matrix should identify each individual by name, and provide the estimated time (number of hours or days) required to complete each task. As a guideline, Table 2 of this attachment presents a fictitious example of a Responsibility Allocation Matrix (RAM) also known as a Resource Allocation Matrix. **The RAM should be presented in both the Technical, and Managerial Bid and the Financial Bid.**

Table 2: Example of Responsibility Allocation Matrix

WBS number	Work Pack 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

5.2.3 Managerial Risk Assessment

This Management Plan subsection should provide an assessment of the managerial risks involved in performing the work for the concept study, and identify critical issues that may jeopardise the successful completion of the project within cost and schedule constraints.

5.2.4 Milestones and Deliverables

Milestones and deliverables should be detailed in accordance to what is specified in Table 5 in Annex A - Statement of Work.

5.2.5 Schedule

This Management Plan subsection should relate tasks, milestones and deliverables to a project timetable. For planning purposes, the project expected start date is December 2013.

5.2.6 Project Control System

This Management Plan subsection should outline the methods and systems to be used to control tasks, schedules, and costs for the project. Any project management tool or a spreadsheet software package may be used as long as it contains, as a minimum, the information required in the Monthly Progress Report (DID-0006). Additionally, the Project Control System should provide the capability to report the amount of work per WBS item for each individual on a monthly basis.

The cost figures and values of all industrial contributions should be provided separately in the Financial Bid in Section II.

5.3. Project Team Composition (Evaluation Criterion 8)

In this subsection the Bidder should identify the number of national industrial and academic partners of the project team while specifying if the organization are of industrial or academic.

6. Bid Appendices

The following items should be addressed in individual appendices as part of the Bids.

Required Bid Appendices

- 6.1) List of acronyms used in the Bid
- 6.2) Bidder's Criteria Substantiation (refer to Section 2 of Annex D).
- 6.3) Résumés: The Bid should include résumés (and/or NSERC form 100) of all key personnel including those of subcontractors and these should be appended to Sections I and II.
- 6.4) List of Contacts: The list of contacts should be appended to Sections I and II, in a format suitable for distribution and should include all of the Bidder's points-of-contact involved in the Bid development and/or contract negotiations. The following example format should be used:

Table 3: Sample List of Contacts

Role	Name	Telephone	Fax	E-mail
Project Manager				
Project Engineers/ Principal Investigator				
Contracting Authority				
Claims officer				
Communications (for press release)				
Etc.				

Applicable Bid Appendices

The following Bid appendices are to be provided, *if applicable*, with Sections I and II:

- 6.5) Corporate literature: Only literature that is relevant and will be useful to support the Bid.
- 6.6) Relevant technical papers published by team members.
- 7.6) Any other Bid appendices deemed appropriate by the Bidder.

Bidders are reminded that there is a limited number of pages that the bid must not exceed. If the number of pages of Sections I and II, as described herein, is exceeded, the evaluation will strictly be based on the first 60 pages submitted, including appendices.

Annex D – Point Rated Criteria

1 *Impact / Technical / Management Point Rated Criteria*

The Bidder should achieve the minimum score requirements as indicated in Table 1: “List of Evaluation Criteria and Associated Ratings”. Bids will be evaluated according to the point-rated criteria as specified in Table 1 and at subsection 3 of this document: “Evaluation Criteria and Benchmark Statements”. The criteria are grouped under the following divisions:

- 1) Impact;
- 2) Technical; and
- 3) Management.

“Evaluation Criteria and Benchmark Statements” contains a series of evaluation criteria, each supported by a set of benchmark statements (0, A, B, C, D). Each of these statements has a corresponding relative value:

- 0 = 0% of the maximum point rating
- A = 25% of maximum point rating
- B = 50% of maximum point rating
- C = 75% of maximum point rating
- D = 100% of maximum point rating

As an example, the maximum point rating for the “*Understanding the Requirements and Technical Principles*” criterion is 20 points. If a Bid receives a “C” for this criterion in the evaluation process, the score attributed will be:

75% of 20 points = 15 points (score)

Table 1 identifies:

- 1) The maximum point rating assigned to each criterion;
- 2) The maximum point rating possible for each division (Impact, Technical, and Management);
- 3) The maximum point rating possible for the overall score;
- 4) The minimum point rating required for the overall score.

Note that the first criterion “Merit of the Concept” has a minimum score requirement of 15 to make sure that the bidder addresses the scope of work presented in section A.3.1 of Annex A.

Table 1: List of Evaluation Criteria and Associated Ratings

Evaluation Criteria and Ratings	
	Ratings
Impact Criteria	
1. Merit of the Concept (Minimum Score Requirement of 15)	20
2. Canadian Technology Strength	10
<i>Maximum Score</i>	30
Technical Criteria	
3. Understanding the Requirements and Technical Principles	20
4. Feasibility of Achieving the Goals and Technical Objectives	15
5. Scope of the Concept	15
<i>Maximum Score</i>	50
Management Criteria	
6. Team Capability	10
7. Project Management Plan	10
<i>Maximum Score</i>	20
<i>Maximum Overall Score</i>	100
<i>Minimum Overall Score Requirement</i>	70

2 Bidder’s Criteria Substantiation

The Bidder is requested to provide a substantiation, which should be submitted as an appendix to their Section I.

For each of the applicable 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 criterion. Cross-references to appropriate sections of the bid should be provided and the essence of the referenced information should be summarized in the substantiation.

For convenience, a template for the Self-Evaluation Table is provided in Table 1. Enter each technical/management/impact 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.

Table 1: Bidder's Criteria Substantiation.

Company:	
Project Title:.	
Criteria	
Substantiation	
<i>Ex.: 1</i> <i>(criterion number)</i>	<i>Criterion substantiation and Bidder's bid cross-reference.</i> <i>It is expected that 300 words or so should be sufficient to make your case.</i>

3 EVALUATION CRITERIA AND BENCHMARK STATEMENTS

IMPACT CRITERIA

RELEVANCE AND MERIT OF THE CONCEPT

This criterion evaluates the relevance and merit of the proposed concept relative to the scope of work presented in Appendices 4 and 5 of Annex A *Scope of the individual Statements of work.*

- 0)
 - The relevance and merit of proposed concept is not addressed.
- A)
 - The relevance and merit of the proposed concept are only partially addressed and not substantiated.
- B)
 - The relevance and merit of the proposed concept are addressed and substantiated, but gaps exist.
- C)
 - The relevance and merit of the proposed concept are addressed and substantiated and no gap exists.
- D)
 - The relevance and merit of the proposed concept are addressed in detail and well substantiated and no gap exists.

2. CANADIAN TECHNOLOGY STRENGTH

This criterion evaluates the proportion of Canadian technology or know-how and its criticality to the success of the project

0)

- The key technology and expertise relevant to the proposed concept resides outside Canada; OR
- It is unlikely that Canadian technology strength will be developed.

A)

- Some key technology and expertise to the proposed concept are within Canadian industries or academia. OR
- Canadian technology strength is not identified or it is not convincing that technology strength will be developed for Canada.

B)

- The proposal demonstrates that some key technology and expertise to the proposed concept are within Canadian industries or academia. AND
- Canadian technology strength is identified but it is not significant.

C)

- The proposal demonstrates that the majority of key technology and expertise in the bid are within Canadian industries or academia. AND
- Either Canadian technology strength is identified and substantiated, but it is not significant; or Canadian technology strength is identified and is significant but it is not fully substantiated.

D)

- The proposal demonstrates that the majority of key technology and expertise in the bid are within Canadian industries or academia; AND
- Significant Canadian technology strength is identified and substantiated.

TECHNICAL AND CRITERIA

3. UNDERSTANDING THE REQUIREMENTS AND TECHNICAL PRINCIPLES

This criterion assesses the degree to which the Bid identifies and substantiates in detail the underlying requirements and technical principles and also to what extent it thoroughly demonstrates an understanding of these requirements and principles as stated in Appendices 4 and 5 of Annex A – Statement of Work

0)

- The bid does not address the requirements, OR
- Does not identify the technical principles driving the proposed concept.

A)

- The proposal includes an incomplete overview of the main requirements OR
- The proposal demonstrates incomplete knowledge of the technical principles relevant to the goal of the study; OR

- The bid does not identify how the objectives will help in further defining these requirements; OR
- The proposal does not include an adequate review of the existing literature or that of previous relevant studies.

B)

- The proposal includes only an overview of the main requirements; AND
- The proposal exhibits a general understanding of these requirements and principles AND
- The proposal demonstrates a basic knowledge of the technical principles relevant to the goal of the study; AND
- The proposal includes a cursory review of and references to existing literature or that of previous relevant to the central theme of the proposed concept.

C)

- The proposal demonstrates identification and understanding of the main requirements; AND
- The proposal demonstrates knowledge of the technical principles relevant to the goal of the study; AND
- The bid includes a presentation of the proposed concept and operations requirements that will be addressed by the proposed activities and objectives; AND
- The proposal includes references to and a discussion of other work or previous activities relevant to the central theme of the proposed concept.

D)

- The proposal includes an exhaustive identification of the requirements; AND
- The proposal demonstrates a comprehensive knowledge of the technical principles relevant to the goal of the study; AND
- The bid includes a presentation of proposed concept and operations requirements that will be addressed by the proposed activities and objectives, and their relationship to overall objectives; AND
- The proposal includes references to and a thorough discussion of the existing literature relevant to the central theme of the proposed concept is provided.

4. FEASIBILITY OF ACHIEVING GOALS AND TECHNICAL OBJECTIVES

The criterion assesses the description and overall feasibility of the proposed approach and the degree to which it is capable of delivering the goals and technical objectives. This includes the compatibility of the technology selected and incorporation into the proposed design for addressing the technical requirements and enhancements. This criterion evaluates the technical risks associated with the eventual integration and implementation of the concept. It assesses if the proposed effort is well documented and substantiate.

O)

- The feasibility of achieving the goals and technical objectives is not demonstrated

A)

- The proposal does not present an adequate case with system(s) that can deliver the technical objectives; OR
- The proposed concept can obtain the desired technical results, but gaps exist.; OR
- Main elements of a preliminary technology development road map, in order to meet the technical basic requirements, are lacking.

B)

- The proposal presents an adequate case with system(s) that can deliver the technical objectives; AND

- The proposed concept can obtain the desired technical results, but some details or information of limited importance are omitted; AND
- Main elements of a preliminary technology development road map, in order to meet the technical basic requirements or enhancements, are lacking.

C)

- The proposal presents a well-referenced case with system(s) that can deliver the technical objectives; AND
- The proposed concept displays creative, feasible and valid concepts and methods that can obtain the desired technical results with details; AND
- Main elements of a preliminary technology development road map are presented in order to meet the technical basic requirements and enhancements of the study.

D)

- The proposal presents a well-referenced and convincing case with system(s) that can undoubtedly deliver the technical objectives. AND
- The proposed concept relies on well proven technology with one or more components having flight heritage and is substantiated with ample details; AND
- A preliminary technology development roadmap is presented in order to meet the technical basic requirements and enhancements of the study.

5. SCOPE OF THE CONCEPT

The criterion assesses the description and overall scope of the proposed Concept Study.

0)

- The bid does not address the scope and the aspects of what is requested in the SOW OR
- does not provide a description of the approach for the concept development.

A)

- The bid addresses the scope and the aspects of what is requested in the SOW, but gaps exist, OR
- It does not provide a description of the approach for the concept development.

B)

- The bid addresses the scope and the aspects of what is requested in the SOW, but gaps exist, AND
- It provides a description of the approach for the concept development, but either gaps exist or is not relevant.

C)

- The bid addresses the full scope and aspects of what is requested in the SOW, AND
- It provides a description and substantiation of a relevant approach for the concept development.

D)

- The bid addresses the full scope and aspects of what is requested in the SOW. AND
- It provides a detailed description and substantiation of a relevant approach for the concept development. AND
- The bid provides a preliminary design of the proposed concept and a description of the operation concept.

MANAGEMENT CRITERIA

6. TEAM CAPABILITY

This criterion assesses the capability (education, knowledge, experience, expertise and completeness of skill-sets in science, engineering and management) of the personnel assembled to carry out the proposal.

0)

- The proposed team does not have the required expertise; OR
- The proposal does not address this criterion.

A)

- The proposed team has no experience in conducting work similar in complexity and scope to what is requested in the SOW; OR
- The proposed team lacks expertise and may not be capable of fulfilling the statement of work (SOW); OR
- The roles and responsibilities of the team members are not defined.

B)

- The key personnel identified in the proposed team has been involved in at least one project similar in complexity and scope to what is requested in the SOW; AND
- The proposed team is lacking some expertise but demonstrates that it is capable of fulfilling the statement of work (SOW); AND
- The team may have deficiencies in the completeness of the skills of its members; AND
- Some team members have experience in the design and development of space flight hardware in a similar environment as described in the relevant SOW or space software.

C)

- The key personnel identified in the proposed team has been involved in at least two projects similar in complexity and scope to what is requested in the SOW; AND
- The expertise of the proposed team demonstrates that it is highly capable of fulfilling the statement of work (SOW); AND
- The completeness of the team is very well demonstrated through the complementarities of skills of its members and by the roles / tasks that they are assigned during the concept study; AND
- The roles and responsibilities for most of the team members, including sub-contractors, are defined; AND
- Most of the required key personnel are identified and there are qualified back-up personnel identified for most of them; AND
- The key personnel have experience in the design and development of space flight hardware in a similar environment as described in the relevant SOW or space software.

D)

- The key personnel identified in the proposed team has been involved in more than two projects similar in complexity and scope to what is requested in the SOW; AND
- The expertise of the proposed team demonstrates that it is highly capable of fulfilling the statement of work (SOW) 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
- The completeness of the team is very well demonstrated through the complementarities of skills of its members and by the roles / tasks that they are assigned during the concept study; AND
- All required key personnel are identified and there are qualified back-up personnel identified for all of them; AND

- The key personnel have significant experience in the design and development of space flight hardware in a similar environment as described in the relevant SOW and space software.

7. PROJECT MANAGEMENT PLAN

This criterion assesses the completeness of the management plan (including WBS, WPs, personnel allocation, detailed schedule and milestones, and managerial risk assessment) and evaluates the effectiveness of the described methodology in successfully achieving the stated objectives of the work to carry out this study.

0)

- The work-plan does not follow methodological approach and is unlikely to obtain the appropriate objectives; OR
- The proposal does not address this criterion.

A)

- The proposal presents a poor work-plan; OR
- The proposed methodology is not effective in achieving the objectives of the work; OR
- There is a lack of correlation between the work-plan and the management method; OR
- Risks are not identified.

B)

- The proposal presents a basic work-plan; OR
- The proposed methodology is not effective in achieving the objectives of the work; OR
- There is a lack of correlation between the work-plan and the management method; OR
- Risks are identified and mitigation strategies are insufficient.

C)

- The work-plan as described in the proposal is based on a methodological approach; AND
- The effectiveness of the proposed methodology in achieving the objectives of the work is credible; AND
- The correlation between the work-plan and the management method exists; AND
- Risks are identified and mitigation strategies are discussed.

D)

- The work-plan as described in the proposal follows a clearly defined methodology; AND
- The effectiveness of the proposed methodology in achieving the objectives of the work is highly credible; AND
- The correlation between the work-plan and the management method is clear; AND
- Comprehensive risk analysis and mitigation strategies are provided.