Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Travaux publics et Services gouvernementaux Canada
Voir dans le document/
See herein
NA
Québec
NA

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
ACCP Ph O ALI, SHOW, TICFIRE

Solicitation No. - N° de l'invitation	**Date**
9F045-190490/A	2020-09-30

Client Reference No. - N° de référence du client
9F045-190490

GETS Reference No. - N° de référence de SEAG
PW-$MTB-130-15866

File No. - N° de dossier	**CCC No./N° CCC - FMS No./N° VME**
MTB-9-42298 (130)	

Solicitation Closes - L'invitation prend fin
at - à 02:00 PM
on - le 2020-11-05

Time Zone
Fuseau horaire
Heure Normale du l'Est
HNE

F.O.B. - F.A.B.
Plant-Usine: ☐ **Destination:** ☐ **Other-Autre:** ☐

Address Enquiries to: - Adresser toutes questions à:	**Buyer Id - Id de l'acheteur**
Caty, Mélanie	mtb130

Telephone No. - N° de téléphone	**FAX No. - N° de FAX**
(438) 340-1557 ( )	(514) 496-3822

Destination - of Goods, Services, and Construction:
Destination - des biens, services et construction:
AGENCE SPATIALE CANADIENNE
6767 ROUTE DE L AEROPORT
Développement du l'utilisation de
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

Delivery Required - Livraison exigée	**Delivery Offered - Livraison proposée**
Voir doc.	

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**

Issuing Office - Bureau de distribution
Travaux publics et Services gouvernementaux Canada
Place Bonaventure, portail Sud-Oue
800, rue de La Gauchetière Ouest
7e étage, suite 7300
Montréal
Québec
H5A 1L6

Canada

Table of Contents

PART 1 - GENERAL INFORMATION

1.1 Introduction

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

Part 1 General Information: provides a general description of the requirement;

Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation;

Part 3 Bid Preparation Instructions: provides Bidders with instructions on how to prepare their bid;

Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, and the basis of selection;

Part 5 Certifications and Additional Information: includes the certifications and additional information to be provided;

Part 6 Security, Financial and Other Requirements: includes specific requirements that must be addressed by Bidders; and

Part 7 Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract.

The Annexes include:

Annex A - The Statement of Work
Annex B - The Basis of Payment
Annex C - Mandatory Criteria, Point Rated Criteria and Self-Evaluation
Annex D - Certifications
Annex E - Electronic payment instruments
Annex F - Mandatory Non-Disclosure Agreement

1.2 Summary

Project Title

Feasibility study of the Aerosol Limb Imager (ALI), the Spatial Heterodyne Observations of Water (SHOW) and the Thin Ice Cloud in Far InfraRed Experiment (TICFIRE), instruments for the Aerosols – Cloud, Convection, Precipitation (A-CCP) mission

Description

In late 2018 NASA began a three year study of two priority designated observables — Aerosols and Cloud-Convection-Precipitation (A-CCP) — to leverage the advantages of a single synergistic observing system. NASA invited the Canadian Space Agency to participate in a workshop concerning the A-CCP pre-formulation study. The CSA extended this invitation to scientists from Environment and Climate Change Canada (ECCC) and to scientists with relevant expertise from Canadian universities. The Canadian delegation to this workshop made a presentation about potential Canadian contributions to the mission.

This was followed up by submission of technical information about potential Canadian instrument contributions to the A-CCP mission. These are: the Aerosol Limb Imager (ALI), the Spatial Heterodyne Observations of Water (SHOW), and the Thin Ice Clouds in Far InfraRed Experiment (TICFIRE).

Initial NASA assessments have indicated that the Canadian instruments ALI, SHOW and TICFIRE will enhance baseline observations and may be accommodated on A-CCP spacecraft.

With this RFP, the CSA will undertake work by Canadian industry to carefully examine the current instrument concepts, the user and science requirements that were recently established by the Canadian science teams for each of these instruments on the A-CCP mission, the mission constraints imposed by NASA, and technology and design options in order to identify the optimal instrument concept, estimate costs and chart the path to technology readiness. One contract by stream will be awarded.

Stream 1: For the Aerosol Limb Imager (ALI) instrument
Stream 2: For the Spatial Heterodyne Observations of Water (SHOW) instrument
Stream 3: For the Thin Ice Cloud in Far InfraRed Experiment (TICFIRE) instrument

Bidders can submit a proposal for each Stream.

In the event they wish to submit bids for both Streams 1, 2 and 3, bidders must provide **separate** bids, and clearly identify on each bid (1, 2 or 3) for which Stream they are proposing their services.

1.2.1 Actual Available Budget

Stream 1:
The maximum funding available for the contract resulting from the bid solicitation for this stream is **$500 000** (Applicable Taxes extra, as appropriate). Annex A (Statement of Work) includes a description of the work required. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 1.

Stream 2:
The maximum funding available for the contract resulting from the bid solicitation for this stream is $**500 000** (Applicable Taxes extra, as appropriate). Annex A (Statement of Work) includes a description of the work required. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 2.

Stream 3:
The maximum funding available for the contract resulting from the bid solicitation for this stream is $**500 000** (Applicable Taxes extra, as appropriate). Annex A (Statement of Work) includes a description of the work required. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 3.

In this RFP, up to 3 (three) contracts are expected to be awarded. For additional information, please refer to Part 2, section 2.7 – Maximum Funding, of the bid solicitation.

1.2.2 Period of Contract

From the contract award up to 11 months.

1.2.3 Intellectual property

Contractor to own Intellectual property

1.2.4 Security Requirements

There are no security requirements associated with this requirement.

1.2.5 Requirements- Controlled Goods Program (if applicable)

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

1.2.6 Trade Agreements

This requirement is not subject to the trade agreements.

1.2.7 Canadian Content

The requirement is limited to Canadian services.

1.2.8 Epost Connect

IMPORTANT NOTICE TO SUPPLIERS RE. BID SUBMISSION REQUIREMENTS

Due to the impacts from the COVID-19 pandemic, temporary measures are being taken on-site at the Québec Region Bid Receiving Unit to encourage social distancing. The health and safety of staff and suppliers remains our top priority.

Suppliers are required to submit bids electronically using the Canada Post epost Connect application for the subject bid solicitation. This service allows suppliers to submit bids, offers and arrangements electronically to PWGSC Bid Receiving Units. This online service enables the electronic transfer of large files up to Protected B level.

Faxed, emailed and hard copy (submitted in person or via mail/courier) bids will not be accepted for the subject bid solicitation.

Given current circumstances and network limitations, some active procurements may be delayed. To stay up to date on the status of specific procurements, please consult Buysandsell.gc.ca.

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

1.2.9 Confidentiality of Contract Documents

A "Non-Disclosure Agreement Contract" must be signed and sent to the Contracting Authority before having access to information by or on behalf of Canada in connection with the Work (refer to Annex F).

1.2.10 Confidentiality of the Request for Proposal documents

The "Mandatory Non-Disclosure Agreement (NDA) must be signed and sent to the Contracting Authority before having access to the optional reference documents (refer to 2.5 of the RFP). The consultation of these reference documents is optional to provide a proposal.

1.3 Debriefings

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

1.4 Communications

As a courtesy and in order to coordinate any public announcements pertaining to this contract, the Government of Canada requests that successful Bidders notify the Contracting Authority **10 days** in advance of their intention to make public an announcement related to the recommendation of a contract award, or any information related to the contract. The Government of Canada retains the right to make primary contract announcements.

PART 2 - BIDDER INSTRUCTIONS

2.1 Standard Instructions, Clauses and Conditions

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

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

The 2003 (2019-03-04) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

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

Delete: 60 days
Insert: 240 days

2.2 Submission of Bids

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

a) Only bids submitted using epost Connect service will be accepted. The Bidder must send an email requesting to open an epost Connect conversation to the following address: TPSGC.RQReceptionSoumissions-QRSupplyTendersReception.PWGSC@tpsgc-pwgsc.gc.ca

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

It is the Bidder's responsibility to ensure the request for opening an epost Connect conversation is sent to the email address above at least six days before the solicitation closing date.

b) Dud to the nature of this solicitation, bids transmitted by facsimile, email or hardcopy to PWGSC will not be accepted.

2.3 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPSs, bidders must provide the

information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions

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

a. an individual;

b. an individual who has incorporated;

c. a partnership made of former public servants, or

d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

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

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

Former Public Servant in Receipt of a Pension

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

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

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

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

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

If so, the Bidder must provide the following information:

a. name of former public servant;

b. conditions of the lump sum payment incentive;

c. date of termination of employment;

d. amount of lump sum payment;

e. rate of pay on which lump sum payment is based;

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

g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

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

2.4 Enquiries - Bid Solicitation

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

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

2.5 Mandatory Non-Disclosure Agreement Requirement

If a Supplier or a subcontractor wishes to review the Reference Documents RD-5 and RD-6 entitled

For stream 1:

- AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6].

For stream 2:

- SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6]

For stream 3:

- TICFIRE (microsatellite) Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 [RD-6]
- Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5]

They must request these documents from the Contracting Authority through e-mail.

The document entitled
AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3) contains information that is confidential or proprietary to Canada or third party.

The Supplier or any subcontractor must sign a Non-Disclosure Agreement in the form set out in Annex F and return the original duly signed to the Contracting Authority before being provided with a copy of the

document entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3).

All Suppliers must destroy or delete all copies of the document entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3) at the end of the RFP period, or upon request from the Contracting Authority within thirty (30) days following that request.

2.6 Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Quebec
.
Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the Bidders.

2.7 Improvement of Requirement During Solicitation Period

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

2.8 Bid Challenge and Recourse Mechanisms

(a) Several mechanisms are available to potential suppliers to challenge aspects of the procurement process up to and including contract award.

(b) Canada encourages suppliers to first bring their concerns to the attention of the Contracting Authority. Canada's Buy and Sell website, under the heading "Bid Challenge and Recourse Mechanisms" contains information on potential complaint bodies such as:

- Office of the Procurement Ombudsman (OPO)
- Canadian International Trade Tribunal (CITT)

(c) Suppliers should note that there are **strict deadlines** for filing complaints, and the time periods vary depending on the complaint body in question. Suppliers should therefore act quickly when they want to challenge any aspect of the procurement process.

2.9 Maximum funding

The total maximum funding available for the contracts resulting from the bid solicitation will be $**1,500,000.00 dollars (applicable taxes extra) to be distributed within the three Streams as described below*.** This disclosure does not commit Canada to pay the maximum funding available.

Stream 1:
The maximum funding available for the contract resulting from the bid solicitation, for this stream, is **$500 000** (Applicable Taxes extra, as appropriate), for the work described in Annex A SOW. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 1.

Stream 2:
The maximum funding available for the contract resulting from the bid solicitation, for this stream, is $**500 000** (Applicable Taxes extra, as appropriate), for the work described in Annex A SOW. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 2.

Stream 3:
The maximum funding available for the contract resulting from the bid solicitation, for this stream, is $**500 000** (Applicable Taxes extra, as appropriate), for the work described in Annex A SOW. Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available. A maximum of 1 contract is expected to be awarded within Stream 3.

*Note: A maximum of 3 contracts are expected to be awarded under this RFP (Stream 1, 2 and 3 together). For additional information, please refer to Part 4 - Evaluation Procedures and Basis of Selection.

PART 3 - BID PREPARATION INSTRUCTIONS

3.1 Bid preparations instructions

The Bidder must submit its bid electronically in accordance with section 08 of the 2003 standard instructions. The epost Connect system has a limit of 1GB per single message posted and a limit of 20GB per conversation.
The bid must be gathered per section and separated as follows:

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

Bids transmitted by facsimile, email or hardcopy will not be accepted.

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

Section I: Technical and Managerial Bid

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

The technical and managerial bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that

Bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, Bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

To maintain the integrity of the evaluation, evaluators will consider only information presented in the bid. No information will be inferred and personal knowledge or beliefs will not be utilized in the assessment. Please note: Website references, technical papers, product samples, videotapes, slides, or other ancillary items will not be considered during the evaluation process.

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

Annex C MANDATORY CRITERIA, POINT RATED CRITERIA and SELF-EVALUATION: The proposal preparation instructions contain instructions that Bidders have to follow while preparing their technical and managerial bid.

The technical bid should not exceed twenty-five (25) pages (12pt font), excluding the title page, table of contents, and annexes. Annexes must not exceed fifty (50) pages. Bids that exceed the page limit will not be read and evaluated past the pages indicated.

Section II: Financial Bid

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

Basis of Payment in Annex "B" for the work described in Annex A, **not exceeding the maximum funding available for the contract** resulting from the bid solicitation, as specified at Part 2, section 2.7 Maximum funding. The total amount of applicable taxes should be shown separately, if applicable.

3.1.2 Electronic Payment of Invoices – Bid

If you are willing to accept payment of invoices by Electronic Payment Instruments, complete Annex E - Electronic Payment Instruments, to identify which ones are accepted.

If Annex E - Electronic Payment Instruments is not completed, it will be considered as if Electronic Payment Instruments are not being accepted for payment of invoices.

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

3.1.3 Exchange Rate Fluctuation

C3011T (2013-11-06) , Exchange Rate Fluctuation

3.1.4 Price breakdown

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

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

b) Equipment: Specify each item required to complete the Work and provide the pricing basis of each one, Canadian customs duty and excise taxes included, as applicable.

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

d) Travel and Living Expenses: Indicate the number of trips and the number of days for each trip (Annex A – Statement of work,3.3 Milestones, reviews & Meetings) the cost, destination and purpose of each journey, together with the basis of these costs which must not exceed the limits of the National Joint Council (NJC). With respect to the NJC's Directive, only the meal, private vehicle allowances specified in Appendices B, C and D of the Directive http://www.njc-cnm.gc.ca/directive/travelvoyage/index-eng.php, and the other provisions of the Directive referring to "travellers", rather than those referring to "employees", are applicable. TheTreasury Board Secretariat's Special Travel Authorities, https://www.canada.ca/en/treasury boardsecretariat/services/travel-relocation/special-travel-authorities.html, also apply.

e) Subcontracts: Identify any proposed subcontractor and provide for each one the same price breakdown information as contained in this article.

f) Other Direct Charges: Identify any other direct charges anticipated, such as long distance communications and rentals, and provide the pricing basis.

g) Applicable Taxes: Identify any Applicable Taxes separately.

Section III: Certifications

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

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

4.1 Evaluation Procedures

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

(b) An evaluation team composed of qualified professionals will evaluate the bids.

4.1.1 Technical and Management Evaluation

4.1.1.1 Mandatory Technical Criteria

The mandatory evaluation criteria are described at Annex C: *Mandatory technical criteria, Point rated technical criteria and Self-Evaluation* Bids which fail to meet the mandatory evaluation criteria will be declared non-responsive.

4.1.1.2 Point Rated Technical and Management Criteria

Point Rated Technical Evaluation Criteria are described at Annex C: *Mandatory technical criteria, Point rated technical criteria and Self-Evaluation* not addressed will be given a score of zero.

4.1.2 Financial Evaluation

4.1.2.1 Mandatory Financial Criteria

Stream 1:

The Bidder must submit for Stream 1 up to a maximum of **$500 000** for the work described in Annex A SOW, (Applicable Taxes extra, as appropriate), which must not exceed the maximum funding available for the contract resulting from the bid solicitation as indicated in Part 2, Section 2.7 *Maximum Funding*, (Applicable Taxes extra, as appropriate).

Stream 2:

The Bidder must submit for Stream 2 up to a maximum of **$500 000** for the work described in Annex A SOW, (Applicable Taxes extra, as appropriate) which must not exceed the maximum funding available for the contract resulting from the bid solicitation as indicated in Part 2, Section 2.7 *Maximum Funding*, (Applicable Taxes extra, as appropriate).

Stream 3:

The Bidder must submit for Stream 3 up to a maximum of **$500 000** for the work described in Annex A SOW, (Applicable Taxes extra, as appropriate) which must not exceed the maximum funding available for the contract resulting from the bid solicitation as indicated in Part 2, Section 2.7 *Maximum Funding*, (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.

4.2 Basis of Selection (for Stream 1, stream 2 and Steam 3)

4.2.1 Basis of Selection – Highest Rated Within Budget

1. To be declared responsive, each bid must:
   a) meet all mandatory evaluation criteria; and
   b) obtain the required minimum of 65 points, on a scale of 130 points, for the overall Evaluation of the bid.

2. Bids not meeting (a) or (b) will be declared non-responsive.

3. In the event that more than one responsive bid have the same score, these responsive bids will be further ranked based on the highest score of the “Added Value of the Proposed Solution”, Criterion PC4 a,b,c;

4. 1 contract will be awarded for the Stream #1 Responsive Bid List.

5. 1 contract will be awarded for the Stream #2 Responsive Bid List.

6. 1 contract will be awarded for the Stream #3 Responsive Bid List.

7. A maximum of 3 contracts are expected to be awarded under this RFP (Stream 1, 2 and 3 together).

PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION

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

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

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

5.1 Certifications Required with the Bid

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

5.1.1 Integrity Provisions - Declaration of Convicted Offences

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

5.2 Certifications Precedent to Contract Award and Additional Information

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

5.2.1 Integrity Provisions – Required Documentation

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

5.2.2 Federal Contractors Program for Employment Equity - Bid Certification

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

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

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

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

5.2.3 Additional Certifications Precedent to Contract Award

5.2.3.1 Canadian Content Certification

This procurement is limited to Canadian services.

The Bidder certifies that:
( ) the service offered is a Canadian service as defined in paragraph 2 of clause A3050T.

5.2.3.1.1 *SACC Manual* clause A3050T (2018-12-06) Canadian Content Definition

5.2.3.2 Status and Availability of Resources

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

5.2.3.3 Education and Experience

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

5.2.3.4 Language Capability

The Bidder certifies that:

( ) All proposed consultants must be able to communicate (spoken and written) in English

5.2.3.5 Annex D – Certifications

The information that figures at Annex D - Certifications, must be duly completed at the closing date and hour of the invitation or before the issuance of the Standing offer.

Note 1:
To be considered, if these documents have not been provided at bid closing, PWGSC will notify the bidder, offeror or supplier that they are required to provide them within **two (2) business days** following notification by PWGSC.

(Note: this time requirement reflects PWGSC's expectation that these documents ought to be readily available to a bidder, offeror or supplier.)

5.3 List of Proposed Subcontractors

If the bid includes the use of subcontractors, the Bidder must provide a list of all subcontractors including a description of the things to be purchased, a description of the work to be performed and the location of the performance of that work. The list should not include the purchase of off-the-shelf items, software and such standard articles and materials as are ordinarily produced by manufacturers in the normal course of business, or the provision of such incidental services as might ordinarily be subcontracted in performing the Work

The Bidder must provide, for each subcontractor, the following:

a) The name of the subcontractor: complete name of its legal entity and place of incorporation;
b) The subcontractor contact: name, title, telephone, fax numbers and email address;
c) A description of the roles and responsibilities of the subcontractor and/or material to be purchased from that subcontractor;
d) A document signed by the subcontractor indicating its agreement to undertake the work as described in the Bidder's proposal.

PART 6 - FINANCIAL REQUIREMENTS

6.1 Financial Capability

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

6.2 Insurance - No Specific Requirement

The Contractor is responsible for deciding if insurance coverage is necessary to fulfill its obligation under the Contract and to ensure compliance with any applicable law. Any insurance acquired or maintained by the Contractor is at its own expense and for its own benefit and protection. It does not release the Contractor from or reduce its liability under the Contract.

6.3 Requirements - Controlled Goods Program (if applicable)

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

PART 7 - RESULTING CONTRACT CLAUSES

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

7.1 Statement of Work

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

7.2 Standard Clauses and Conditions

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

7.2.1 General Conditions

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

7.2.2 Non-Disclosure Agreement Contract

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

7.3 Security Requirements

7.3.1 There is no security requirement applicable to the Contract.

7.4 Term of Contract

7.4.1 Period of the Contract

The period of the Contract is from date of Contract to 11 months inclusive.

7.5 Authorities

7.5.1 Contracting Authority

The Contracting Authority for the Contract is:

Mélanie Caty
Supply Specialist
Public Works and Government Services Canada

Space Programs Directorate
Telephone: 438-340-1557
E-mail address: melanie.caty@pwgsc-tpsgc.gc.ca
The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

7.5.2 Project Authority

The Project Authority for the Contract is: (*Will be inserted at the contract award)*

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

7.5.3 Technical Authority

The Technical Authority for the Contract is: (*Will be inserted at the contract award.)*

The Technical 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 recommendations to the Project Authority concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Technical Authority, however the Technical 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.

7.5.4 Contractor's Representative

Name: _____
Title: _____
Organization: _____
Address: _____
Telephone: ___-___-_____
E-mail address: _____

7.6 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a ***Public Service Superannuation Act*** (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

7.7 Payment

7.7.1 Basis of Payment - Cost reimbursable - Limitation of expenditure

The Contractor will be paid for its costs reasonably and properly incurred in the performance of the Work, if applicable and profit, in accordance with the Basis of payment in annex B, to a limitation of expenditure of $_____ ***(will be inserted at contract award)***. Customs duties are included and Applicable Taxes are extra.

7.7.2 Limitation of Expenditure

1. Canada's total liability to the Contractor under the Contract must not exceed $ _____***(will be inserted at contract award)***. Customs duties are included and Applicable Taxes are extra.
2. No increase in the total liability of Canada or in the price of the Work resulting from any design changes, modifications or interpretations of the Work, will be authorized or paid to the Contractor unless these design changes, modifications or interpretations have been approved, in writing, by the Contracting Authority before their incorporation into the Work. The Contractor must not perform any work or provide any service that would result in Canada's total liability being exceeded before obtaining the written approval of the Contracting Authority. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:
    a. when it is 75% committed, or
    b. four months before the contract expiry date, or
    c. as soon as the Contractor considers that the contract funds provided are inadequate for the completion of the Work,

    whichever comes first.

3. If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

7.7.3 Progress Payments

1. Canada will make progress payments in accordance with the payment provisions of the Contract, no more than once a month, for cost incurred in the performance of the Work, up to 100 percent of the amount claimed and approved by Canada if:

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

    b. the amount claimed is in accordance with the basis of payment;

    c. the total amount for all progress payments paid by Canada does not exceed 100 percent of the total amount to be paid under the Contract;

    d. all certificates appearing on form PWGSC-TPSGC 1111 have been signed by the respective authorized representatives.
2. Progress payments are interim payments only. Canada may conduct a government audit and interim time and cost verifications and reserves the rights to make adjustments to the Contract from time to time during the performance of the Work. Any overpayment resulting from progress payments or otherwise must be refunded promptly to Canada.

7.7.4 Electronic Payment of Invoices – Contract

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

a. Visa Acquisition Card;
b. MasterCard Acquisition Card;
c. Direct Deposit (Domestic and International);
d. Electronic Data Interchange (EDI);

7.7.5 Time Verification

SACC Manual clause C0711C (2008-05-12), Time Verification

7.8 Invoicing Instructions

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

Each claim must show:

a) all information required on form PWGSC-TPSGC 1111 ;
b) all applicable information detailed under the section entitled “Invoice Submission” of the general conditions ;
c) a copy of time sheets to support the time claimed;
d) a copy of the invoices, receipts, vouchers for all direct expenses, travel and living expenses. For travel and living, expense support must be grouped by trip and submitted only when all receipts for a particular trip are submitted together on a particular claim. CSA approval for each trip must be included. Original receipts are required, credit card receipts or travel agent itineraries are not acceptable.
e) a copy of the progress report.

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

a) CSA e-mail address: asc.facturation-invoicing.csa@canada.ca

b) PWGSC e-mail address: QueReclamationsMontreal/QueMontrealClaims@tpsgc-pwgsc.gc.ca

3. 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.

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

7.9 Certifications and Additional Information

7.9.1 Compliance

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

7.9.2 *SACC Manual* Clauses

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

7.10 Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in _____ (*The name of the province or territory will be inserted at contract award*).

7.11 Priority of Documents

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

a) the Articles of Agreement;

b) the general conditions 2040 (2020-05-28) General Conditions – Research & Development, apply to and form part of the Contract;

c) Annex A, Statement of Work;

d) Annex B, Basis of Payment;

e) the Contractor's bid dated _____.

7.12 Foreign Nationals (Canadian Contractor)

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

7.13 Insurance – No Specific Requirement

The Contractor is responsible for deciding if insurance coverage is necessary to fulfill its obligation under the Contract and to ensure compliance with any applicable law. Any insurance acquired or maintained by the Contractor is at its own expense and for its own benefit and protection. It does not release the Contractor from or reduce its liability under the Contract

7.14 Controlled Goods Program (if applicable)

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

7.15 Directive on Communications with the Media

1. Definitions

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

2. **Communication Activities Format**

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

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

a) By clearly and prominently labelling publications, advertising and promotional products and any form of material and products sponsored or funded by the CSA, as follows, in the appropriate official language:

"This program/project/activity is undertaken with the financial support of the Canadian Space Agency."

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

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

The Contractor must obtain and use a high resolution printed or electronic copy of the CSA's corporate identity logo and seek advice on its application, by contacting the project authority as mentioned in Paragraph 7.5.2 of this contract.

3. Communication Activity Coordination Process

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

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

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

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

7.16 Dispute Resolution

(a) The parties agree to maintain open and honest communication about the Work throughout and after the performance of the contract.

(b) The parties agree to consult and co-operate with each other in the furtherance of the contract and promptly notify the other party or parties and attempt to resolve problems or differences that may arise.

(c) If the parties cannot resolve a dispute through consultation and cooperation, the parties agree to consult a neutral third party offering alternative dispute resolution services to attempt to address the dispute.

(d) Options of alternative dispute resolution services can be found on Canada's Buy and Sell website under the heading "Dispute Resolution".

ANNEX A

STATEMENT OF WORK (SOW)

Three (3) Statement of work will be inserted at the end of this document, one for each stream.

ANNEX B

BASIS OF PAYMENT

Limitation of Expenditure
For the Work described at Annex A, Statement of Work, the Contractor will be reimbursed for the costs reasonably and properly incurred in the performance of the Work, as determined in accordance with the Basis of Payment as follows:

1.LABOUR: at the following firm rates, overhead and profit excluded.

CATEGORY OF WORK	FIRM HOURLY RATE	ESTIMATED HOURS

Est.: $ _____

2. **EQUIPMENT:** at laid down cost without markup **Est.: $ _____**
(Specify type of equipment.)

3. **RENTALS:** at actual cost without markup **Est.: $ _____**
(Specify what rentals.)

4. **MATERIALS AND SUPPLIES:** at laid down cost without markup (Specify what categories of materials and supplies.) **Est.: $ _____**

5. **TRAVEL AND LIVING EXPENSES:** **Est.: $ _____**
The Contractor will be reimbursed its authorized travel *(Annex A – Statement of work, 3.3 Milestones, Reviews and Meetings)* and living expenses reasonably and properly incurred in the performance of the Work, at cost, without any allowance for profit and/or administrative overhead, in accordance with the meal, and private vehicle allowances specified in Appendices B, C and D of the National Joint Council Travel Directive, and with the other provisions of the directive referring to "travellers", rather than those referring to "employees". Canada will not pay the Contractor any incidental expense allowance for authorized travel.
All travel must have the prior authorization of the Technical Authority. All payments are subject to government audit.

6. **SUBCONTRACTS:** at actual cost without markup **Est.: $ _____**
(Identify subcontractors, if applicable.)

7. **OTHER DIRECT CHARGES:** at actual cost without markup **Est.: $ _____**
(Specify what categories of direct charges.)

8. **OVERHEAD:** at a firm rate of __% of item __ above **Est.: $ _____**

9. **PROFIT:** at a firm rate of __ of item __ above **Est.: $ _____**

Estimated Cost to a Limitation of Expenditure: $ _____
(Applicable Taxes extra)

With the exception of the firm rate(s) and price(s), the amounts shown in the various items specified above are estimates only. Minor changes to these estimates will be accepted for billing purposes as the Work proceeds, provided that these changes have the prior approval of the Technical Authority, and provided that the estimated cost does not exceed the aforementioned Limitation of Expenditure.

ANNEX C

MANDATORY CRITERIA, POINT RATED CRITERIA and SELF-EVALUATION

I INTRODUCTION

The following section of the RFP describes the technical and managerial evaluation criteria, along with the corresponding benchmark statements, that will be used in the assessments of the proposals.

It is essential that the elements contained in the proposals be stated in a clear and concise manner. Providing complete information for each criterion will be to the Bidder's advantage. The CSA, will select proposals as determined by the selection criteria contained in this solicitation document.

Important note for stream 3: the term "far infrared" used in Annex C refers to the portion of radiation wavelengths exceeding 16 microns.

II EVALUATION CRITERIA

The Mandatory criteria and Technical and Management proposal will be evaluated and scored in accordance with the Table below:

Evaluation Criteria and Associated Ratings for stream 1, 2 and 3					
Item	Stream number	Evaluation criteria title	Mandatory (M) or Point rated (P)	Maximum score	Minimum required score
Mandatory Criteria					
MC1	1, 2 and 3	Corporate experience	M	n/a	n/a
MC2	A) 1 only	Corporate expertise	M	n/a	n/a
	B) 2 only	Corporate expertise	M	n/a	n/a
	C) 3 only	Corporate expertise	M	n/a	n/a
MC3	1, 2 and 3	Work plan	M	n/a	n/a
Point rated criteria					
PC1	1, 2 and 3	Understanding users requirements	P	20 pts	10 pts
PC2	1, 2 and 3	Identifying key challenges and potential solutions		20 pts	10 pts

Evaluation Criteria and Associated Ratings for stream 1, 2 and 3

Item	Stream number	Evaluation criteria title	Mandatory (M) or Point rated (P)	Maximum score	Minimum required score
PC3	A) 1 only	Experience in imaging spectrometer instrumentation	P	40 pts	20 pts
	B) 2 only	Experience in imaging spectrometer instrumentation	P	40 pts	20 pts
	C) 3 only	Experience in far infrared radiometer instrumentation	P	40 pts	20 pts
PC4	A) 1 only	Expertise in imaging spectrometer instrumentation	P	30 pts	15 pts
	B) 2 only	Expertise in imaging spectrometer instrumentation	P	30 pts	15 pts
	C) 3 only	Experience in far infrared radiometer instrumentation	P	30 pts	15 pts
PC5	1, 2 and 3	Effectiveness of implementation plan	P	20 pts	10 pts
		Overall		130 pts	65 pts

To be responsive, the Bidder must at least achieve the total combined minimum pass score requirement for the Criteria (65/130) as indicated in the Table.

Evaluation criteria that are not addressed in the proposal will be given a score of zero (0).

1. Mandatory Criteria (MC)

The bid must comply with the following Mandatory Technical Criteria in order to be evaluated under the Point Rated Technical Criteria.

Mandatory requirements are evaluated on a pass or fail basis and they will be evaluated very strictly as to compliancy. Therefore, no rating is associated with them. Proposals not meeting the mandatory criteria will be deemed non-responsive.

TABLE #1 - Mandatory Criteria (MC)		
Item	**Mandatory Criteria**	
MC1	**Corporate experience – For stream 1, 2 and 3**	
	The bidder must have been active in business related to all elements included in the following item: • Design, assembly, radiometric calibration, characterization, and qualification of scientific imaging spectrometers for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight To demonstrate conformance with this criterion, the bidder must possess a minimum of three (3) years of experience in the last fifteen (15) years on a minimum of two previous or current projects. The bidder must provide a detailed description of these projects, this description must demonstrate that they possess the experience for all elements listed in the item above. Each of these elements may be demonstrated with a different project. Except where expressly provided otherwise, the experience described in the bid must be the experience of one or more of the following: • The Bidder itself • The Bidder's subcontractors The experience of the Bidder's suppliers will not be considered.	**Do you possess the experience necessary as described per MC1?** **Mark the appropriate answer:** **YES** _____ **NO** _____
MC2	**Corporate expertise – For stream 1, 2 and 3**	
	<u>A) Use this text for stream 1 only:</u> The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource. To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements: • Name • Education • Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of	**Are you able to provide a resume for each proposed resource as detailed in MC2 A), including letters of commitment from proposed subcontractors?** **Mark the appropriate answer:** **YES** _____ **NO** _____

substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible. Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable. **B) Use this text for stream 2 only:** The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource. To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements: • Name • Education • Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible. Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable.	**Are you able to provide a resume for each proposed resource as detailed in MC2 B), including letters of commitment from proposed subcontractors?** **Mark the appropriate answer:** **YES** _____ **NO** _____
C) Use this text for stream 3 only: The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and	**Are you able to provide a resume for each proposed resource as detailed in MC2 C), including letters of commitment from**

	radiometric / geometric data corrections. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource. To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements: • Name • Education • Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible. Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable.	**proposed subcontractors?** **Mark the appropriate answer:** **YES** _____ **NO** _____
MC3	**Work Plan – For stream 1, 2 and 3**	
	The bidder must provide an effective and credible work plan. To demonstrate conformance with this criterion, the bid must include a Work Breakdown Structure (WBS) describing all the project elements that organize and define the total scope of the project, including subcontracted work, and must be deliverable-oriented. The bidder must prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. Each WPD must include, as a minimum: • A unique identifier traceable to the WBS • A title • The names of the lead and contributors responsible for completion of the work • The scope of the work package • The start date and duration • Required inputs and dependencies A description of every activity covered by the WPD including the level of effort (in the number of hours of work of each person working on the Work Package) and earned value measurement method for each activity, and all non-labour costs	**Are you able to provide this work plan, WBS, as described in MC3?** **Mark the appropriate answer:** **YES** _____ **NO** _____

2. Point-Rated Technical Criteria (RC)

For each of the following Point Rated Criteria, bids must obtain the minimum points required for each rated criterion to be assessed as responsive under the point rated technical criteria section. Proposals not meeting the minimum required points or not meeting the mandatory requirements will be deemed non-

responsive. Only those proposals which are responsive (compliant) with all of the mandatory criteria and then achieve (or exceed) the stated minimum points required for the point rated technical criteria section will be further considered for award of a contract. In all cases, the level of detail provided must be sufficient to confirm compliance with the requirements.

PC1 - Understanding users requirements

For stream 1, 2 and 3

This criterion measures the level of preparation of the bidder. More specifically it evaluates the ability of the bidder to understand the users requirements and to recognize the critical characteristics to be met during the instrument conceptual design. To demonstrate conformance with this criterion, the bid must unequivocally show how the critical characteristics are identified and quantified from the analysis of the users requirements and how these characteristics can realistically be achieved with the current technologies.

Excellent (20 pts): The bid provides a sound and comprehensive analysis of the user requirements from which the critical characteristics to be met in the instrument conceptual design are fully identified and quantified. The compatibility of the identified characteristics and the current technologies is substantiated.

Adequate (15 pts): The bid provides an analysis of the user requirements with some elements improperly addressed. As a result, the critical characteristics to be met in the instrument conceptual design are only partially identified. The compatibility of the identified characteristics and the current technologies is substantiated.

Minimum required (10 pts): The bid provides an analysis of the users requirements with some elements improperly addressed. As a result, the critical characteristics to be met in the instrument conceptual design are only partially identified. The compatibility of the identified characteristics and the current technologies is NOT substantiated.

Poor (5 pts): The bid shows a poor understanding of the users requirements. Several elements are missing or improperly addressed in the analysis. The critical characteristics to be met in the instrument conceptual design are not identified or improperly identified. The compatibility of the identified characteristics and the current technologies is NOT substantiated.

PC2 - Identifying key challenges and potential solutions

For stream 1, 2 and 3

This criterion measures the capacity and readiness of the bidder. More specifically, it evaluates the ability of the bidder to identify the key technical challenges of the project and to offer and implement potential solutions. To demonstrate conformance with this criterion, the bid must provide a discussion on the challenges and constraints. The bidder must also explain the approach privileged to identify the solutions, why these solutions are promising, and how they will be implemented.

Excellent (20 pts): The bid identifies properly the key technical challenges and design constraints, presents a convincing approach to generate the design solutions, and consequently proposes at least three credible solutions to be investigated. A comprehensive plan to implement each solution and address the inherent risks is provided.

Adequate (15 pts): The bid identifies properly the key technical challenges and design constraints, presents a convincing approach to generate the design solutions, and consequently proposes at least two credible solutions to be investigated. A comprehensive plan to implement each solution and address the inherent risks is provided.

Minimum required (10 pts): The bid presents a somewhat convincing approach to generate the design solutions. At least one solution is proposed to be investigated. The implementation plan for this solution reveals inefficiencies and instill doubts as to the likelihood of achieving a compliant instrument conceptual design.

Poor (5 pts): The bid presents a questionable approach to the design solutions. The proposed solutions are not credible or there is no solution offered.

PC3 – Experience

A) in imaging spectrometer instrumentation For stream 1 only

This criterion measures the pertinent experience of the bidder in the design and instrumentation of imaging spectrometers, especially employing AOTF type disperser and polarization characterization. To demonstrate conformance with this criterion, the bid must provide a description of the relevant projects to which the team leader and team members have contributed. These projects will be considered in the evaluation of the PC3 criterion only if the details of the specific technical contribution of each person in these projects are provided and allow the evaluators to validate the claimed experience.

Excellent (40 pts): The team leader has contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers with an AOTF disperser intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight, AND each individual of a minimum of four (4) team members has done the same for at least one (1) imaging spectrometer intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Adequate (30 pts): The team leader and each individual of a minimum of four (4) team members have contributed in the design and / or instrumentation of at least one (1) scientific imaging spectrometers with an AOTF disperser intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Minimum required (20 pts): The team leader and each individual of a minimum of three (3) team members have contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Poor (10 pts): The team leader and each individual of a minimum of two (2) team members have contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

B) in imaging spectrometer instrumentation For stream 2 only

This criterion measures the pertinent experience of the bidder in the design and instrumentation of imaging spectrometers, especially employing Spatial Heterodyne Spectroscopy (SHS) technique. To demonstrate conformance with this criterion, the bid must provide a description of the relevant projects to which the team leader and team members have contributed. These projects will be considered in the evaluation of the PC3 criterion only if the details of the specific technical contribution of each person in these projects are provided and allow the evaluators to validate the claimed experience.

Excellent (40 pts): The team leader has contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers employing SHS technique intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight, AND each individual of a minimum of four (4) team members has done the same for at least one (1) imaging spectrometer intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Adequate (30 pts): The team leader and each individual of a minimum of four (4) team members have contributed in the design and / or instrumentation of at least one (1) scientific imaging spectrometers

employing SHS technique intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Minimum required (20 pts): The team leader and each individual of a minimum of three (3) team members have contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Poor (10 pts): The team leader and each individual of a minimum of two (2) team members have contributed in the design and / or instrumentation of at least two (2) scientific imaging spectrometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

C) in far infrared radiometer instrumentation For stream 3 only

This criterion measures the pertinent experience of the bidder in the design and instrumentation of non-traditional infrared radiometers, i.e. those including spectral bands centered at wavelengths beyond 16 microns. To demonstrate conformance with this criterion, the bid must provide a description of the relevant projects to which the team leader and team members have contributed. These projects will be considered in the evaluation of the PC3 criterion only if the details of the specific technical contribution of each person in these projects are provided and allow the evaluators to validate the claimed experience.

Excellent (40 pts): The team leader has contributed in the design and / or instrumentation of at least three (3) scientific far infrared radiometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight, AND each individual of a minimum of four (4) team members has done the same for at least two (2) far infrared radiometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Adequate (30 pts): The team leader and each individual of a minimum of four (4) team members have contributed in the design and / or instrumentation of at least two (2) far infrared radiometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Minimum required (20 pts): The team leader and each individual of a minimum of three (3) team members have contributed in the design and / or instrumentation of at least two (2) far infrared radiometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

Poor (10 pts): The team leader and each individual of a minimum of two (2) team members have contributed in the design and / or instrumentation of at least two (2) far infrared radiometers intended for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight.

PC4 - Expertise

A) in imaging spectrometer instrumentation – For stream 1 only

This criterion determines whether the key resources, including subcontractors, have the skill set required to deliver the contractual work. To demonstrate conformance with this criterion, the bid must identify the key technical resources and state the expertise and work assignment for each person. The resume of each key resource, as required by the MC2 criterion, will be used to assess his level of experience and the relevance to his assignment in this work. Only the resources who have used their expertise in at least two (2) projects that meet the MC1 criterion are admissible in this evaluation, i.e. considered as having demonstrated a sufficient level of experience.

Excellent (30 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for each of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance.

Adequate (20 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for seven (7) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance

Minimum required (15 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for six (6) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance.

Poor (5 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for five (5) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance

B) in imaging spectrometer instrumentation – For stream 2 only

This criterion determines whether the key resources, including subcontractors, have the skill set required to deliver the contractual work. To demonstrate conformance with this criterion, the bid must identify the key technical resources and state the expertise and work assignment for each person. The resume of each key resource, as required by the MC2 criterion, will be used to assess his level of experience and the relevance to his assignment in this work. Only the resources who have used their expertise in at least two (2) projects that meet the MC1 criterion are admissible in this evaluation, i.e. considered as having demonstrated a sufficient level of experience.

Excellent (30 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for each of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance.

Adequate (20 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for seven (7) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance

Minimum required (15 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for six (6) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance.

Poor (5 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for five (5) of the following eight fields of expertise: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance

C) in far infrared radiometer instrumentation – For stream 3 only

This criterion determines whether the key resources, including subcontractors, have the skill set required to deliver the contractual work. To demonstrate conformance with this criterion, the bid must identify the key technical resources and state the expertise and work assignment for each person. The resume of each key resource, as required by the MC2 criterion, will be used to assess his level of experience and the relevance to his assignment in this work. Only the resources who have used their expertise in at least two (2) projects that meet the MC1 criterion are admissible in this evaluation, i.e. considered as having demonstrated a sufficient level of experience.

Excellent (30 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for each of the following eight fields of expertise: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and radiometric / geometric data corrections.

Adequate (20 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for seven (7) of the following eight fields of expertise: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and radiometric / geometric data corrections.

Minimum required (15 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for six (6) of the following eight fields of expertise: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and radiometric / geometric data corrections.

Poor (5 pts): The bid has identified at least one dedicated staff with a sufficient level of working experience for five (5) of the following eight fields of expertise: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and radiometric / geometric data corrections.

PC5 - Effectiveness of implementation plan

For stream 1, 2 and 3

This criterion evaluates the underlying methodology and the thoroughness of the implementation plan. To demonstrate conformance with this criterion, the bid must elaborate on the methodology to deliver and provide details, at a minimum, on the work breakdown structure, personnel allocation, schedules, milestones, and deliverables. The plan will be evaluated for its completeness, credibility, and effectiveness. Where an implementation plan is deemed complete, credible, and effective, it means that an evaluator, using his/her expertise, experience, and the information provided in the bid, is of the opinion that the bidder has clearly demonstrated, through details and clear substantiations, that the plan allows to deliver high quality work within the required schedule.

Excellent (20 pts): The bid provides a coherent and comprehensive implementation plan with at least the following elements covered: (i) work breakdown structure and work package definition; (ii) personnel allocation matrix showing the level of effort for each individual team member or sub-contractor that has been allocated to each work package; (iii) milestones and deliverables; and (iv) schedules. The plan instills confidence that the project will achieve successful delivery and completion. The plan demonstrates an efficient implementation approach.

Adequate (15 pts): The bid provides a credible implementation plan with at least the following elements covered: (i) work breakdown structure and work package definition; (ii) personnel allocation matrix showing the level of effort for each individual team member or sub-contractor that has been allocated to each work package; (iii) milestones and deliverables; and (iv) schedules. The likelihood of achieving successful completion is good. The plan demonstrates a somewhat efficient implementation approach.

Minimum required (10 pts): The bid provides an implementation plan with some elements improperly addressed. Consequently, the likelihood of achieving successful completion is marginal OR the plan reveals serious inefficiencies.

Poor (5 pts): The bid does not provide an adequate implementation plan as more than one of the elements are missing or are improperly addressed. Consequently, doubts remain regarding the likelihood of the project achieving successful completion.

3. BIDDER'S SELF-EVALUATION

The Bidder is requested to provide a self-evaluation and substantiation, which must be submitted as an appendix.

For each of the applicable criterion:

- Select the benchmark statement (Excellent, Adequate, Minimum Required, Poor) that best represents the Bid being submitted;
- Provide the corresponding Score as described in Table 2 below; and
- Provide the substantiation for the selected benchmark statement and summarized cross-reference(s) to the Bid, if applicable. The substantiation must 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 are acceptable provided that the essence of the referenced information is summarized in the substantiation.

For convenience, a template for the Self-Evaluation Matrix is provided in Table 2 below. Enter each criterion number, the mark selected, the score and the substantiation. It is expected that approximately 300 words should be sufficient to make your case for the rating chosen in the substantiation column. Any documents that would support the substantiation should be added.

TABLE 2 – SELF-EVALUATION MATRIX

Organization: **Mission Selected for Proposal:**			
Criteria	**Mark**	**Score (Points)**	**Substantiation**
*Ex.: **PC2** (Criterion number)*	*Ex.: **Adequate** (Benchmark statement Excellent, Adequate, Minimum required, Poor)*	*Ex.: **15***	*Criterion substantiation and Bidder's Bid cross-reference.* *It is expected that 300 words or so should be sufficient to make your case for the rating chosen.*

ANNEX D

CERTIFICATIONS

AT THE CLOSING DATE AND HOUR OF THE INVITATION OR BEFORE THE ISSUANCE OF THE CONTRACT, THE OFFERORS MUST PROVIDE THE FOLLOWING CERTIFICATIONS.

All the criteria identified below are MANDATORY. Each criteria must be met and documentation provided in order to demonstrate the degree to which it is met.

Please identify where the substantial document is located in your offer.

Canada will not evaluate information such as references to a website address where supplementary information can be found.

Only those offers that meet all the mandatory technical criteria in the table below will be subject to further evaluation.

If these documents have not been provided at bid closing, PWGSC will notify the bidder, offeror or supplier that they are required to provide them within **two (2) business days** following notification by PWGSC.

(Note: this time requirement reflects PWGSC's expectation that these documents ought to be readily available to a bidder, offeror or supplier.)

The offers that fail to meet all these conditions will be rejected and will be given no further consideration.

TABLE #1 - Mandatory Criteria (MC)		
Item	**Mandatory Criteria**	
MC1	**Corporate experience – For stream 1, 2 and 3**	
	The bidder must have been active in business related to all elements included in the following item: • Design, assembly, radiometric calibration, characterization, and qualification of scientific imaging spectrometers for: (i) airborne or stratospheric balloon flight in support of the development a space payload; or (ii) space flight To demonstrate conformance with this criterion, the bidder must possess a minimum of three (3) years of experience in the last fifteen (15) years on a minimum of two previous or current projects. The bidder must provide a detailed description of these projects, this description must demonstrate that they possess the experience for all elements listed in the item above. Each of these elements may be demonstrated with a different project. Except where expressly provided otherwise, the experience described in the bid must be the experience of one or more of the following: • The Bidder itself • The Bidder's subcontractors The experience of the Bidder's suppliers will not be considered.	**Indicate the page where this information is listed**: _____
MC2	**Corporate expertise – For stream 1, 2 and 3**	
	<u>Use this text for stream 1 only:</u> The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) imaging spectrometer design;(ii) optical polarimetry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for visible to SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) aerosol retrieval methodology using atmospheric limb radiance. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource. To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements: • Name • Education • Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of	**Indicate the page where this information is listed**: _____

substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible.

Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable.

Use this text for stream 2 only:

The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) imaging spectrometer design;(ii) optical interferometry (iii) fore-optics (telescope) design; (iv) optomechanical and thermal design; (v) proximity electronics design for SWIR detectors; (vi) spectral and radiometric calibration system design; (vii) spectrometric system assembly and characterization for space; and (viii) water profiles retrieval methodology using atmospheric limb radiance. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource.

To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements:

- Name
- Education
- Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible.

Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable.

Use this text for stream 3 only:

The bidder must assemble a technical team that possesses the expertise necessary to: (i) develop the instrument conceptual design; (ii) determine the feasibility of the design; and (iii) demonstrate the feasibility of implementing the selected instrument concept and delivering the qualified flight instrument, as described in the Statement of Work (Annex A). The combined expertise of the team members must encompass a minimum of six (6) of the following specializations: (i) far infrared detector design; (ii) radiometric package design for far infrared detectors; (iii) far infrared telescope design; (iv) mechanical and optomechanical design; (v) proximity electronics design for far infrared detectors; (vi) far infrared radiometric calibration system design; (vii) far infrared system assembly and characterization; and (viii) atmospheric radiance modeling and

	radiometric / geometric data corrections. The provided team must consist of a minimum of six (6) technical contributors of the above specializations, of whom the majority (more than 50%) must be employed by the bidder. A Bachelor's degree in a relevant field of study is required as a minimum for each proposed resource. To demonstrate conformance with this criterion, the Bidder must provide resumes that describe each proposed resource's experience. Each resume of a proposed resource must include at least the following elements: • Name • Education • Work experience: for each project, provide the project name and duration, a detailed description of the project, a detailed description of the specific responsibility and technical contribution, and a statement of substantiation of the relevance to the required expertise above. Only the projects that meet the MC1 criterion are admissible. Letters of Commitment from proposed subcontractors confirming the participation of key team members not directly employed by the lead contractor should be provided where applicable.	
	Work Plan – For stream 1, 2 and 3	
MC3	The bidder must provide an effective and credible work plan. To demonstrate conformance with this criterion, the bid must include a Work Breakdown Structure (WBS) describing all the project elements that organize and define the total scope of the project, including subcontracted work, and must be deliverable-oriented. The bidder must prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. Each WPD must include, as a minimum: • A unique identifier traceable to the WBS • A title • The names of the lead and contributors responsible for completion of the work • The scope of the work package • The start date and duration • Required inputs and dependencies A description of every activity covered by the WPD including the level of effort (in the number of hours of work of each person working on the Work Package) and earned value measurement method for each activity, and all non-labour costs	**Indicate the page where this information is listed**: _____

ANNEX E

ELECTRONIC PAYMENT INSTRUMENTS

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

( ) VISA Acquisition Card;

( ) MasterCard Acquisition Card;

( ) Direct Deposit (Domestic and International);

( ) Electronic Data Interchange (EDI);

ANNEX F

MANDATORY NON-DISCLOSURE AGREEMENT

REQUEST FOR PROPOSAL FILE # 9F045-190490

PUBLIC SERVICES AND ¨PROCUREMENT CANADA (PSPC)

Select the stream of your request:

stream 1 ALI : _____

stream 2 SHOW: _____

stream 3 TICFIRE: _____

BY:

_____, a body corporate duly incorporated under the laws of _____, having its Head Office located at _____;
Hereinafter referred to as the ("Supplier')

TO: HER MAJESTY THE QUEEN IN RIGHT OF CANADA, as represented by the Minister of Public Works and Government Services;
Hereinafter referred to as ("Canada")

The Supplier agrees that, for the purpose of preparing a response to PWGSC for the RFP (the "Purpose") is being giving access to Confidential Information or proprietary to Canada or to third party and agrees to comply with the obligations referred to under this NDA;

1. The Supplier acknowledges that the documents entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3), must be treated as confidential and must not be disclosed or used in any way except in relation with the Purpose of this RFP.

2. For the purpose of this NDA, Confidential Information includes, but not limited to the documents entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3) and any documents, Instructions, guidelines, data, material, advice or another information whether received orally, in printed form or recorded electronically or otherwise and whether or not labeled as proprietary, that is disclosed to a person or entity or that person or entity becomes aware of for the purpose of this RFP.

3. The Supplier agrees that the documents entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3), will not be reproduced, copied, divulged, released or disclosed, in whole or in part, in whatever way or form any Confidential Information to any person or entity other than a person employed by the Supplier without the prior written consent of the PWGSC's Contracting Authority and for any purpose other than for the preparation of a response to this RFP.

4. The Supplier agrees to immediately notify the PWGSC's Contracting Authority if any person, other than the Supplier's current employees accesses the Confidential Information at any time.

5. Also, regardless of whether it is Confidential Information, the Supplier must at all times treat the information designated as Confidential Information and ensure it cannot be accessed by anyone excepting the Supplier's current employees, which have a legitimate "need to know' for the Purpose of presenting a RFP.

6. The Supplier shall at all times use the same degree of care as it uses to protect its own confidential information of like importance to prevent the unauthorized use or disclosure of Confidential Information, but in no event less than a reasonable degree of care. The Supplier shall not, nor shall it permit its employees to, remove any copyright, confidential, proprietary rights, or intellectual property notices attached to or included in any Confidential Information and shall reproduce all such notices on any copies of the Confidential Information.

7. The Supplier is responsible for any breach of this NDA by any of its employees, and the Supplier shall not, nor shall permit its employees to, modify, disassemble, decompile, or reverse engineer any Confidential Information even if it relates to the Purpose.

8. All the Information contained in the documents entitled AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION, DDD-92501032-1002 Rev.P1 [RD-6] (for stream 1), SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT, ABBCABOM-00654, Rev. C [RD-6] (for stream 2), TICFIRE Mission Study, Mission Concept Description, DDD-TICF-M-0001 Rev. P3 (RD-06) and Thin Ice Clouds in the Far InfraRed Experiment (microsatellite) User Requirements Document, CSA-MICRO-RD-0004 [RD-5] (for stream 3) and all other Confidential Information disclosed under this NDA shall remain the property of Canada or a third party, or of any other person or entity to whom it lawfully belongs, as applicable.

9. Without restricting the generality of the foregoing, the Supplier recognizes that no license or conveyance of any rights to the Supplier under any discoveries, inventions, patents, trade secrets, copyrights, or other form of intellectual property is granted or implied by the disclosure of Confidential Information under this NDA.

10. The Supplier must require any proposed subcontractor with a "need to know", to execute a NDA on the same conditions as those contained in this NDA prior to disclosure of the Confidential Information.
11. At close or early termination of the bid period, the Confidential Information must immediately delivered to the Contracting Authority as well as every draft, working paper and note that contains

any information related to the Confidential Information. The supplier must not keep any documents, either soft or hard copies, once he has submitted his bid.

12. All Confidential Information will remain the property of Canada and must be returned to the Contracting Authority within thirty (30) days following that request.

13. The NDA remains in force indefinitely.

14. Nothing in this NDA should be construed as preventing the disclosure or use of any confidential information to the extent that such information:

    (a) is or becomes in the public domain through no fault of the Supplier or any proposed subcontractor;

    (b) is or becomes known to the Supplier from a source other than Canada, except any source that is known to the Supplier to be under an obligation to Canada not to disclose the information; or

    (c) is disclosed under compulsion of a legislative requirement or any order of a Court or other tribunal having jurisdiction.

15. The Supplier agrees that a breach of this NDA may result in disqualification of a Supplier or a Qualified Supplier at any time, or immediate termination of the resulting Contract. The Qualified Respondent also acknowledges that a breach of this NDA may result in a review of the Qualified Supplier's security clearance and review of the Qualified Supplier's status as an eligible Supplier for other requirements.

16. The Supplier acknowledges and agrees that it will be liable for any and all claims, loss, damages, costs, or expenses incurred or suffered by Canada caused by the failure of the Supplier, or by anyone to whom the Supplier discloses the Confidential Information to comply with these conditions.

17. Canada reserves the right to refuse the request for access to documents.

IN WITNESS WHEREOF, this Non-Disclosure Agreement has been duly signed this day of _____, 2020, by an authorized representative of the

_____
Name of Supplier

_____
Name of authorized representative (print)

_____
Signature
(I have authority to bind the corporation)
Signed by its authorized representative

Witness:
_____
Name of the Witness

CSA-A-CCP-SOW-0002

Canadian Space Agency

ANNEX A

Aerosol Limb Imager (ALI) on the Aerosols – Clouds, Convection, Precipitation (A-CCP) satellite mission

Phase 0 Statement of Work (SOW)

Date: October 2020

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1 INTRODUCTION

1.1 BACKGROUND

NASA's Earth Science Division is pursuing measurement of the five highest priority targeted Earth observables identified by the National Academies of Sciences, Engineering, and Medicine in the report entitled "Thriving on Our Changing Planet: A Decadal Survey for Earth Observations from Space" [RD-1]. In late 2018 NASA began a three year multi-center study of two of the priority designated observables—Aerosols and Cloud-Convection-Precipitation (A-CCP)—to leverage the advantages of a single synergistic observing system. This pre-formulation study [RD-2] for an observing system that includes space-based instruments and sub-orbital instruments will conclude in late 2021. It will be followed by a Mission Concept Review in summer 2022, and initiation of the mission in autumn 2022.

In December 2018, NASA invited the Canadian Space Agency to participate in a workshop concerning the A-CCP pre-formulation study. The CSA extended this invitation to scientists from Environment and Climate Change Canada (ECCC) and to scientists with relevant expertise from Canadian universities. The Canadian delegation to this workshop made a presentation about potential Canadian contributions to the mission [RD-3]. This was followed up by submission of technical information about potential Canadian instrument contributions to the A-CCP mission. These are:

- Aerosol Limb Imager (ALI): a hyperspectral limb imager covering the visible and near infrared spectral range. The instrument is also capable of resolving linear polarization of the input limb radiance. The instrument is optimized for high spatial resolution stratospheric aerosol, volcanic plume and thin cirrus cloud measurements. It is designed to provide spectrally resolved aerosol extinction and particle size parameters with high vertical resolution and cross-track coverage.
- Spatial Heterodyne Observations of Water (SHOW) is an imaging spectrometer for dense profiling of water vapour above clouds. SHOW is designed to vertically resolved atmospheric profiles of water vapour by measuring limb scattered sunlight. The instrument utilizes an interferometric technique known as Spatial Heterodyne Spectroscopy (SHS), where the spectral range is limited to a narrow vibrational absorption band of water vapour in the near infrared.
- Thin Ice Clouds in Far-InfraRed Experiment (TICFIRE) is a nadir viewing imaging radiometer providing co-registration of cloud image data in thermal and far infrared spectral bands. The primary data product is spectral radiance for science and potential assimilation in operational forecasting systems. The observations allow for improved measurement accuracy of the effective cloud particle size along with optical depth, cloud top altitudes, and temperature. The observations also allow estimation of low concentration atmospheric water vapour in cold regions, near the tropopause, and at high latitudes near the ground, improving the measurement accuracy of traditional thermal infrared observations.

Initial NASA assessments have indicated that the Canadian instruments ALI, SHOW and TICFIRE will enhance baseline observations and may be accommodated on A-CCP spacecraft.

In June 2019, following the Pasadena workshop, NASA formally invited the CSA and collaborating organizations (ECCC, Universities): 1) to investigate potential partnership in the A-CCP observing system through contribution of the three Canadian space-based instruments and

a key radar subsystem, and, 2) to participate in the A-CCP Study Team in order to help identify the best A-CCP architectures (satellite, sub-orbital and instrument configurations) for eventual implementation as an Earth Science mission. As part of this study, inclusion of the Canadian instruments on NASA spacecraft is being assessed by NASA from technical, scientific, and cost perspectives. Simulations of measurements to be made by the Canadian instruments will be generated for A-CCP candidate satellite architectures in order to assess the science value of the Canadian instruments with respect to the A-CCP Science and Applications Traceability Matrix (SATM) [RD-4], and with respect to the other instruments from NASA and international partners.

CSA governance approval to proceed with the Options Analysis phase for the A-CCP Earth Science Mission was granted in July 2019. This decision took into consideration letters of support from CSA's Atmospheric Science Advisory Committee (ASAC), Environment and Climate Change Canada (ECCC), and the participating university scientists. Subsequently, CSA has:

- Issued contracts for the preparation of the User and Science Requirements (URD) for the three instruments;
- Successfully nominated three ECCC, one National Research Council (NRC), and four university scientists to A CCP study teams: Science and Applications Leadership Team (SALT), Science Impact Team (SIT), Applications Impact Team (AIT), Science Community Committee (SCC), and Sub-Orbital Working Group.
- Issued an RFP for Modelling, Simulations and Scientific Analyses for the A-CCP study.

With this RFP, the CSA will undertake work by Canadian industry to carefully examine the current instrument concepts, the instrument user and science requirements established by the Canadian science team, the mission constraints imposed by NASA, and technology and design options in order to identify the optimal instrument concept, estimate costs and chart the path to technology readiness.

1.2 CHALLENGES AND PURPOSE

The ALI concept was successfully demonstrated on a stratospheric balloon in 2014 and 2018, using mostly COTS components. Operating in a limb-viewing configuration, measurements were used to retrieve spatially resolved information of the stratospheric aerosol distribution, including spectral extinction coefficient and particle size.
The main technical challenge of this Phase 0 project is re-optimization and updating of the instrument design for the satellite platform, especially in the ACCP mission context including synergy with other potential Canadian instruments: nadir looking TICFIRE and limb looking SHOW.
Technical issues include implementation of a large aperture AOTF, LCR for dual polarization measurements, extended spectral range, stray light control, SNR and others.

The main purposes of this contractual work are:

1. Derive instrument requirements from the users and science requirement document (URD), the A-CCP mission constraints and spacecraft interface requirements;
2. Identify and investigate the instrument concept having a strong potential to meet the challenges;

3. Identify the optimal instrument concept, demonstrate that it will be capable of meeting all the necessary requirements and that it can achieve Technology Readiness Level 6 by no later than April 2024;
4. Demonstrate the technical feasibility of implementing the selected instrument concept and delivering the qualified flight instrument by April 2028;
5. Establish a cost estimate for design, test, qualification and delivery of the instrument. Support the cost estimate with a detailed basis of estimation.

The vendor performing the work shall be hereinafter referred to as the 'Contractor'. The contractor's team, made up of persons employed by the contractor as well as persons working under sub-contracts, must include Canadian companies whose technologies and expertise will be used to realize the contract objectives.

In this document, the Canadian Space Agency is also referred to as 'CSA' or the 'Agency' and is the Customer. The Contractor will report directly to CSA.

1.3 SCOPE

This Statement of Work (SOW) defines the scope of the tasks for the Bidder to develop an optimized concept for the Atmospheric Limb Imager (ALI) instrument and to perform related work described in section 1.2 above and elaborated in the rest of this SOW.

1.4 DOCUMENT CONVENTIONS

The following verbs, as used in this document, have specific meaning as indicated below:

- "shall" indicates a mandatory requirement.
- "should" indicates a preferred but not mandatory alternative.
- "may" indicates an option.
- "will" indicates a statement of intention or fact.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS DESCRIPTION

The following documents at the issue and revision level specified in Table 2-1 are applicable and form an integral part of this document to the extent specified herein. They can be obtained from the following File Transfer Protocol (FTP) link:

ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/

TABLE 2-1 APPLICABLE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
AD-1	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard	Rev. A	7 November 2008
AD-2	CSA-ST-GDL-0001	CSA Technology Readiness Levels and Assessment Guidelines	Rev. D	29 March 2019
AD-3	CSA-ST-FORM-0003	CTE Identification Workbook	Rev. B	March 2019
AD-4	CSA-SE-STD-0002	CSA Systems Engineering Contract Data Requirements List (CDRL) Compendium	Initial Release	23 June 2009

2.2 REFERENCE DOCUMENTS DESCRIPTION

The following documents provide additional information or guidelines that may clarify the contents of the SOW.

TABLE 2-2 REFERENCE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
RD-1	N/A	US Decadal Strategy for Earth Observation, http://nap.edu/24938	N/A	January 2018
RD-2	N/A	A-CCP Study Plan https://earth.gsfc.nasa.gov/missions/accp/links	N/A	4 December 2018
RD-3	N/A	Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	N/A	April 04 2019

RD-4	N/A	A-CCP mission level Science and Applications Traceability Matrix. https://earth.gsfc.nasa.gov/missions/accp/links	SATM-F	30 April 2020
RD-5		—Not used as a reference in this SOW—		
RD-6	DDD-92501032-1002	AEROSOL LIMB IMAGER ELEGANT BREADBOARD DESIGN DESCRIPTION (to be provided upon completion of the Non-Disclosure Agreement in Appendix C of this SOW)	Rev.P1	25 May 2020
RD-7	N/A	AEROSOL LIMB IMAGER User Requirements Document (for A-CCP) ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	Version 1.1	22 July 2020
RD-8	N/A	Mission constraints and interface requirements as communicated by the NASA A-CCP Study Team.	N/A	October 2020 to June 2021
RD-9	N/A	A-CCP Quarterly Forum Presentations, Architecture Briefings and Schedule Updates. https://earth.gsfc.nasa.gov/missions/accp/links	N/A	2019-2021
RD-10		Guidelines on Costing (Treasury Board) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32600	N/A	2019
RD-11	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6th Ed.	2017
RD-12	ANSI/AIAA G-043	Guide for the Preparation of Operational Concept Documents	Rev. B	2018

3 WORK DESCRIPTION

This section describes the work that is required to complete the study. Many of the tasks require collaboration with the ALI Science Team (Canadian universities and ECCC). Some of the tasks require collaboration with the NASA A-CCP Study Team.

3.1 TASKS

The main Tasks of this work, as well as related Applicable & Reference Documents and Deliverable Documents are listed in Table 3-1.

TABLE 3-1 TASKS, APPLICABLE & REFERENCE DOCUMENTS, DELIVERABLES

Tasks	Description	AD/RD	CDRL
T1.	Review of the A-CCP mission study and the A-CCP mission development timeline.	RD-1 RD-2 RD-9	
T2.	Review of the ALI instrument concept (from 2020).	RD-6	
T3.	Review of the user requirements stated in the A-CCP ALI URD (2020), and as derived from the SATM.	RD-7 RD-4	
T4.	Review of mission constraints and interface requirements as communicated by the NASA A-CCP Study Team, as they become available.	RD-8	
T5.	Conversion of user requirements, mission constraints and interface requirements into Instrument Concept Design Requirements.		EN0
T6.	Analysis of the user requirements, A-CCP mission constraints and interface requirements and flow down of the instrument requirements for worst case observation conditions.		EN1
T7.	Investigation of available technology capabilities for components that are critical to development of an optimal instrument concept.		MD0
T8.	Identification of suppliers of key technologies for which there may be few suppliers globally. Determination of lead times for procurement of the key technologies, as suggested by the suppliers.		EN6
T9.	Assessment of design options and their impacts on instrument performance, mass, volume, power, and interface to spacecraft.		MD0 EN3
T10.	Development of an optimal concept that meets user requirements, satisfies NASA mission constraints, and makes best use of Canadian technologies and expertise in space-based infrared remote sensing instrument design and manufacture.		EN3

T11.	Development of Instrument Requirements Specifications and Preliminary Interface Requirements for the recommended optimal baseline instrument concept. Demonstrate traceability to RD4, RD7 and RD8.		EN1 EN2 EN5
T12.	Development of the instrument concept of science operations, in consultation with the instrument science team (Canadian universities and ECCC) and with the NASA A-CCP Study Team.		OP0
T13.	Development of the Technology Readiness and Risk Assessment for the optimal instrument concept (including path to TRL 6 by April 2024).	AD-2 AD-3	MD1 MD2
T14.	Development of Mission Risk Assessment.		MD4
T15.	Development of a cost estimate (or range of possible costs) for the instrument to be designed, developed, qualified and characterized for Phases A through D (including support for AI&T, launch and commissioning).		MD3
T16.	Support to NASA for any technical questions that may arise during the contract period.		EN4
T17.	Describe Background Intellectual Property and Foreground Intellectual Property		MD5

3.2 DETAILED R&D AND ENGINEERING ACTIVITIES

The Contractor is expected to derive the instrument requirements for ALI, develop an optimal instrument concept, and to prepare an implementation plan as well as cost estimates for Phases A through D (including support for AI&T, launch and commissioning).

The following list of R&D activities refers to Table 3.1 Tasks. It provides more detail about the work to be accomplished by the Contractor, which shall include, but is not limited to:

1. Analyze users requirements, A-CCP mission constraints and interface requirements and flow down the instrument requirements for worst case observation conditions (T1 to T6).
2. In support of the instrument concept assessments, investigate characteristics and in-orbit degradation of prospective optical components (T7 and T8).
3. Identify and investigate detailed instrument concept having a strong potential to meet the requirements. Complete the Technology Trade-off Study. Prepare the Design Trade-off Study Report (T9). At a minimum, the factors to be considered in the trade-off analyses shall include:
    - Optical design options
    - Optics performance (FOV, resolution, stray light, SNR, polarization accuracy, etc.)
    - Detector characteristics

- Thermo-elastic effects
- Effects of spacecraft pointing stability on vertical resolution
- First order estimates of engineering budgets
- Calibration methodology

4. Prepare the Instrument Requirements Specifications for the optimal baseline instrument concept. Demonstrate traceability to RD4, RD6 and RD7. Demonstrate that the selected instrument conceptual design shall meet all performance requirements. The selected instrument conceptual design shall include design margins for the instrument and major sub-systems of 50% for new designs, 30% for iterative designs, and 10% for existing designs. Prepare Preliminary Interface Requirements Document (IRD) for the recommended optimal baseline instrument concept (T10 and T11). Establish the specifications for the selected instrument concept by:
    - Performing opto and optomechanical designs and analyses
    - Refining the required detector performance characteristics;
    - In collaboration with the ALI Science Team, defining the instrument operation concept;
    - Defining the internal and external interface requirements;
    - Defining the environmental requirements;
    - Performing the preliminary evaluation of instrument engineering budgets: mass, volume, power, data (with and without onboard data processing).
5. Devise the instrument Assembly, Integration and Test (AIT) approach and demonstrate the feasibility of delivering the qualified flight instrument by April 2028 (T10 and T11).
6. Prepare instrument science mission concept of operation. Demonstrate that the selected instrument conceptual design has no discrepancies with the instrument concept of operations (T12).
7. Perform a Technology Readiness and Risk Assessment for the optimal baseline conceptual design, and demonstrate that it can achieve Technology Readiness Level 6 by no later than April 2024. Identify the current technology development status of key elements of the instrument and the technology development plan. As much as possible, the development plan should be based on components that are free of ITAR restrictions (T13).
8. Identify and assess ALI mission risks in meeting A-CCP requirements and time line (T14).
9. Evaluate the cost for the development, qualification, and delivery of the baseline instrument, Phases A through D (including support for AI&T, launch and commissioning). All assumptions used to create the estimate shall be listed. Any options or de-scope options that are included shall be clearly described. An assessment of the sensitivity of the cost to the different users and mission requirements shall be provided (T15).
10. Support NASA for any technical questions that may arise during the contract period in coordination with TA and provide Technical Reports about the work performed (T16).

3.3 MILESTONES, REVIEWS & MEETINGS

The contractor shall plan and perform the work in order to meet the following CSA milestones:

TABLE 3-2 MILESTONES, REVIEWS & MEETINGS

Description	Date
Kick-off Meeting	Contract Award + 2 weeks
Complete investigation and assessment of instrument concepts – initial release MD0, EN3	15 February 2021
Complete the Technology Readiness and Risk Assessment of the optimal baseline instrument concept – initial release MD1, MD2	1 March 2021
Review meeting (Milestone 1)	22 March 2021
Detailed evaluation of performance and engineering budgets for the optimal baseline instrument concept – initial release EN0, EN1, EN2	15 April 2021
Instrument Operation Concept – initial release OP0	31 May 2021
Review meeting (Milestone 2)	15 June 2021
Cost Estimation for Phases A-D – initial release MD3, MD4	30 August 2021
Completion – final versions of all deliverables	15 October 2021
Final Review Meeting	29 October 2021

The location of the meetings will be determined in consultation with the Technical Authority.

The contractor should include a budget for travel costs to the CSA for the Kick-Off Meeting and for the Final Review Meeting.

3.3.1 Kick-off, Progress, Milestone and Final Review Meetings Deliverables

The contractor shall conduct progress review meetings every two weeks.

For the Kick-off meeting the contractor shall produce CDRL PM2.

For each meeting defined in Table 3-2, and for the biweekly progress reviews, the contractor shall produce CDRL PM3, PM4, PM5 and PM6.

For milestone review meetings defined in Table 3-2, the contractor shall produce technical presentation packages as required to support review of the Mission, Engineering and Operations documents, and shall submit these to CSA three days in advance of the meetings.

The purpose of the Instrument (Mission) Requirements Review is to demonstrate the validity of the instrument requirements specifications, to examine the preliminary interface requirements and to ensure project readiness to proceed with the development of system requirements. The Contractor must demonstrate that the Instrument (Mission) Requirements Review entry and exit criteria are met, including the common entry and exit criteria, as per AD-02.

The deliverables for this review will be as per Table A-1.

The contractor shall deliver CDRL PM7 & PM8 to close the contract.

3.3.2 Cost Estimate

The Contractor must provide an indicative Cost Estimate for the science instrument, in accordance with Treasury Board (TB) guidelines (RD-10), as per Table 3-3 Science Instrument Cost Breakdown, for all phases leading to the development, implementation, operation and disposal. Along with the cost estimate, a justification for these costs must be included. The justification must describe the type of analysis (analogous, bottom-up, etc.), as well as the assumptions made (CDRL MD3). Cost estimates must provide sufficient granularity to allow costing estimating of the science instrument for the life cycle of the mission. This estimate is for information purpose and it will not be contractually binding for the Contractor to compete for subsequent phases if any.

TABLE 3-3 TEMPLATE FOR SCIENCE INSTRUMENT COST BREAKDOWN

Category		Phase A	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
	Gov FY (example)	FY20/21	Etc.					
Labour	Management							
	Technology Development							
	Design							
	Documentation							
	Reviews							
	Manufacturing							
	Assembly							
	Testing							
	Product Assurance							
	Science Team Support							
	Ground segment							
	Operations							
	Total Labour							
Non-Labour	Hardware / Software Procurement							
	Science Team Support							
	Tools, Equipment and Facilities							
	Travel and Living							
	Subcontractors							
	EEE Parts, Materials And Qualification Processes							
	Other Direct Charges							
	Total Non-Labour							

	Subtotal							
Risk	Risk Contingency							
Taxes	Applicable Taxes							
Total By Phase								
Total All Phases								

3.4 WORK BREAKDOWN STRUCTURE

The contractor shall propose a work breakdown structure [CDRL PM9] that describes a logical and realistic approach to managing the work. Each work package should:

- provide a brief description of the work to be accomplished,
- identify the person who will lead the work,
- identify the persons who will contribute to the work,
- quantify the number of hours that are allocated for each person contributing to the work,
- identify the start and end dates for the work package,
- identify progress milestones,
- identify deliverables from the work package,
- identify links to other work packages (dependencies).

3.5 SCHEDULE

The contractor shall provide a schedule as part of their technical proposal, describing the sequence and duration of work packages, expected achievements or indicators of progress in performing the work packages, progress review meetings, milestones and deliverables

3.6 ORGANIGRAM

The contractor shall provide an organizational chart showing roles and responsibilities as well as reporting and supervision hierarchy.

3.7 PROJECT MANAGEMENT

3.7.1 Project Planning, Performance and Leadership

The Contractor shall plan and manage the work to be performed under this contract in such a manner as to achieve project performance, scope, quality and schedule requirements of this SOW.

The Contractor shall provide the technical leadership and support necessary to ensure effective and efficient performance of all contract and sub-contract efforts and activities.

The Contractor shall dedicate experienced personnel, and implement sub-contracts as required for services of experts in Canadian industries and universities, in all the disciplines required to carry out the work.

The Contractor shall provide the necessary leadership to effectively manage the collaborations with scientists from ECCC and Canadian universities, as well as with the NASA A-CCP Study Team, in keeping with the project objectives.

3.7.2 Project Management Control

The Contractor shall establish and maintain a close management and technical interface with the Technical Authority (TA) in order to ensure a coordinated program effort that will meet or exceed the project objectives defined in Table 3-1 within budget and personnel availability constraints.

3.7.3 Project Management Reporting

The contractor shall produce monthly progress reports as per CDRL PM1.

3.7.4 Action Item Log

The contractor shall maintain Action Item log according to CDRL PM6.

3.8 INTELLECTUAL PROPERTY

The Contractor must complete the Contractor Disclosure of Intellectual Property CSA (CDRL MD5), identifying the Background Intellectual Property (BIP) and foreground Intellectual Property (FIP) that will be generated in this Phase 0 contract, the owners of the BIP and how it will be managed and coordinated among the various collaborators and entities involved.

4 CONTRACTOR DELIVERABLES

4.1 HARDWARE

No hardware is expected to be deliverable under this contract.

4.2 SOFTWARE

No software is expected to be deliverable under this contract.

4.3 DOCUMENTATION

The Contractor shall deliver all documentation requested in Appendix A.

The Contractor Shall interface with the TA to assure all documents in the CDRL are released and deposited according to CSA CADM instruction (CDRL PM0) or using agreed format and tailored DIDs.

The Contractor may propose to combine documents called by more than one CDRL into one document, but this is subject to prior approval from the CSA. Where this approval is granted, the document cover page must list all the CDRL numbers that are covered by this document.

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

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

Electronic documents must be prepared using the most appropriate tool (Microsoft Word, Excel, MS Project, etc.); released versions must be delivered in electronic format in both native format and pdf format. Schedules must be submitted in Microsoft Project format.

Documents and other data must be delivered via e-mail or direct transfer (FTP). For direct transfer, a notification of the document or data readiness and location on a contractor repository must be sent. In certain occasions, when specified in the Work Package, paper copies may be required.

Electronic documents or notifications of their availability on contractor repositories must be sent to the e-mail address of the CSA Project Manager.

Emails are to contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted. Hard copy and media deliverables are to be addressed to:

- Attention:
  Canadian Space Agency
  6767, Route de l'Aéroport
  Longueuil, QC, J3Y 8Y9
  Canada

At the end of each Work Package, all data, electronic files and documentation created by, or provided to the Contractor for the performance of the Work Package must be returned to CSA.

All simulation scenarios that have been considered (e.g. with STK) must be delivered in CD-ROM or DVD-ROM format.

All documentation must be written in English.

All documents must be provided 10 working days prior to the specified Review/Meeting unless otherwise indicated.

5 GOVERNMENT FURNISHED EQUIPMENT

No government furnished equipment is expected to be deliverable under this internal study. If applicable, any government furnished information must be returned to the Crown at the conclusion of the Contract.

6 ACRONYMS AND ABBREVIATIONS

This list contains the acronyms and abbreviations contained in this document. Those not contained in this list may be categorised as trademark or standard names used in the software industry.

A-CCP	Aerosols – Cloud, Convection, Precipitation
AIT	Applications Impact Team
ALI	Aerosol Limb Imager
AOI	Area of Interest
AR	As Required
ASAC	CSA Atmospheric Science Advisory Committee
BIP	Background Intellectual Property
CDRL	Contract Data Requirements List
CF	Contractor Format
CSA	Canadian Space Agency
DID	Data Item Description
DVD-ROM	Digital Versatile Disk - Read Only Memory
ECCC	Environment and Climate Change Canada
FIP	Foreground Intellectual Property
FOV	Field of View
FTP	File Transfer Protocol
FY	Fiscal Year
IP	Intellectual Property
IFOV	Instantaneous Field of View
IRD	Interface Requirements Document
MTF	Modulation Transfer Function
NASA	National Aeronautics and Space Administration
NRC	National Research Council
PSF	Point Spread Function
RD	Reference Document
RFP	Request for Proposal
SALT	Science and Applications Leadership Team
SATM	Science and Applications Traceability Matrix
SCC	Science Community Committee
SIT	Science Impact Teams
SIT-A	SIT - Aerosols
SIT-C	SIT – Clouds, Convection, Precipitation
SHOW	Spatial Heterodyne Observations of Water

SOW	Statement of Work
STK	Systems Tool Kit
TA	CSA Technical Authority
TBC	To Be Confirmed
TICFIRE	Thin Ice Clouds in Far InfraRed Experiment
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
URD	Users and Science Requirement Document

APPENDICES

A CONTRACT DATA REQUIREMENTS LIST (CDRL)

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

LEGEND:

1) DID No.

- CF = Contractor's format

2) Document Versions:

- D: Draft (under Version Control, expected to be updated – up to 50% complete and correct)
- P:Preliminary (under Version Control, expected to be updated - 70% complete and correct).
- IR: Initial Release (under Configuration Control, may well be revised during normal project life - 95-100% complete & correct).
- U: Update (expected revision, but not final; under Configuration Control, previous versions remain unchanged under Configuration Control).
- F: Final (under Configuration Control, normally not expected to be revised, but could be if necessary - 100% complete and correct).

3) Time Indicator:

- AR = As Required

TABLE A-1 – CDRL

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.0 MISSION DOCUMENTATION							
MD0	Technology Trade-off Studies	3.1	DID-005	15 February 2021	AR	15 October 2021	Approval
MD1	Technologies Development Plan	3.1	DID-006	1 March 2021	-	15 October 2021	Approval
MD2	Technology Readiness Level (TRL) Assessment Report	3.1	DID-004	1 March 2021	-	15 October 2021	Approval
MD3	Life Cycle Cost Analysis	3.2 f	DID-009	30 August 2021	-	15 October 2021	Approval
MD4	Mission Risk Analysis Report	3.2 a	DID-010	30 August 2021	AR	15 October 2021	Approval
MD5	Contractor Disclosure of IP	3.8	DID-120			15 October 2021	Approval
A.1 PROJECT MANAGEMENT							
PM0	General Preparation Instructions	4.3	DID-100	AR	AR	-	Info
PM1	Progress Report	3.8.3	DID-107	AR	Monthly	-	Info
PM2	Kick-Off Meeting Presentation	3.4.1	DID-108	AR	-	-	Info
PM3	Progress Presentation	3.4.1	CF	AR	AR	-	Info
PM4	Meeting Agenda	3.4.1	CF	AR	AR	-	Info
PM5	Minutes of Meetings	3.4.1	CF	AR	AR	-	Info
PM6	Action Items Log (AIL)	3.4.1	DID-112	AR	AR	-	Info
PM7	Phase Closure / Final Report	3.4	CF	15 October 2021	-	-	Info
PM8	Executive Report	3.4	CF	15 October 2021	-	-	Info
PM9	Work Breakdown structure	3.5	DID-102	Kick-off Meeting	-	-	Info

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.2 ENGINEERING							
EN0	Instrument Concept Design Requirements	3.1	CF	15 April 2021	-	15 October 2021	Info
EN1	Instrument Requirements Specification	3.1	DID-400	15 April 2021	-	15 October 2021	Approval
EN2	Interface Requirements Document (IRD)	3.1	DID-500	15 April 2021	-	15 October 2021	Approval
EN3	Design Trade-off Studies	3.1	DID-629	15 February 2021	AR	15 October 2021	Approval
EN4	Technical Report	3.1	CF	AR	AR		Info
EN5	Requirements Traceability Matrix	3.1	DID-532	15 April 2021	-	15 October 2021	Approval
EN6	Long Lead Items List	3.1	DID-529	31 May 2021	-	15 October 2021	Info
A.3 OPERATIONS							
OP0	Mission / Science Operations Plan	3.1	DID-826	31 May 2021	-	15 October 2021	Approval

B DATA ITEMS DESCRIPTIONS (DIDS)

DATA ITEM DESCRIPTION

DID-004 – Technology Readiness Assessment Report

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

Issued periodically to document the execution of the Technology Readiness Assessment process.

PREPARATION INSTRUCTIONS:

The Technology Readiness Assessment (TRA) must be comprised of 2 parts:

1) A Technology Maturity Assessment to determine the technical maturity of each specific technology required, at a specific point in time, namely at the times specified in the CDRL, and
2) A Viability Assessment to determine the approach forward from the already achieved R&D results, including an assessment of:
    a) The Technology R&D Risk, i.e. to develop a clear understanding of the remaining "development hurdles" and the projected uncertainty in the likelihood of development success for novel technologies; and
    b) The R&D Cost and Feasibility, i.e. to determine the relative costs of achieving the next TRL by overcoming the "development hurdles" mentioned above, including challenges in providing a relevant environment and any required special R&D facilities; this step is identified as an "Advancement Degree of Difficulty Assessment" in the NASA Systems Engineering Handbook, Appendix G (NASA/SP-2007-6105 Rev. 1, December 2007).

The TRA must be performed against the hierarchical breakdown of the hardware and software configuration items of the system Product Breakdown Structure to achieve a systematic, overall understanding at the system, subsystem, and component levels and to ensure that the technologies with the lowest TRL are identified.

DATA ITEM DESCRIPTION

DID-005 – Technology Trade-off Studies

DID Issue: IR **Date: 2014-02-17**

PURPOSE:
To compare various available technologies and select the best-suited technology to supporting the selection between design choices so as to optimize the system design.

PREPARATION INSTRUCTIONS:
The Technology Trade-off Studies must ensure that a thorough and comprehensive set of options and alternatives is considered and analyzed for the system design, with consideration for all aspects of the system life cycle and all aspects of system life cycle cost.
The Technology Trade-off Studies shall include the following information as a minimum:

- Function to be filled or performed by the selected technology;
- Minimum or desired performance characteristics or specifications;
- Technical constraints of whatever nature (mass, dimensions, power consumption, etc.);
- Budget constraints;
- Schedule constraints;
- List of all candidate technologies;
- Comparative analyses of all candidate technologies with respect to each performance criteria and constraint;
- Summary of findings;
- Identification of the selected technology;
- Advantages and disadvantages of the selected technology and compromises made to arrive at this selection;
- Copies of, or references to, data used to make the analyses (published specifications, test data, independent analyses, etc.).

DATA ITEM DESCRIPTION

DID-006 – Technologies Development Plan

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

To define and detail all technologies development activities to be performed in the early phases of the mission in order to maximize the chances of success in achieving the mission objectives within cost and schedule constraints.

PREPARATION INSTRUCTIONS:

The Technologies Development Plan must include functional and performance requirements, and a roadmap (mapping TRL to a timeline coordinated with the mission development schedule) for each Critical Technology.

The Technologies Development Plan must be developed in conjunction with the Technology Readiness Assessment Report and the Technology Trade-off Studies.

The Technologies Development Plan shall include the following data, tailored to the specific needs of each project. The Contractor's format is acceptable.

1. SCOPE

This DID establishes the content, format, maintenance, and submittal requirements for the Technologies Development activities. It is applicable to all technologies used in the system.

2. CONTENTS

This plan shall contain the following information, as a minimum:

c) A description of the Contractor's organisation, methods, and control to implement the technologies development work;

d) A description of the technologies development activities to be performed, detailing benefits, constraints, and objectives;

e) A detailed time-correlated sequence of technologies development milestones from contract-start date through to completion of design certification;

f) A description of support equipment, software, facilities, and tooling necessary for the technologies development activities;

g) A description of technologies development and breadboard tests planned at equipment level;

DATA ITEM DESCRIPTION

DID-009 – Life Cycle Cost Analysis (LCCA)

DID Issue: IR **Date: 2014-02-20**

PURPOSE:

To determine the overall cost of designing, building, testing, operating, maintaining and disposing of a space system.

PREPARATION INSTRUCTIONS:

The LCCA shall be structured on the system WBS and shall analyze all the costs attributed to the system during its life cycle. It shall include the following costs:

1) Initial capital costs, including project planning and management, engineering (design and development), manufacturing, testing, integration, launch and commissioning. Ground segment acquisitions and development shall also be included;
2) Operating costs, including operations personnel, consumables, training, simulations, etc.;
3) Maintenance costs if applicable;
4) Risk mitigation allowances;
5) Disposal costs.

DATA ITEM DESCRIPTION

DID-010 – Mission Risk Analysis

DID Issue: IR **Date: 2014-02-21**

PURPOSE:

To assess the likelihood and consequence of each identified risk.

PREPARATION INSTRUCTIONS:

The Mission Risk Analysis shall contain the following information, as a minimum:

Introduction (purpose, scope);

Applicable and Reference Documents;

Project Overview: Shall provide a brief overview of the project and its deliverables while focussing on perceived risk areas;

Risk categories or Risk Breakdown Structure to facilitate risk identification to a consistent level of detail. The following main categories shall be used for the first level of the risk breakdown structure:

Cost – Risks associated with system acquisition or development cost exceeding the budget,

Schedule – Risks associated with achieving designated milestones within the designated time frame,

Technical – Risks associated with the engineering process that may keep the system from meeting its technical specifications or may adversely affect overall system quality and performance, and

Programmatic – Risks associated with programmatic factors such as export control, regulations, changes to the project environment, force majeure, etc.;

Risk identification methodology describing the approach followed for identifying and documenting risks that might affect the mission.

Risks identified: for each identified risk, a statement shall identify the risk cause as well as its consequence using the following wording: *''there is a risk that* _____ (specify cause*) resulting in* _____ (specify consequence)''. Risks shall be grouped by category and identified to one or more specific work packages;

Risk analysis assessing the likelihood and consequence of each identified risk; this should take the form of the usual likelihood vs. consequence matrix.

DATA ITEM DESCRIPTION

DID-100 – General Preparation Instructions

DID Issue: IR **Date: 2013-12-19**

PURPOSE:

This DID specifies:

a) format requirements for the preparation and formatting of deliverable project documentation;

b) document and data delivery methods, notifications and identification requirements;

c) document and data structure requirements;

d) metadata requirements for all document and data submissions.

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

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. PREPARATION

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

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

WXYZ-CDRL-NUM-CIE_ContractNumber_sentYYYY-MM-DD

where:

WXYZ: A 4-8 letter acronym of the project

CDRL-NUM: The CDRL Identifier

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

ContractNumber: For example: _9F028-07-4200-03

_sentYEAR-MONTH-DAY: Date Tracking Number

1.2. ELECTRONIC DOCUMENTS FORMAT

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

1.1.1 Page Numbering

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

1.1.2 Document Numbers

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

1.3. DELIVERY, NOTIFICATIONS AND IDENTIFICATION REQUIREMENTS

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

Documents may be delivered via e-mail or direct transfer (FTP) or on DVD or CD-ROM disk.

1.1.3 E-mailed documents

E-mailed documents must be sent to:

CM_Receipt@space.gc.ca

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

1.1.4 Direct Transferred Documents

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

CM_Receipt@space.gc.ca

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

CSA-CM-ITAR@asc-csa.gc.ca

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

1.1.5 Documents Delivered on DVD or CD-ROM disk

Hard copy and media deliverables are to be addressed to:

CM Library, 6A-100

Attention: CSA XXXX Project

Canadian Space Agency

6767, Route de l'Aéroport

Longueuil, QC, J3Y 8Y9

CANADA

The DVD or CD-ROM label must show the following information:

a) Company Name

b) Document Title

c) Document Number and Revision Status

d) CSA SOW Number

e) CDRL Number and Title

f) Contract Number

2. DOCUMENT STRUCTURE AND CONTENT2.1 OVERALL

Except as otherwise specified, all documents must have the overall structure as follows:

g) Cover/Title Page;

h) Table of Contents;

i) Introduction;

j) Applicable and Reference Documents;

k) Body of Document; and

l) Appendices

2.2 COVER/TITLE PAGE

The title page must contain the following information:

m) Document Number and date: Volume x of y (if multivolume)

n) Rev. indicator / date of Rev.

o) Document Title

p) Project Name

q) Contract No.

r) CDRL Item No. or Nos., if one document responds to more than one CDRL, subject to prior approval from the PA.

s) Prepared for: Canadian Space Agency

t) Prepared by: Contractor name, CAGE Code, address, and phone number

u) Product tree identifier, if applicable

v) © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR].

2.3 TABLE OF CONTENTS

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

2.4 INTRODUCTION

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

w) Project description and background;

x) Identification (number, title) and a brief overview of the system, hardware, or software to which the document applies;

y) Purpose of the document;

z) Scope of the document (what it includes and what it does not include);

aa) Document conventions; and

bb) Roles and responsibilities of the participants and stakeholders.

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

2.5 APPLICABLE AND REFERENCE DOCUMENTS

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

2.6 BODY OF DOCUMENT

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

2.7 APPENDICES

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

3. METADATA ON DELIVERABLES

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

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

Provided by Supplier	Metadata Description	Comments
Yes	CSA Project Identifier	Project Acronym
Yes	Contract Identifier	PWGSC identifier
Yes	Contract Revision Identifier	PWGSC identifier
Optional	Contract Revision Date	
Yes	SOW Identifier	CSA Doc ID
Yes	SOW Revision Identifier	CSA Doc Revision ID
Yes	Document Type	Dwg, Doc, RFD, RFW, ECR, ECN, IP CR, IP CN/CD, QN, etc.
Yes	CDRL Identifier	Per CSA SOW (e.g. EN-006)
Yes	CDRL Sub-category Identifier	If multiple, separate subject documents per CDRL item (e.g. EN-006.03) (can be contractor defined)
Optional	Project WBS identifier	
Optional	SOW paragraph identifier.	
Optional	DID/ DRD Identifier	
Yes	Deliverable submission format	Electronic, Hard copy, On media (CD-ROM, etc.)
Yes	Deliverable Transmittal Identifier	e.g. CADM09-0123. Can also be a notification of delivery identifier
Yes	Deliverable Transmittal Date	
Yes	Originator's Organization Identifier	CAGE code, company name, short name, etc.
Optional	Document Author	
Yes	Deliverable Type	Dwg, Doc, RFD, RFW, ECR, ECN, NCR, Problem Report, IP CR, IP CN/CD, QN, etc.
Yes	Document Type	Specification, Design, Plan, Tech Note, Report, etc.
Yes	Originator's Document Identifier	
When applicable	Originator's Document Volume Identifier	
When applicable	Originator's Document Part Identifier	

Provided by Supplier	Metadata Description	Comments
When applicable	Originator's Document Issue Identifier	When both Issue and Revision are used concurrently to identify released documents
Yes	Originator's Document Revision Identifier	
Yes	Originator's Document Title	
Yes	Document Release Date	
Yes	Document Effective Date	Applicable to document changes, deviations, waivers,
Yes	Document Expiry Date	If applicable
When applicable	Originator's Authorizing ECN Identifier	Class 2 ECN approving document release and submission to customer
Yes	Document Maturity	Draft, Preliminary, Initial Release, Updated Revision, etc.
When applicable	Class	If deliverable is a change, deviation, waiver, etc. to a released item. (Class I, Class II)
Yes	Security Classification of Deliverable	Per Government of Canada definitions for Classified and Protected data (C,S,TS,PA,PB,PC)
Yes	Sensitivity of Document contents	Company Proprietary, Trade Secret, etc.
Yes	ITAR Content Indicator	Yes or No
Yes	Export Controlled Content Indicator	Yes or No
Yes	Affected Document Identifier	If deliverable is a change, deviation, waiver, etc. to a released document/drawing/model. Enables change-to-document, waiver-to-document relationships, etc.
Yes	Affected Document Revision Identifier	As above
Yes	Affected Document Title	As above
Yes	Product Breakdown Structure / Item Hierarchy Identifier	Critical for Item-to-Document Relationship

Provided by Supplier	Metadata Description	Comments
Yes	Associated Project/System Milestone Review	PDR, CDR, etc. When Reviews are at sub-system level, identify accordingly. e.g. Bus PDR
When applicable	Associated System Baseline	If different from Project Milestone
Yes	Filename of Deliverable	Filename and file type (for all representations submitted - .doc, .pdf, etc.). Original, revisable format to be delivered before contract completion.
Yes	Format of Deliverable / Application used to produce	MS WORD 2007, Project Scheduler 9, etc.
When applicable	Filename of Parent Deliverable Bundle	If part of a document Bill of Material
When applicable	Identification of Delivery Media	If physically delivered
When applicable	Originator's Repository Address of deliverable	To identify source location of document

DATA ITEM DESCRIPTION

DID-102 – CWBS and Work Package Descriptions

DID Issue: IR **Date: 2013-12-18**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

The Contractor shall prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. Each WPD shall include, as a minimum:

A unique identifier traceable to the WBS;

A title;

The name of the individual responsible for completion of the work;

The scope of the work package;

The start date and duration;

Required inputs and dependencies;

A description of every activity covered by the WPD including the level of effort and earned value measurement method for each activity, and all non-labour costs;

Assumptions;

Output and work package acceptance criteria;

Issue date;

Version number; and

List of deliverable with delivery milestone.

DATA ITEM DESCRIPTION

DID-107 – Progress Report

DID Issue: IR **Date: 2014-01-10**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

NOTE TO CSA PROJECT MANAGERS: The content required below includes all the information required for a large project. For smaller or Phase 0 or A projects, the CSA Project Manager may elect to tailor these requirements down to a suitable level, however, it is necessary to ensure that enough information is obtained to maintain control of the project.

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

Each progress report shall answer the following three questions:

1) Is the project on schedule?
2) Is the project within budget?
3) Is the project free of any areas of concern in which the assistance or guidance of the CSA may be required?

Each negative response must be supported with an explanation.

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

4) Summary outlook, including technical performance, work performed, schedule and cost status (at CWBS level 2), organization and key personnel changes and areas of concerns;
5) Financial status including actual and forecasted expenditures, by month, as compared to the original monthly planned expenditure profile;
6) *For cost reimbursable contracts:* Cost performance status in tabular form, with the following information provided for each Work Package (WP):
    a) Budgeted Cost of Work Scheduled (BCWS), current and cumulative,
    b) Budgeted Cost of Work Performed (BCWP), current and cumulative,

c) Actual Cost of Work Performed (ACWP), current and cumulative,

d) Cost variance (current and cumulative),

e) Budget at completion (BAC),

f) Estimate at completion (EAC),

g) Cost variance at completion, and

h) Cost Performance Index (CPI);

7) *For fixed price contracts:* Updated milestones payment plan;

8) A detailed integrated project schedule status including:

a) The schedule baseline,

b) Dependencies between activities,

c) Percent of completion for all activities,

d) List of completed milestones,

e) Critical path,

f) 1st level subcontractor's activities having impact on WP delivery date shall be provided, and

g) All other activities having an impact on WP delivery date shall be provided;

9) Schedule variances from the plan, including deviations from schedule and proposed corrective actions for significant variances;

10) Major meetings schedule update;

11) Status of the work in progress, specifically the work performed in the previous calendar period; sufficient sketches, diagrams, photographs, etc. shall be included, if necessary, to describe the progress accomplished;

12) The work projected for the next period, and estimated date of completion of next milestone;

13) Outline of technical and programmatic issues, with solutions recommended;

14) Contractual issues, including changes to activities and costs;

15) Subcontracts events, status and issues;

16) Equipment ordered, received, made and assembled;

17) Description of trips or conferences connected with the Contract during the period of the report;

18) Risk status report including previous issues resolved, status of on-going risks (changes, likelihoods and impacts), and identification of new risks, their likelihood and impact, and proposed mitigation action;

19) Product Assurance reporting:

a) A narrative section describing: significant accomplishments during the reporting period, audits performed, significant problems, recommended solutions, and corrective action status, significant changes in the PA Organization and Program related organizations,

b) Summary tables or updates as applicable:

i) Technical review action items, configuration baseline, non-conformances, failure analysis, audits (internal as well as at the subcontractors and their sub-tiers),

ii) Reliability analysis status,

iii) Inspection and Test Status,

iv) Deviations/Waivers status,

v) List of Class I Non-conformances,

vi) List of Class II Non-conformances,

vii) PA documentation status,

viii) PA Action Item Log,

ix) Contractor problem status, and

x) Status of GIDEP/ESA Alerts,

c) Software assurance highlights:

i) Assurance accomplishments and resulting metrics for activities such as, but not limited to, inspection and test, reviews, Instrument Provider/subcontractor surveys, and audits,

ii) Trends in metrics data (e.g., total number of software problem reports, including the number of problem reports that were opened and closed in that reporting period),

iii) Significant problems or issues that could affect cost, schedule and/or performance, and

iv) Plans for upcoming software assurance activities; and

20) Status of all action items from previous review(s) and meeting(s).

DATA ITEM DESCRIPTION

DID-108 – Kick-off Meeting Presentation

DID Issue: IR **Date: 2014-01-10**

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 shall contain the following information, as a minimum:

Review of major assumptions;

Review of contract deliverables;

Work requirements, WBS status and schedule;

Project's funding and expected cash-flow;

FIP and BIP;

Licensing issues if any;

Presentation to include the required copyrights and IP disclosure;

Other items as deemed appropriate

DATA ITEM DESCRIPTION

DID-112 – Action Items Log (AIL)

DID Issue: IR **Date: 2013-12-19**

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) Description of the action required;
4) Open Date;
5) Source of AI (e.g. PDR meeting, RID, etc.);
6) Originator;
7) Office of Prime Interest (OPI);
8) Person responsible (for taking action);
9) Target/Actual Date of Resolution;
10) Progress update;
11) Rationale for closure;
12) Status (Open or Closed); and
13) Remarks.

The date in column 9) will be the target date as long as the item is open, and the actual date once the item is closed.

DATA ITEM DESCRIPTION

DID-120 – FIP and BIP Disclosure

DID Issue: IR **Date: 2014-01-16**

PURPOSE:

To fully disclosure all FIP and BIP resulting from a Phase 0 contract.

PREPARATION INSTRUCTIONS:

The FIP Disclosure must contain the following information, as a minimum:

1) Introduction including the scope and the purpose;
2) List and description of all FIP resulting from the Phase 0 contract; and
3) List and description of all BIP required by CSA for use of the FIP resulting from the Phase 0 contract.

DATA ITEM DESCRIPTION

DID-400 – Requirements Document

DID Issue: IR **Date: 2014-01-23**

PURPOSE:

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

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

PREPARATION INSTRUCTIONS:

1) Requirements documents shall conform to norms of English usage for Systems Engineering:

   "shall" indicates a mandatory requirement

   "should" indicates a preferred but not mandatory alternative,

   "will" indicates statement of intention or fact

   "may" indicates an option.

2) Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be verifiable on the item as integrated.

3) All requirements shall be documented in the MBSE model and requirements documents expressed from the model *(Optional)*.

4) Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

5) There shall be one set of requirements for each node in the System Hierarchical Tree. Note that interface requirements (which are between two or more nodes) are in separate documents.

6) Requirements shall conform to the following standards for quality:

   a) They shall be unambiguously clear to the intended readership;

   b) There shall be one requirement per paragraph;

   c) Each requirement shall have a unique identifier (e.g. an ID number or paragraph number);

   d) They shall not define design solutions;

   e) They shall define their source and/or rationale

   f) They shall be verifiable, preferably by test;

g) They shall specify the conditions under which they apply; and

h) Performance requirements shall be quantified.

7) The Requirements Document shall comprise a number of sections, each defining a specific set of requirements. The document shall address all of the following categories of requirements, as applicable to the project:

1.1. Functional and performance requirements (see item 8) below);

a) External interface requirements (unless done in a separate document);

b) Resource allocation requirements,

c) Design requirements;

d) Construction requirements (see item 9) below);

e) Environmental requirements (see item 10) below),

f) Qualification and/or verification requirements;

g) Safety requirements

h) System environmental requirements associated with:

v) Storage, packaging and handling environment

vi) External stowage requirements, if any;

vii) Ground operations environment

viii) Integration to launch vehicle environment (for flight payload only)

ix) Launch environment (for flight payload only)

x) On-orbit environment (for flight payload only)

i) Operational requirements, if any;

j) Ground Support Equipment requirements, if any (unless done in a separate document); and

k) Other applicable requirements types.

8) Functional and performance requirements shall include, as applicable to the project:

a) Functional and performance requirements imposed on the system by the scientific needs (flow down from MRD);

b) Operating modes requirements;

c) Power requirements including:

i) Power consumption,

ii) Power transients,

iii) Voltage requirements;

d) Telemetry and Telecommand requirements;

e) Software requirements;

f) Other applicable requirements.

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

DATA ITEM DESCRIPTION

DID-500 – Interface Requirements Documents (IRD)

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

Interface Requirements Documents (IRD) define requirements on each of the two or more nodes sharing an interface to ensure that when connected physically or virtually they are compatible and together achieve their combined functions. The IRD serves as the parent for the Interface Control Document.

PREPARATION INSTRUCTIONS:

Interface requirements typically cover the following interface characteristics:

1) Electrical: power supply levels and consumption, digital and analogue signals, EMC;
2) Mechanical: loads, attachment locations, attachment methods, volume constraints;
3) Thermal transmission: heat loads and lifts, radiative properties, especially for enclosures;
4) Data: data to be passed and standards;
5) Synchronization: timing and delay requirements;
6) Optics: properties of optical rays transmitted between subsystems, e.g. focal length, focal point, aberrations of a telescopically focused image.

Some environmental requirements (e.g. transmitted mechanical vibration levels) can logically be placed into a Requirements Document or an IRD, it being the author's choice.

The following requirements apply to all interface requirements documents.

All requirements applicable at the interface between the subject items shall be documented. This should cover the standard items listed above.

Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be testable on the item as integrated.

Requirements shall conform to the following standards for quality:

7) They shall be unambiguously clear to the intended readership;
8) There shall be one requirement per paragraph;
9) Each requirement shall have a unique identifier (e.g. An ID number or paragraph number);
10) They shall not define design solutions;
11) They shall define their source and/or rationale;

12) They shall be verifiable, preferably via a direct measurement;

13) They shall specify the conditions under which they apply; and

14) Performance requirements shall be quantified.

Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

Following are examples of IRDs that may be required, depending on the nature of the project:

15) Spacecraft-to-Launch Vehicle IRD

16) Spacecraft-to-Ground Segment IRD

17) Spacecraft Internal IRD (e.g. between Bus and Payloads)

18) Ground Segment Internal IRD

DATA ITEM DESCRIPTION

DID-529 – Long Lead Items List

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To identify hardware and software items with long procurement schedules. It supports cash flow planning by the Government.

PREPARATION INSTRUCTIONS:

The Long Lead Items List shall identify, as a minimum:

- All long lead items;
- The time frame, relative to the project schedule, when these items need to be ordered or fabricated; and
- The estimated cost of all identified items.

DATA ITEM DESCRIPTION

DID-532 – System Traceability Matrix

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To show how the system requirements flow into subsystem, sub-sub-system, unit, and SCD requirements.

PREPARATION INSTRUCTIONS:

The Traceability Matrix shall, as a minimum:

1) Contain all requirements in the project, down to Source Control Documents requirements;
2) Show how requirements are allocated to subsystems, and how they are decomposed and derived before application to subsystems; and
3) Point to analysis or budgeting documents as sources of requirements based on derivation and decomposition; the analysis is a step in between the parent requirement and the derived child requirement.

DATA ITEM DESCRIPTION

DID-629 – Design Trade-off Study

DID Issue: IR **Date: 2014-01-30**

PURPOSE:

To document studies performed to make design decisions.

PREPARATION INSTRUCTIONS:

The Design Trade-off Study may be used for decisions related to architecture, functionality, design, production, etc. The Design Trade-off Study may be prepared in the Contractor's format, and shall, as a minimum, contain the following information:

1) Purpose of the study;
2) Cases considered;
3) Criteria definitions;
4) Analysis description;
5) Analysis results;
6) Decisions.

DATA ITEM DESCRIPTION

DID-826 – Mission / Science Operations Plan

DID Issue: IR **Date: 2014-02-24**

PURPOSE:

To define the mission / science activities to be performed throughout the mission life cycle.

PREPARATION INSTRUCTIONS:

NOTE: This plan is initiated during Phase 0 and completed in Phase A. It eventually may be considered as a preliminary sub-plan to the Routine Operations Plan, which developed much later, during Phase C.

The Mission / Science Operations Plan shall contain the following information, as a minimum:

1) PI/Science Team structure, composition, roles, shift schedules, and management approach;
2) A demonstration that the Mission / Science Operations Plan responds to the operations requirements and is in line with the Concept of Operations (ConOps);
3) Characterized external interface requirements;
4) Rules for priority and decision-making during critical events and situations;
5) Preliminary communication and reporting protocols;
6) Preliminary sequence of operational activities and identification of corresponding procedures;
7) Preliminary overall schedule;
8) Required resources and initial conditions, particularly ground reception facilities and the Operations Center;
9) Preliminary anomaly detection, resolution and correction procedures; and
10) Preliminary contingency scenarios and possible recovery actions.

CSA-A-CCP-SOW-0003

Canadian Space Agency

ANNEX A

Spatial Heterodyne Observations of Water (SHOW) on the Aerosols – Clouds, Convection, Precipitation (A-CCP) satellite mission

Phase 0 Statement of Work (SOW)

Date: October 2020

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1 INTRODUCTION

1.1 BACKGROUND

NASA's Earth Science Division is pursuing measurement of the five highest priority targeted Earth observables identified by the National Academies of Sciences, Engineering, and Medicine in the report entitled "Thriving on Our Changing Planet: A Decadal Survey for Earth Observations from Space" [RD-1]. In late 2018 NASA began a three year multi-center study of two of the priority designated observables—Aerosols and Cloud-Convection-Precipitation (A-CCP)—to leverage the advantages of a single synergistic observing system. This pre-formulation study [RD-2] for an observing system that includes space-based instruments and sub-orbital instruments will conclude in late 2021. It will be followed by a Mission Concept Review in summer 2022, and initiation of the mission in autumn 2022.

In December 2018, NASA invited the Canadian Space Agency to participate in a workshop concerning the A-CCP pre-formulation study. The CSA extended this invitation to scientists from Environment and Climate Change Canada (ECCC) and to scientists with relevant expertise from Canadian universities. The Canadian delegation to this workshop made a presentation about potential Canadian contributions to the mission [RD-3]. This was followed up by submission of technical information about potential Canadian instrument contributions to the A-CCP mission. These are:

- Aerosol Limb Imager (ALI): a hyperspectral limb imager covering the visible and near infrared spectral range. The instrument is also capable of resolving linear polarization of the input limb radiance. The instrument is optimized for high spatial resolution stratospheric aerosol, volcanic plume and thin cirrus cloud measurements. It is designed to provide spectrally resolved aerosol extinction and particle size parameters with high vertical resolution and cross-track coverage.
- Spatial Heterodyne Observations of Water (SHOW) is an imaging spectrometer for dense profiling of water vapour above clouds. SHOW is designed to vertically resolved atmospheric profiles of water vapour by measuring limb scattered sunlight. The instrument utilizes an interferometric technique known as Spatial Heterodyne Spectroscopy (SHS), where the spectral range is limited to a narrow vibrational absorption band of water vapour in the near infrared.
- Thin Ice Clouds in Far-InfraRed Experiment (TICFIRE) is a nadir viewing imaging radiometer providing co-registration of cloud image data in thermal and far infrared spectral bands. The primary data product is spectral radiance for science and potential assimilation in operational forecasting systems. The observations allow for improved measurement accuracy of the effective cloud particle size along with optical depth, cloud top altitudes, and temperature. The observations also allow estimation of low concentration atmospheric water vapour in cold regions, near the tropopause, and at high latitudes near the ground, improving the measurement accuracy of traditional thermal infrared observations.

Initial NASA assessments have indicated that the Canadian instruments ALI, SHOW and TICFIRE will enhance baseline observations and may be accommodated on A-CCP spacecraft.

In June 2019, following the Pasadena workshop, NASA formally invited the CSA and collaborating organizations (ECCC, Universities): 1) to investigate potential partnership in the A-CCP observing system through contribution of the three Canadian space-based instruments and

a key radar subsystem, and, 2) to participate in the A-CCP Study Team in order to help identify the best A-CCP architectures (satellite, sub-orbital and instrument configurations) for eventual implementation as an Earth Science mission. As part of this study, inclusion of the Canadian instruments on NASA spacecraft is being assessed by NASA from technical, scientific, and cost perspectives. Simulations of measurements to be made by the Canadian instruments will be generated for A-CCP candidate satellite architectures in order to assess the science value of the Canadian instruments with respect to the A-CCP Science and Applications Traceability Matrix (SATM) [RD-4], and with respect to the other instruments from NASA and international partners.

CSA governance approval to proceed with the Options Analysis phase for the A-CCP Earth Science Mission was granted in July 2019. This decision took into consideration letters of support from CSA's Atmospheric Science Advisory Committee (ASAC), Environment and Climate Change Canada (ECCC), and the participating university scientists. Subsequently, CSA has:

- Issued contracts for the preparation of the User and Science Requirements (URD) for the three instruments;
- Successfully nominated three ECCC, one National Research Council (NRC), and four university scientists to A CCP study teams: Science and Applications Leadership Team (SALT), Science Impact Team (SIT), Applications Impact Team (AIT), Science Community Committee (SCC), and Sub-Orbital Working Group.
- Issued an RFP for Modelling, Simulations and Scientific Analyses for the A-CCP study.

With this RFP, the CSA will undertake work by Canadian industry to carefully examine the current instrument concepts, the instrument user and science requirements established by the Canadian science team, the mission constraints imposed by NASA, and technology and design options in order to identify the optimal instrument concept, estimate costs and chart the path to technology readiness.

1.2 CHALLENGES AND PURPOSE

SHOW was demonstrated on stratospheric balloon and high altitude NASA ER2 airplane flights. Operating in a limb-viewing configuration, high spatial and spectral water vapour profiles in the upper troposphere and lower stratosphere were successfully retrieved.
The main technical challenge of this Phase 0 project is re-optimization and updating of the instrument design for the satellite platform, especially in the ACCP mission context including synergy with other potential Canadian instruments: nadir looking TICFIRE and limb looking ALI.
The center piece of SHOW is a Spatial Heterodyne Spectrometer which is composed of beamsplitters, field widening prisms and gratings. A highly integrated (''monolithic'') design was successfully implemented in the past (around 2010) and needs to be re-examined, re-optimized and to have clearly identified fabrication method and suppliers. As an example, a known issue is BK7 glass darkening .

The main purposes of this contractual work are:

1. Derive instrument requirements from the users and science requirement document (URD), the A-CCP mission constraints and spacecraft interface requirements;
2. Identify and investigate the instrument concepts having a strong potential to meet the challenges and make the required measurements of low temperature targets in the non-

traditional far infrared spectral bands. Assess technological feasibility and risks of each of these concepts;

3. Identify the optimal instrument concept, demonstrate that it will be capable of meeting all the necessary requirements and that it can achieve Technology Readiness Level 6 by no later than April 2024;
4. Demonstrate the technical feasibility of implementing the selected instrument concept and delivering the qualified flight instrument by April 2028;
5. Establish a cost estimate for design, test, qualification and delivery of the instrument. Support the cost estimate with a detailed basis of estimation.

The vendor performing the work shall be hereinafter referred to as the 'Contractor'. The contractor's team, made up of persons employed by the contractor as well as persons working under sub-contracts, must include Canadian companies whose technologies and expertise will be used to realize the contract objectives.

In this document, the Canadian Space Agency is also referred to as 'CSA' or the 'Agency' and is the Customer. The Contractor will report directly to CSA.

1.3 SCOPE

This Statement of Work (SOW) defines the scope of the tasks for the Bidder to develop an optimized concept for the Spatial Heterodyne Observations of Water (SHOW) instrument and to perform related work described in section 1.2 above and elaborated in the rest of this SOW.

1.4 DOCUMENT CONVENTIONS

The following verbs, as used in this document, have specific meaning as indicated below:

- "shall" indicates a mandatory requirement.
- "should" indicates a preferred but not mandatory alternative.
- "may" indicates an option.
- "will" indicates a statement of intention or fact.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS DESCRIPTION

The following documents at the issue and revision level specified in Table 2-1 are applicable and form an integral part of this document to the extent specified herein. They can be obtained from the following File Transfer Protocol (FTP) link:

ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/

TABLE 2-1 APPLICABLE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
AD-1	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard	Rev. A	7 November 2008
AD-2	CSA-ST-GDL-0001	CSA Technology Readiness Levels and Assessment Guidelines	Rev. D	29 March 2019
AD-3	CSA-ST-FORM-0003	CTE Identification Workbook	Rev. B	March 2019
AD-4	CSA-SE-STD-0002	CSA Systems Engineering Contract Data Requirements List (CDRL) Compendium	Initial Release	23 June 2009

2.2 REFERENCE DOCUMENTS DESCRIPTION

The following documents provide additional information or guidelines that may clarify the contents of the SOW.

TABLE 2-2 REFERENCE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
RD-1	N/A	US Decadal Strategy for Earth Observation, http://nap.edu/24938	N/A	January 2018
RD-2	N/A	A-CCP Study Plan https://earth.gsfc.nasa.gov/missions/accp/links	N/A	4 December 2018
RD-3	N/A	Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	N/A	April 04 2019

RD-4	N/A	A-CCP mission level Science and Applications Traceability Matrix. https://earth.gsfc.nasa.gov/missions/accp/links	SATM-F	30 April 2020
RD-5		—Not used as a reference in this SOW—		
RD-6	ABBCABO M-00654	SHOW, Spatial Heterodyne Observations of Water Instrument, FINAL CONCEPT DOCUMENT (to be provided upon completion of the Non-Disclosure Agreement in Appendix C of this SOW)	C	March 2013
RD-7	N/A	**S**patial **H**eterodyne **O**bservations of **W**ater User Requirements Document (for A-CCP) ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	Version 1.1	22 July 2020
RD-8	N/A	Mission constraints and interface requirements as communicated by the NASA A-CCP Study Team.	N/A	October 2020 to June 2021
RD-9	N/A	A-CCP Quarterly Forum Presentations, Architecture Briefings and Schedule Updates. https://earth.gsfc.nasa.gov/missions/accp/links	N/A	2019-2021
RD-10		Guidelines on Costing (Treasury Board) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32600	N/A	2019
RD-11	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6th Ed.	2017
RD-12	ANSI/AIA A G-043	Guide for the Preparation of Operational Concept Documents	Rev. B	2018

3 WORK DESCRIPTION

This section describes the work that is required to complete the study. Many of the tasks require collaboration with the SHOW Science Team (Canadian universities and ECCC). Some of the tasks require collaboration with the NASA A-CCP Study Team.

3.1 TASKS

The main Tasks of this work, as well as related Applicable & Reference Documents and Deliverable Documents are listed in Table 3-1.

TABLE 3-1 TASKS, APPLICABLE & REFERENCE DOCUMENTS, DELIVERABLES

Tasks	Description	AD/RD	CDRL
T1.	Review of the A-CCP mission study and the A-CCP mission development timeline.	RD-1 RD-2 RD-9	
T2.	Review of the SHOW instrument concept (from 2013).	RD-6	
T3.	Review of the user requirements stated in the A-CCP SHOW URD (2020), and as derived from the SATM.	RD-7 RD-4	
T4.	Review of mission constraints and interface requirements as communicated by the NASA A-CCP Study Team, as they become available.	RD-8	
T5.	Conversion of user requirements, mission constraints and interface requirements into Instrument Concept Design Requirements.		EN0
T6.	Analysis of the user requirements, A-CCP mission constraints and interface requirements and flow down of the instrument requirements for worst case observation conditions.		EN1
T7.	Investigation of available technology capabilities for components that are critical to development of an optimal instrument concept.		MD0
T8.	Identification of suppliers of key technologies for which there may be few suppliers globally. Determination of lead times for procurement of the key technologies, as suggested by the suppliers.		EN6
T9.	Assessment of design options and their impacts on instrument performance, mass, volume, power, and interface to spacecraft.		MD0 EN3
T10.	Development of an optimal concept that meets user requirements, satisfies NASA mission constraints, and makes best use of Canadian technologies and expertise in space-based infrared remote sensing instrument design and manufacture.		EN3

T11.	Development of Instrument Requirements Specifications and Preliminary Interface Requirements for the recommended optimal baseline instrument concept. Demonstrate traceability to RD4, RD7 and RD8.		EN1 EN2 EN5
T12.	Development of the instrument concept of science operations, in consultation with the instrument science team (Canadian universities and ECCC) and with the NASA A-CCP Study Team.		OP0
T13.	Development of the Technology Readiness and Risk Assessment for the optimal instrument concept (including path to TRL 6 by April 2024).	AD-3 AD-4	MD1 MD2
T14.	Development of Mission Risk Assessment.		MD4
T15.	Development of a cost estimate (or range of possible costs) for the instrument to be designed, developed, qualified and characterized for Phases A through D (including support for AI&T, launch and commissioning).		MD3
T16.	Support to NASA for any technical questions that may arise during the contract period.		EN4
T17.	Describe Background Intellectual Property and Foreground Intellectual Property		MD5

3.2 DETAILED R&D AND ENGINEERING ACTIVITIES

The Contractor is expected to derive the instrument requirements for SHOW, develop an optimal instrument concept, and to prepare an implementation plan as well as cost estimates for Phases A through D (including support for AI&T, launch and commissioning).

The following list of R&D activities refers to Table 3.1 Tasks. It provides more detail about the work to be accomplished by the Contractor, which shall include, but is not limited to:

1. Analyze users requirements, A-CCP mission constraints and interface requirements and flow down the instrument requirements for worst case observation conditions (T1 to T6).
2. In support of the instrument concept assessments, investigate characteristics and in-orbit degradation of prospective optical components (T7 and T8).
3. Identify and investigate detailed instrument concept having a strong potential to meet the requirements. Complete the Technology Trade-off Study. Prepare the Design Trade-off Study Report (T9). At a minimum, the factors to be considered in the trade-off analyses shall include:
    - Optical design options
    - Optics performance (resolution, interferograms quality, aliasing effects, etc.)
    - Detector characteristics

- Thermo-elastic effects
- Effects of spacecraft pointing stability on vertical resolution
- First order estimates of engineering budgets
- Calibration methodology

4. Prepare the Instrument Requirements Specifications for the optimal baseline instrument concept. Demonstrate traceability to RD4, RD6 and RD7. Demonstrate that the selected instrument conceptual design shall meet all performance requirements. The selected instrument conceptual design shall include design margins for the instrument and major sub-systems of 50% for new designs, 30% for iterative designs, and 10% for existing designs. Prepare Preliminary Interface Requirements Document (IRD) for the recommended optimal baseline instrument concept (T10 and T11). Establish the specifications for the selected instrument concept by:
    - Performing opto and optomechanical designs and analyses
    - Refining the required detector performance characteristics;
    - In collaboration with the SHOW Science Team, defining the instrument operation concept;
    - Defining the internal and external interface requirements;
    - Defining the environmental requirements;
    - Performing the preliminary evaluation of instrument engineering budgets: mass, volume, power, data (with and without onboard data processing).
5. Devise the instrument Assembly, Integration and Test (AIT) approach and demonstrate the feasibility of delivering the qualified flight instrument by April 2028 (T10 and T11).
6. Prepare instrument science mission concept of operation. Demonstrate that the selected instrument conceptual design has no discrepancies with the instrument concept of operations (T12).
7. Perform a Technology Readiness and Risk Assessment for the optimal baseline conceptual design, and demonstrate that it can achieve Technology Readiness Level 6 by no later than April 2024. Identify the current technology development status of key elements of the instrument and the technology development plan. As much as possible, the development plan should be based on components that are free of ITAR restrictions (T13).
8. Identify and assess SHOW mission risks in meeting A-CCP requirements and time line (T14).
9. Evaluate the cost for the development, qualification, and delivery of the baseline instrument, Phases A through D (including support for AI&T, launch and commissioning). All assumptions used to create the estimate shall be listed. Any options or de-scope options that are included shall be clearly described. An assessment of the sensitivity of the cost to the different users and mission requirements shall be provided (T15).
10. Support NASA for any technical questions that may arise during the contract period in coordination with TA and provide Technical Reports about the work performed (T16).

3.3 MILESTONES, REVIEWS & MEETINGS

The contractor shall plan and perform the work in order to meet the following CSA milestones:

TABLE 3-2 MILESTONES, REVIEWS & MEETINGS

Description	Date
Kick-off Meeting	Contract Award + 2 weeks
Complete investigation and assessment of instrument concepts – initial release MD0, EN3	15 February 2021
Complete the Technology Readiness and Risk Assessment of the optimal baseline instrument concept – initial release MD1, MD2	1 March 2021
Review meeting (Milestone 1)	22 March 2021
Detailed evaluation of performance and engineering budgets for the optimal baseline instrument concept – initial release EN0, EN1, EN2	15 April 2021
Instrument Operation Concept – initial release OP0	31 May 2021
Review meeting (Milestone 2)	15 June 2021
Cost Estimation for Phases A-D – initial release MD3, MD4	30 August 2021
Completion – final versions of all deliverables	15 October 2021
Final Review Meeting	29 October 2021

The location of the meetings will be determined in consultation with the Technical Authority.

The contractor should include a budget for travel costs to the CSA for the Kick-Off Meeting and for the Final Review Meeting.

3.3.1 Kick-off, Progress, Milestone and Final Review Meetings Deliverables

The contractor shall conduct progress review meetings every two weeks.

For the Kick-off meeting the contractor shall produce CDRL PM2.

For each meeting defined in Table 3-2, and for the biweekly progress reviews, the contractor shall produce CDRL PM3, PM4, PM5 and PM6.

For milestone review meetings defined in Table 3-2, the contractor shall produce technical presentation packages as required to support review of the Mission, Engineering and Operations documents, and shall submit these to CSA three days in advance of the meetings.

The purpose of the Instrument (Mission) Requirements Review is to demonstrate the validity of the instrument requirements specifications, to examine the preliminary interface requirements and to ensure project readiness to proceed with the development of system requirements. The Contractor must demonstrate that the Instrument (Mission) Requirements Review entry and exit criteria are met, including the common entry and exit criteria, as per AD-02.

The deliverables for this review will be as per Table A-1.

The contractor shall deliver CDRL PM7 & PM8 to close the contract.

3.3.2 Cost Estimate

The Contractor must provide an indicative Cost Estimate for the science instrument, in accordance with Treasury Board (TB) guidelines (RD-10), as per Table 3-3 Science Instrument Cost Breakdown, for all phases leading to the development, implementation, operation and disposal. Along with the cost estimate, a justification for these costs must be included. The justification must describe the type of analysis (analogous, bottom-up, etc.), as well as the assumptions made (CDRL MD3). Cost estimates must provide sufficient granularity to allow costing estimating of the science instrument for the life cycle of the mission. This estimate is for information purpose and it will not be contractually binding for the Contractor to compete for subsequent phases if any.

TABLE 3-3 TEMPLATE FOR SCIENCE INSTRUMENT COST BREAKDOWN

Category		Phase A	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
	Gov FY (example)	FY20/21	Etc.					
Labour	Management							
	Technology Development							
	Design							
	Documentation							
	Reviews							
	Manufacturing							
	Assembly							
	Testing							
	Product Assurance							
	Science Team Support							
	Ground segment							
	Operations							
	Total Labour							
Non-Labour	Hardware / Software Procurement							
	Science Team Support							
	Tools, Equipment and Facilities							
	Travel and Living							
	Subcontractors							
	EEE Parts, Materials And Qualification Processes							
	Other Direct Charges							
	Total Non-Labour							

	Subtotal							
Risk	Risk Contingency							
Taxes	Applicable Taxes							
Total By Phase								
Total All Phases								

3.4 WORK BREAKDOWN STRUCTURE

The contractor shall propose a work breakdown structure [CDRL PM9] that describes a logical and realistic approach to managing the work. Each work package should:

- provide a brief description of the work to be accomplished,
- identify the person who will lead the work,
- identify the persons who will contribute to the work,
- quantify the number of hours that are allocated for each person contributing to the work,
- identify the start and end dates for the work package,
- identify progress milestones,
- identify deliverables from the work package,
- identify links to other work packages (dependencies).

3.5 SCHEDULE

The contractor shall provide a schedule as part of their technical proposal, describing the sequence and duration of work packages, expected achievements or indicators of progress in performing the work packages, progress review meetings, milestones and deliverables

3.6 ORGANIGRAM

The contractor shall provide an organizational chart showing roles and responsibilities as well as reporting and supervision hierarchy.

3.7 PROJECT MANAGEMENT

3.7.1 Project Planning, Performance and Leadership

The Contractor shall plan and manage the work to be performed under this contract in such a manner as to achieve project performance, scope, quality and schedule requirements of this SOW.

The Contractor shall provide the technical leadership and support necessary to ensure effective and efficient performance of all contract and sub-contract efforts and activities.

The Contractor shall dedicate experienced personnel, and implement sub-contracts as required for services of experts in Canadian industries and universities, in all the disciplines required to carry out the work.

The Contractor shall provide the necessary leadership to effectively manage the collaborations with scientists from ECCC and Canadian universities, as well as with the NASA A-CCP Study Team, in keeping with the project objectives.

3.7.2 Project Management Control

The Contractor shall establish and maintain a close management and technical interface with the Technical Authority (TA) in order to ensure a coordinated program effort that will meet or exceed the project objectives defined in Table 3-1 within budget and personnel availability constraints.

3.7.3 Project Management Reporting

The contractor shall produce monthly progress reports as per CDRL PM1.

3.7.4 Action Item Log

The contractor shall maintain Action Item log according to CDRL PM6.

3.8 INTELLECTUAL PROPERTY

The Contractor must complete the Contractor Disclosure of Intellectual Property CSA (CDRL MD5), identifying the Background Intellectual Property (BIP) and foreground Intellectual Property (FIP) that will be generated in this Phase 0 contract, the owners of the BIP and how it will be managed and coordinated among the various collaborators and entities involved.

4 CONTRACTOR DELIVERABLES

4.1 HARDWARE

No hardware is expected to be deliverable under this contract.

4.2 SOFTWARE

No software is expected to be deliverable under this contract.

4.3 DOCUMENTATION

The Contractor shall deliver all documentation requested in Appendix A.

The Contractor Shall interface with the TA to assure all documents in the CDRL are released and deposited according to CSA CADM instruction (CDRL PM0) or using agreed format and tailored DIDs.

The Contractor may propose to combine documents called by more than one CDRL into one document, but this is subject to prior approval from the CSA. Where this approval is granted, the document cover page must list all the CDRL numbers that are covered by this document.

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

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

Electronic documents must be prepared using the most appropriate tool (Microsoft Word, Excel, MS Project, etc.); released versions must be delivered in electronic format in both native format and pdf format. Schedules must be submitted in Microsoft Project format.

Documents and other data must be delivered via e-mail or direct transfer (FTP). For direct transfer, a notification of the document or data readiness and location on a contractor repository must be sent. In certain occasions, when specified in the Work Package, paper copies may be required.

Electronic documents or notifications of their availability on contractor repositories must be sent to the e-mail address of the CSA Project Manager.

Emails are to contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted. Hard copy and media deliverables are to be addressed to:

- Attention:
  Canadian Space Agency
  6767, Route de l'Aéroport
  Longueuil, QC, J3Y 8Y9
  Canada

At the end of each Work Package, all data, electronic files and documentation created by, or provided to the Contractor for the performance of the Work Package must be returned to CSA.

All simulation scenarios that have been considered (e.g. with STK) must be delivered in CD-ROM or DVD-ROM format.

All documentation must be written in English.

All documents must be provided 10 working days prior to the specified Review/Meeting unless otherwise indicated.

5 GOVERNMENT FURNISHED EQUIPMENT

No government furnished equipment is expected to be deliverable under this internal study. If applicable, any government furnished information must be returned to the Crown at the conclusion of the Contract.

6 ACRONYMS AND ABBREVIATIONS

This list contains the acronyms and abbreviations contained in this document. Those not contained in this list may be categorised as trademark or standard names used in the software industry.

A-CCP	Aerosols – Cloud, Convection, Precipitation
AIT	Applications Impact Team
ALI	Aerosol Limb Imager
AOI	Area of Interest
AR	As Required
ASAC	CSA Atmospheric Science Advisory Committee
BIP	Background Intellectual Property
CDRL	Contract Data Requirements List
CF	Contractor Format
CSA	Canadian Space Agency
DID	Data Item Description
DVD-ROM	Digital Versatile Disk - Read Only Memory
ECCC	Environment and Climate Change Canada
FIP	Foreground Intellectual Property
FOV	Field of View
FTP	File Transfer Protocol
FY	Fiscal Year
IFOV	Instantaneous Field of View
IP	Intellectual Property
IRD	Interface Requirements Document
MTF	Modulation Transfer Function
NASA	National Aeronautics and Space Administration
NRC	National Research Council
PSF	Point Spread Function
RD	Reference Document
RFP	Request for Proposal
SALT	Science and Applications Leadership Team
SATM	Science and Applications Traceability Matrix
SCC	Science Community Committee
SIT	Science Impact Teams
SIT-A	SIT - Aerosols
SIT-C	SIT – Clouds, Convection, Precipitation
SHOW	Spatial Heterodyne Observations of Water

SOW	Statement of Work
STK	Systems Tool Kit
TA	CSA Technical Authority
TBC	To Be Confirmed
TICFIRE	Thin Ice Clouds in Far InfraRed Experiment
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
URD	Users and Science Requirement Document

APPENDICES

A CONTRACT DATA REQUIREMENTS LIST (CDRL)

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

LEGEND:

1) DID No.

- CF = Contractor's format

2) Document Versions:

- D: Draft (under Version Control, expected to be updated – up to 50% complete and correct)
- P:Preliminary (under Version Control, expected to be updated - 70% complete and correct).
- IR: Initial Release (under Configuration Control, may well be revised during normal project life - 95-100% complete & correct).
- U: Update (expected revision, but not final; under Configuration Control, previous versions remain unchanged under Configuration Control).
- F: Final (under Configuration Control, normally not expected to be revised, but could be if necessary - 100% complete and correct).

3) Time Indicator:

- AR = As Required

TABLE A-1 – CDRL

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.0 MISSION DOCUMENTATION							
MD0	Technology Trade-off Studies	3.1	DID-005	15 February 2021	AR	15 October 2021	Approval
MD1	Technologies Development Plan	3.1	DID-006	1 March 2021	-	15 October 2021	Approval
MD2	Technology Readiness Level (TRL) Assessment Report	3.1	DID-004	1 March 2021	-	15 October 2021	Approval
MD3	Life Cycle Cost Analysis	3.2 f	DID-009	30 August 2021	-	15 October 2021	Approval
MD4	Mission Risk Analysis Report	3.2 a	DID-010	30 August 2021	AR	15 October 2021	Approval
MD5	Contractor Disclosure of IP	3.8	DID-120			15 October 2021	Approval
A.1 PROJECT MANAGEMENT							
PM0	General Preparation Instructions	4.3	DID-100	AR	AR	-	Info
PM1	Progress Report	3.8.3	DID-107	AR	Monthly	-	Info
PM2	Kick-Off Meeting Presentation	3.4.1	DID-108	AR	-	-	Info
PM3	Progress Presentation	3.4.1	CF	AR	AR	-	Info
PM4	Meeting Agenda	3.4.1	CF	AR	AR	-	Info
PM5	Minutes of Meetings	3.4.1	CF	AR	AR	-	Info
PM6	Action Items Log (AIL)	3.4.1	DID-112	AR	AR	-	Info
PM7	Phase Closure / Final Report	3.4	CF	15 October 2021	-	-	Info
PM8	Executive Report	3.4	CF	15 October 2021	-	-	Info
PM9	Work Breakdown structure	3.5	DID-102	Kick-off Meeting	-	-	Info

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.2 ENGINEERING							
EN0	Instrument Concept Design Requirements	3.1	CF	15 April 2021	-	15 October 2021	Info
EN1	Instrument Requirements Specification	3.1	DID-400	15 April 2021	-	15 October 2021	Approval
EN2	Interface Requirements Document (IRD)	3.1	DID-500	15 April 2021	-	15 October 2021	Approval
EN3	Design Trade-off Studies	3.1	DID-629	15 February 2021	AR	15 October 2021	Approval
EN4	Technical Report	3.1	CF	AR	AR		Info
EN5	Requirements Traceability Matrix	3.1	DID-532	15 April 2021	-	15 October 2021	Approval
EN6	Long Lead Items List	3.1	DID-529	31 May 2021	-	15 October 2021	Info
A.3 OPERATIONS							
OP0	Mission / Science Operations Plan	3.1	DID-826	31 May 2021	-	15 October 2021	Approval

B DATA ITEMS DESCRIPTIONS (DIDS)

DATA ITEM DESCRIPTION

DID-004 – Technology Readiness Assessment Report

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

Issued periodically to document the execution of the Technology Readiness Assessment process.

PREPARATION INSTRUCTIONS:

The Technology Readiness Assessment (TRA) must be comprised of 2 parts:

1) A Technology Maturity Assessment to determine the technical maturity of each specific technology required, at a specific point in time, namely at the times specified in the CDRL, and
2) A Viability Assessment to determine the approach forward from the already achieved R&D results, including an assessment of:
    a) The Technology R&D Risk, i.e. to develop a clear understanding of the remaining "development hurdles" and the projected uncertainty in the likelihood of development success for novel technologies; and
    b) The R&D Cost and Feasibility, i.e. to determine the relative costs of achieving the next TRL by overcoming the "development hurdles" mentioned above, including challenges in providing a relevant environment and any required special R&D facilities; this step is identified as an "Advancement Degree of Difficulty Assessment" in the NASA Systems Engineering Handbook, Appendix G (NASA/SP-2007-6105 Rev. 1, December 2007).

The TRA must be performed against the hierarchical breakdown of the hardware and software configuration items of the system Product Breakdown Structure to achieve a systematic, overall understanding at the system, subsystem, and component levels and to ensure that the technologies with the lowest TRL are identified.

DATA ITEM DESCRIPTION

DID-005 – Technology Trade-off Studies

DID Issue: IR **Date: 2014-02-17**

PURPOSE:
To compare various available technologies and select the best-suited technology to supporting the selection between design choices so as to optimize the system design.

PREPARATION INSTRUCTIONS:
The Technology Trade-off Studies must ensure that a thorough and comprehensive set of options and alternatives is considered and analyzed for the system design, with consideration for all aspects of the system life cycle and all aspects of system life cycle cost.
The Technology Trade-off Studies shall include the following information as a minimum:

- Function to be filled or performed by the selected technology;
- Minimum or desired performance characteristics or specifications;
- Technical constraints of whatever nature (mass, dimensions, power consumption, etc.);
- Budget constraints;
- Schedule constraints;
- List of all candidate technologies;
- Comparative analyses of all candidate technologies with respect to each performance criteria and constraint;
- Summary of findings;
- Identification of the selected technology;
- Advantages and disadvantages of the selected technology and compromises made to arrive at this selection;
- Copies of, or references to, data used to make the analyses (published specifications, test data, independent analyses, etc.).

DATA ITEM DESCRIPTION

DID-006 – Technologies Development Plan

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

To define and detail all technologies development activities to be performed in the early phases of the mission in order to maximize the chances of success in achieving the mission objectives within cost and schedule constraints.

PREPARATION INSTRUCTIONS:

The Technologies Development Plan must include functional and performance requirements, and a roadmap (mapping TRL to a timeline coordinated with the mission development schedule) for each Critical Technology.

The Technologies Development Plan must be developed in conjunction with the Technology Readiness Assessment Report and the Technology Trade-off Studies.

The Technologies Development Plan shall include the following data, tailored to the specific needs of each project. The Contractor's format is acceptable.

1. SCOPE

This DID establishes the content, format, maintenance, and submittal requirements for the Technologies Development activities. It is applicable to all technologies used in the system.

2. CONTENTS

This plan shall contain the following information, as a minimum:

c) A description of the Contractor's organisation, methods, and control to implement the technologies development work;

d) A description of the technologies development activities to be performed, detailing benefits, constraints, and objectives;

e) A detailed time-correlated sequence of technologies development milestones from contract-start date through to completion of design certification;

f) A description of support equipment, software, facilities, and tooling necessary for the technologies development activities;

g) A description of technologies development and breadboard tests planned at equipment level;

DATA ITEM DESCRIPTION

DID-009 – Life Cycle Cost Analysis (LCCA)

DID Issue: IR **Date: 2014-02-20**

PURPOSE:

To determine the overall cost of designing, building, testing, operating, maintaining and disposing of a space system.

PREPARATION INSTRUCTIONS:

The LCCA shall be structured on the system WBS and shall analyze all the costs attributed to the system during its life cycle. It shall include the following costs:

1) Initial capital costs, including project planning and management, engineering (design and development), manufacturing, testing, integration, launch and commissioning. Ground segment acquisitions and development shall also be included;
2) Operating costs, including operations personnel, consumables, training, simulations, etc.;
3) Maintenance costs if applicable;
4) Risk mitigation allowances;
5) Disposal costs.

DATA ITEM DESCRIPTION

DID-010 – Mission Risk Analysis

DID Issue: IR **Date: 2014-02-21**

PURPOSE:

To assess the likelihood and consequence of each identified risk.

PREPARATION INSTRUCTIONS:

The Mission Risk Analysis shall contain the following information, as a minimum:

Introduction (purpose, scope);

Applicable and Reference Documents;

Project Overview: Shall provide a brief overview of the project and its deliverables while focussing on perceived risk areas;

Risk categories or Risk Breakdown Structure to facilitate risk identification to a consistent level of detail. The following main categories shall be used for the first level of the risk breakdown structure:

Cost – Risks associated with system acquisition or development cost exceeding the budget,

Schedule – Risks associated with achieving designated milestones within the designated time frame,

Technical – Risks associated with the engineering process that may keep the system from meeting its technical specifications or may adversely affect overall system quality and performance, and

Programmatic – Risks associated with programmatic factors such as export control, regulations, changes to the project environment, force majeure, etc.;

Risk identification methodology describing the approach followed for identifying and documenting risks that might affect the mission.

Risks identified: for each identified risk, a statement shall identify the risk cause as well as its consequence using the following wording: *''there is a risk that* _____ (specify cause*) resulting in* _____ (specify consequence)''. Risks shall be grouped by category and identified to one or more specific work packages;

Risk analysis assessing the likelihood and consequence of each identified risk; this should take the form of the usual likelihood vs. consequence matrix.

DATA ITEM DESCRIPTION

DID-100 – General Preparation Instructions

DID Issue: IR **Date: 2013-12-19**

PURPOSE:

This DID specifies:

a) format requirements for the preparation and formatting of deliverable project documentation;

b) document and data delivery methods, notifications and identification requirements;

c) document and data structure requirements;

d) metadata requirements for all document and data submissions.

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

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. PREPARATION

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

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

WXYZ-CDRL-NUM-CIE_ContractNumber_sentYYYY-MM-DD

where:

WXYZ: A 4-8 letter acronym of the project

CDRL-NUM: The CDRL Identifier

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

ContractNumber: For example: _9F028-07-4200-03

_sentYEAR-MONTH-DAY: Date Tracking Number

1.2. ELECTRONIC DOCUMENTS FORMAT

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

1.1.1 Page Numbering

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

1.1.2 Document Numbers

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

1.3. DELIVERY, NOTIFICATIONS AND IDENTIFICATION REQUIREMENTS

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

Documents may be delivered via e-mail or direct transfer (FTP) or on DVD or CD-ROM disk.

1.1.3 E-mailed documents

E-mailed documents must be sent to:

CM_Receipt@space.gc.ca

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

1.1.4 Direct Transferred Documents

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

CM_Receipt@space.gc.ca

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

CSA-CM-ITAR@asc-csa.gc.ca

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

1.1.5 Documents Delivered on DVD or CD-ROM disk

Hard copy and media deliverables are to be addressed to:

CM Library, 6A-100

Attention: CSA XXXX Project

Canadian Space Agency

6767, Route de l'Aéroport

Longueuil, QC, J3Y 8Y9

CANADA

The DVD or CD-ROM label must show the following information:

a) Company Name

b) Document Title

c) Document Number and Revision Status

d) CSA SOW Number

e) CDRL Number and Title

f) Contract Number

2. DOCUMENT STRUCTURE AND CONTENT2.1 OVERALL

Except as otherwise specified, all documents must have the overall structure as follows:

g) Cover/Title Page;

h) Table of Contents;

i) Introduction;

j) Applicable and Reference Documents;

k) Body of Document; and

l) Appendices

2.2 COVER/TITLE PAGE

The title page must contain the following information:

m) Document Number and date: Volume x of y (if multivolume)

n) Rev. indicator / date of Rev.

o) Document Title

p) Project Name

q) Contract No.

r) CDRL Item No. or Nos., if one document responds to more than one CDRL, subject to prior approval from the PA.

s) Prepared for: Canadian Space Agency

t) Prepared by: Contractor name, CAGE Code, address, and phone number

u) Product tree identifier, if applicable

v) © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR].

2.3 TABLE OF CONTENTS

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

2.4 INTRODUCTION

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

w) Project description and background;

x) Identification (number, title) and a brief overview of the system, hardware, or software to which the document applies;

y) Purpose of the document;

z) Scope of the document (what it includes and what it does not include);

aa) Document conventions; and

bb) Roles and responsibilities of the participants and stakeholders.

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

2.5 APPLICABLE AND REFERENCE DOCUMENTS

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

2.6 BODY OF DOCUMENT

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

2.7 APPENDICES

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

3. METADATA ON DELIVERABLES

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

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

Provided by Supplier	Metadata Description	Comments
Yes	CSA Project Identifier	Project Acronym
Yes	Contract Identifier	PWGSC identifier
Yes	Contract Revision Identifier	PWGSC identifier
Optional	Contract Revision Date	
Yes	SOW Identifier	CSA Doc ID
Yes	SOW Revision Identifier	CSA Doc Revision ID
Yes	Document Type	Dwg, Doc, RFD, RFW, ECR, ECN, IP CR, IP CN/CD, QN, etc.
Yes	CDRL Identifier	Per CSA SOW (e.g. EN-006)
Yes	CDRL Sub-category Identifier	If multiple, separate subject documents per CDRL item (e.g. EN-006.03) (can be contractor defined)
Optional	Project WBS identifier	
Optional	SOW paragraph identifier.	
Optional	DID/ DRD Identifier	
Yes	Deliverable submission format	Electronic, Hard copy, On media (CD-ROM, etc.)
Yes	Deliverable Transmittal Identifier	e.g. CADM09-0123. Can also be a notification of delivery identifier
Yes	Deliverable Transmittal Date	
Yes	Originator's Organization Identifier	CAGE code, company name, short name, etc.
Optional	Document Author	
Yes	Deliverable Type	Dwg, Doc, RFD, RFW, ECR, ECN, NCR, Problem Report, IP CR, IP CN/CD, QN, etc.
Yes	Document Type	Specification, Design, Plan, Tech Note, Report, etc.
Yes	Originator's Document Identifier	
When applicable	Originator's Document Volume Identifier	
When applicable	Originator's Document Part Identifier	

Provided by Supplier	Metadata Description	Comments
When applicable	Originator's Document Issue Identifier	When both Issue and Revision are used concurrently to identify released documents
Yes	Originator's Document Revision Identifier	
Yes	Originator's Document Title	
Yes	Document Release Date	
Yes	Document Effective Date	Applicable to document changes, deviations, waivers,
Yes	Document Expiry Date	If applicable
When applicable	Originator's Authorizing ECN Identifier	Class 2 ECN approving document release and submission to customer
Yes	Document Maturity	Draft, Preliminary, Initial Release, Updated Revision, etc.
When applicable	Class	If deliverable is a change, deviation, waiver, etc. to a released item. (Class I, Class II)
Yes	Security Classification of Deliverable	Per Government of Canada definitions for Classified and Protected data (C,S,TS,PA,PB,PC)
Yes	Sensitivity of Document contents	Company Proprietary, Trade Secret, etc.
Yes	ITAR Content Indicator	Yes or No
Yes	Export Controlled Content Indicator	Yes or No
Yes	Affected Document Identifier	If deliverable is a change, deviation, waiver, etc. to a released document/drawing/model. Enables change-to-document, waiver-to-document relationships, etc.
Yes	Affected Document Revision Identifier	As above
Yes	Affected Document Title	As above
Yes	Product Breakdown Structure / Item Hierarchy Identifier	Critical for Item-to-Document Relationship

Provided by Supplier	Metadata Description	Comments
Yes	Associated Project/System Milestone Review	PDR, CDR, etc. When Reviews are at sub-system level, identify accordingly. e.g. Bus PDR
When applicable	Associated System Baseline	If different from Project Milestone
Yes	Filename of Deliverable	Filename and file type (for all representations submitted - .doc, .pdf, etc.). Original, revisable format to be delivered before contract completion.
Yes	Format of Deliverable / Application used to produce	MS WORD 2007, Project Scheduler 9, etc.
When applicable	Filename of Parent Deliverable Bundle	If part of a document Bill of Material
When applicable	Identification of Delivery Media	If physically delivered
When applicable	Originator's Repository Address of deliverable	To identify source location of document

DATA ITEM DESCRIPTION

DID-102 – CWBS and Work Package Descriptions

DID Issue: IR **Date: 2013-12-18**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

The Contractor shall prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. Each WPD shall include, as a minimum:

A unique identifier traceable to the WBS;

A title;

The name of the individual responsible for completion of the work;

The scope of the work package;

The start date and duration;

Required inputs and dependencies;

A description of every activity covered by the WPD including the level of effort and earned value measurement method for each activity, and all non-labour costs;

Assumptions;

Output and work package acceptance criteria;

Issue date;

Version number; and

List of deliverable with delivery milestone.

DATA ITEM DESCRIPTION

DID-107 – Progress Report

DID Issue: IR **Date: 2014-01-10**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

NOTE TO CSA PROJECT MANAGERS: The content required below includes all the information required for a large project. For smaller or Phase 0 or A projects, the CSA Project Manager may elect to tailor these requirements down to a suitable level, however, it is necessary to ensure that enough information is obtained to maintain control of the project.

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

Each progress report shall answer the following three questions:

1) Is the project on schedule?
2) Is the project within budget?
3) Is the project free of any areas of concern in which the assistance or guidance of the CSA may be required?

Each negative response must be supported with an explanation.

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

4) Summary outlook, including technical performance, work performed, schedule and cost status (at CWBS level 2), organization and key personnel changes and areas of concerns;
5) Financial status including actual and forecasted expenditures, by month, as compared to the original monthly planned expenditure profile;
6) *For cost reimbursable contracts:* Cost performance status in tabular form, with the following information provided for each Work Package (WP):
    a) Budgeted Cost of Work Scheduled (BCWS), current and cumulative,
    b) Budgeted Cost of Work Performed (BCWP), current and cumulative,

c) Actual Cost of Work Performed (ACWP), current and cumulative,

d) Cost variance (current and cumulative),

e) Budget at completion (BAC),

f) Estimate at completion (EAC),

g) Cost variance at completion, and

h) Cost Performance Index (CPI);

7) *For fixed price contracts:* Updated milestones payment plan;

8) A detailed integrated project schedule status including:

a) The schedule baseline,

b) Dependencies between activities,

c) Percent of completion for all activities,

d) List of completed milestones,

e) Critical path,

f) 1st level subcontractor's activities having impact on WP delivery date shall be provided, and

g) All other activities having an impact on WP delivery date shall be provided;

9) Schedule variances from the plan, including deviations from schedule and proposed corrective actions for significant variances;

10) Major meetings schedule update;

11) Status of the work in progress, specifically the work performed in the previous calendar period; sufficient sketches, diagrams, photographs, etc. shall be included, if necessary, to describe the progress accomplished;

12) The work projected for the next period, and estimated date of completion of next milestone;

13) Outline of technical and programmatic issues, with solutions recommended;

14) Contractual issues, including changes to activities and costs;

15) Subcontracts events, status and issues;

16) Equipment ordered, received, made and assembled;

17) Description of trips or conferences connected with the Contract during the period of the report;

18) Risk status report including previous issues resolved, status of on-going risks (changes, likelihoods and impacts), and identification of new risks, their likelihood and impact, and proposed mitigation action;

19) Product Assurance reporting:

a) A narrative section describing: significant accomplishments during the reporting period, audits performed, significant problems, recommended solutions, and corrective action status, significant changes in the PA Organization and Program related organizations,

b) Summary tables or updates as applicable:

i) Technical review action items, configuration baseline, non-conformances, failure analysis, audits (internal as well as at the subcontractors and their sub-tiers),

ii) Reliability analysis status,

iii) Inspection and Test Status,

iv) Deviations/Waivers status,

v) List of Class I Non-conformances,

vi) List of Class II Non-conformances,

vii) PA documentation status,

viii) PA Action Item Log,

ix) Contractor problem status, and

x) Status of GIDEP/ESA Alerts,

c) Software assurance highlights:

i) Assurance accomplishments and resulting metrics for activities such as, but not limited to, inspection and test, reviews, Instrument Provider/subcontractor surveys, and audits,

ii) Trends in metrics data (e.g., total number of software problem reports, including the number of problem reports that were opened and closed in that reporting period),

iii) Significant problems or issues that could affect cost, schedule and/or performance, and

iv) Plans for upcoming software assurance activities; and

20) Status of all action items from previous review(s) and meeting(s).

DATA ITEM DESCRIPTION

DID-108 – Kick-off Meeting Presentation

DID Issue: IR **Date: 2014-01-10**

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 shall contain the following information, as a minimum:

Review of major assumptions;

Review of contract deliverables;

Work requirements, WBS status and schedule;

Project's funding and expected cash-flow;

FIP and BIP;

Licensing issues if any;

Presentation to include the required copyrights and IP disclosure;

Other items as deemed appropriate

DATA ITEM DESCRIPTION

DID-112 – Action Items Log (AIL)

DID Issue: IR **Date: 2013-12-19**

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) Description of the action required;
4) Open Date;
5) Source of AI (e.g. PDR meeting, RID, etc.);
6) Originator;
7) Office of Prime Interest (OPI);
8) Person responsible (for taking action);
9) Target/Actual Date of Resolution;
10) Progress update;
11) Rationale for closure;
12) Status (Open or Closed); and
13) Remarks.

The date in column 9) will be the target date as long as the item is open, and the actual date once the item is closed.

DATA ITEM DESCRIPTION

DID-120 – FIP and BIP Disclosure

DID Issue: IR **Date: 2014-01-16**

PURPOSE:

To fully disclosure all FIP and BIP resulting from a Phase 0 contract.

PREPARATION INSTRUCTIONS:

The FIP Disclosure must contain the following information, as a minimum:

1) Introduction including the scope and the purpose;
2) List and description of all FIP resulting from the Phase 0 contract; and
3) List and description of all BIP required by CSA for use of the FIP resulting from the Phase 0 contract.

DATA ITEM DESCRIPTION

DID-400 – Requirements Document

DID Issue: IR **Date: 2014-01-23**

PURPOSE:

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

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

PREPARATION INSTRUCTIONS:

1) Requirements documents shall conform to norms of English usage for Systems Engineering:

   "shall" indicates a mandatory requirement

   "should" indicates a preferred but not mandatory alternative,

   "will" indicates statement of intention or fact

   "may" indicates an option.

2) Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be verifiable on the item as integrated.

3) All requirements shall be documented in the MBSE model and requirements documents expressed from the model *(Optional)*.

4) Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

5) There shall be one set of requirements for each node in the System Hierarchical Tree. Note that interface requirements (which are between two or more nodes) are in separate documents.

6) Requirements shall conform to the following standards for quality:

   a) They shall be unambiguously clear to the intended readership;

   b) There shall be one requirement per paragraph;

   c) Each requirement shall have a unique identifier (e.g. an ID number or paragraph number);

   d) They shall not define design solutions;

   e) They shall define their source and/or rationale

   f) They shall be verifiable, preferably by test;

g) They shall specify the conditions under which they apply; and

h) Performance requirements shall be quantified.

7) The Requirements Document shall comprise a number of sections, each defining a specific set of requirements. The document shall address all of the following categories of requirements, as applicable to the project:

1.1. Functional and performance requirements (see item 8) below);

a) External interface requirements (unless done in a separate document);

b) Resource allocation requirements,

c) Design requirements;

d) Construction requirements (see item 9) below);

e) Environmental requirements (see item 10) below),

f) Qualification and/or verification requirements;

g) Safety requirements

h) System environmental requirements associated with:

v) Storage, packaging and handling environment

vi) External stowage requirements, if any;

vii) Ground operations environment

viii) Integration to launch vehicle environment (for flight payload only)

ix) Launch environment (for flight payload only)

x) On-orbit environment (for flight payload only)

i) Operational requirements, if any;

j) Ground Support Equipment requirements, if any (unless done in a separate document); and

k) Other applicable requirements types.

8) Functional and performance requirements shall include, as applicable to the project:

a) Functional and performance requirements imposed on the system by the scientific needs (flow down from MRD);

b) Operating modes requirements;

c) Power requirements including:

i) Power consumption,

ii) Power transients,

iii) Voltage requirements;

d) Telemetry and Telecommand requirements;

e) Software requirements;

f) Other applicable requirements.

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

DATA ITEM DESCRIPTION

DID-500 – Interface Requirements Documents (IRD)

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

Interface Requirements Documents (IRD) define requirements on each of the two or more nodes sharing an interface to ensure that when connected physically or virtually they are compatible and together achieve their combined functions. The IRD serves as the parent for the Interface Control Document.

PREPARATION INSTRUCTIONS:

Interface requirements typically cover the following interface characteristics:

1) Electrical: power supply levels and consumption, digital and analogue signals, EMC;
2) Mechanical: loads, attachment locations, attachment methods, volume constraints;
3) Thermal transmission: heat loads and lifts, radiative properties, especially for enclosures;
4) Data: data to be passed and standards;
5) Synchronization: timing and delay requirements;
6) Optics: properties of optical rays transmitted between subsystems, e.g. focal length, focal point, aberrations of a telescopically focused image.

Some environmental requirements (e.g. transmitted mechanical vibration levels) can logically be placed into a Requirements Document or an IRD, it being the author's choice.

The following requirements apply to all interface requirements documents.

All requirements applicable at the interface between the subject items shall be documented. This should cover the standard items listed above.

Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be testable on the item as integrated.

Requirements shall conform to the following standards for quality:

7) They shall be unambiguously clear to the intended readership;
8) There shall be one requirement per paragraph;
9) Each requirement shall have a unique identifier (e.g. An ID number or paragraph number);
10) They shall not define design solutions;
11) They shall define their source and/or rationale;

12) They shall be verifiable, preferably via a direct measurement;

13) They shall specify the conditions under which they apply; and

14) Performance requirements shall be quantified.

Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

Following are examples of IRDs that may be required, depending on the nature of the project:

15) Spacecraft-to-Launch Vehicle IRD

16) Spacecraft-to-Ground Segment IRD

17) Spacecraft Internal IRD (e.g. between Bus and Payloads)

18) Ground Segment Internal IRD

DATA ITEM DESCRIPTION

DID-529 – Long Lead Items List

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To identify hardware and software items with long procurement schedules. It supports cash flow planning by the Government.

PREPARATION INSTRUCTIONS:

The Long Lead Items List shall identify, as a minimum:

- All long lead items;
- The time frame, relative to the project schedule, when these items need to be ordered or fabricated; and
- The estimated cost of all identified items.

DATA ITEM DESCRIPTION

DID-532 – System Traceability Matrix

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To show how the system requirements flow into subsystem, sub-sub-system, unit, and SCD requirements.

PREPARATION INSTRUCTIONS:

The Traceability Matrix shall, as a minimum:

1) Contain all requirements in the project, down to Source Control Documents requirements;
2) Show how requirements are allocated to subsystems, and how they are decomposed and derived before application to subsystems; and
3) Point to analysis or budgeting documents as sources of requirements based on derivation and decomposition; the analysis is a step in between the parent requirement and the derived child requirement.

DATA ITEM DESCRIPTION

DID-629 – Design Trade-off Study

DID Issue: IR **Date: 2014-01-30**

PURPOSE:

To document studies performed to make design decisions.

PREPARATION INSTRUCTIONS:

The Design Trade-off Study may be used for decisions related to architecture, functionality, design, production, etc. The Design Trade-off Study may be prepared in the Contractor's format, and shall, as a minimum, contain the following information:

1) Purpose of the study;
2) Cases considered;
3) Criteria definitions;
4) Analysis description;
5) Analysis results;
6) Decisions.

DATA ITEM DESCRIPTION

DID-826 – Mission / Science Operations Plan

DID Issue: IR **Date: 2014-02-24**

PURPOSE:

To define the mission / science activities to be performed throughout the mission life cycle.

PREPARATION INSTRUCTIONS:

NOTE: This plan is initiated during Phase 0 and completed in Phase A. It eventually may be considered as a preliminary sub-plan to the Routine Operations Plan, which developed much later, during Phase C.

The Mission / Science Operations Plan shall contain the following information, as a minimum:

1) PI/Science Team structure, composition, roles, shift schedules, and management approach;
2) A demonstration that the Mission / Science Operations Plan responds to the operations requirements and is in line with the Concept of Operations (ConOps);
3) Characterized external interface requirements;
4) Rules for priority and decision-making during critical events and situations;
5) Preliminary communication and reporting protocols;
6) Preliminary sequence of operational activities and identification of corresponding procedures;
7) Preliminary overall schedule;
8) Required resources and initial conditions, particularly ground reception facilities and the Operations Center;
9) Preliminary anomaly detection, resolution and correction procedures; and
10) Preliminary contingency scenarios and possible recovery actions.

CSA-A-CCP-SOW-0004

Canadian Space Agency

ANNEX A

Thin Ice Clouds in Far-InfraRed Experiment (TICFIRE) on the Aerosols – Clouds, Convection, Precipitation (A-CCP) satellite mission

Phase 0 Statement of Work (SOW)

Date: October 2020

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1 INTRODUCTION

1.1 BACKGROUND

NASA's Earth Science Division is pursuing measurement of the five highest priority targeted Earth observables identified by the National Academies of Sciences, Engineering, and Medicine in the report entitled "Thriving on Our Changing Planet: A Decadal Survey for Earth Observations from Space" [RD-1]. In late 2018 NASA began a three year multi-center study of two of the priority designated observables—Aerosols and Cloud-Convection-Precipitation (A-CCP)—to leverage the advantages of a single synergistic observing system. This pre-formulation study [RD-2] for an observing system that includes space-based instruments and sub-orbital instruments will conclude in late 2021. It will be followed by a Mission Concept Review in summer 2022, and initiation of the mission in autumn 2022.

In December 2018, NASA invited the Canadian Space Agency to participate in a workshop concerning the A-CCP pre-formulation study. The CSA extended this invitation to scientists from Environment and Climate Change Canada (ECCC) and to scientists with relevant expertise from Canadian universities. The Canadian delegation to this workshop made a presentation about potential Canadian contributions to the mission [RD-3]. This was followed up by submission of technical information about potential Canadian instrument contributions to the A-CCP mission. These are:

- Aerosol Limb Imager (ALI): a hyperspectral limb imager covering the visible and near infrared spectral range. The instrument is also capable of resolving linear polarization of the input limb radiance. The instrument is optimized for high spatial resolution stratospheric aerosol, volcanic plume and thin cirrus cloud measurements. It is designed to provide spectrally resolved aerosol extinction and particle size parameters with high vertical resolution and cross-track coverage.
- Spatial Heterodyne Observations of Water (SHOW) is an imaging spectrometer for dense profiling of water vapour above clouds. SHOW is designed to vertically resolved atmospheric profiles of water vapour by measuring limb scattered sunlight. The instrument utilizes an interferometric technique known as Spatial Heterodyne Spectroscopy (SHS), where the spectral range is limited to a narrow vibrational absorption band of water vapour in the near infrared.
- Thin Ice Clouds in Far-InfraRed Experiment (TICFIRE) is a nadir viewing imaging radiometer providing co-registration of cloud image data in thermal and far infrared spectral bands. The primary data product is spectral radiance for science and potential assimilation in operational forecasting systems. The observations allow for improved measurement accuracy of the effective cloud particle size along with optical depth, cloud top altitudes, and temperature. The observations also allow estimation of low concentration atmospheric water vapour in cold regions, near the tropopause, and at high latitudes near the ground, improving the measurement accuracy of traditional thermal infrared observations.

Initial NASA assessments have indicated that the Canadian instruments ALI, SHOW and TICFIRE will enhance baseline observations and may be accommodated on A-CCP spacecraft.

In June 2019, following the Pasadena workshop, NASA formally invited the CSA and collaborating organizations (ECCC, Universities): 1) to investigate potential partnership in the A-CCP observing system through contribution of the three Canadian space-based instruments and

a key radar subsystem, and, 2) to participate in the A-CCP Study Team in order to help identify the best A-CCP architectures (satellite, sub-orbital and instrument configurations) for eventual implementation as an Earth Science mission. As part of this study, inclusion of the Canadian instruments on NASA spacecraft is being assessed by NASA from technical, scientific, and cost perspectives. Simulations of measurements to be made by the Canadian instruments will be generated for A-CCP candidate satellite architectures in order to assess the science value of the Canadian instruments with respect to the A-CCP Science and Applications Traceability Matrix (SATM) [RD-4], and with respect to the other instruments from NASA and international partners.

CSA governance approval to proceed with the Options Analysis phase for the A-CCP Earth Science Mission was granted in July 2019. This decision took into consideration letters of support from CSA's Atmospheric Science Advisory Committee (ASAC), Environment and Climate Change Canada (ECCC), and the participating university scientists. Subsequently, CSA has:

- Issued contracts for the preparation of the User and Science Requirements (URD) for the three instruments;
- Successfully nominated three ECCC, one National Research Council (NRC), and four university scientists to A CCP study teams: Science and Applications Leadership Team (SALT), Science Impact Team (SIT), Applications Impact Team (AIT), Science Community Committee (SCC), and Sub-Orbital Working Group.
- Issued an RFP for Modelling, Simulations and Scientific Analyses for the A-CCP study.

With this RFP, the CSA will undertake work by Canadian industry to carefully examine the current instrument concepts, the instrument user and science requirements established by the Canadian science team, the mission constraints imposed by NASA, and technology and design options in order to identify the optimal instrument concept, estimate costs and chart the path to technology readiness.

1.2 CHALLENGES AND PURPOSE

TICFIRE may be the first cloud imager to make radiometric measurements at wavelengths of up to 100 μm. Extending spectral range of this type of instrument to the far infrared introduces new challenges for the instrument concept development. Compared to conventional thermal infrared remote sensing, considerably less radiance is available to the instrument when observing low temperature clouds in the longer wavelengths. Shifting the measurement wavelength from 10 to 21 μm, for instance, reduces by nearly 75% the differential spectral radiance to be detected from a change of 1°K in 250°K cloud scenes. As a result, the instrument concept must satisfy stringent requirements in system throughput and noise performance. The limited choices of space qualified optical components and detectors for this spectral range, seldom exploited until now, adds to this challenge.

Another aspect to be investigated in the instrument concept development is the radiometric calibration source. If cavity blackbodies are excluded for use because of their size and mass, plate blackbody design and coating will be needed to deliver comparable performance in the spectral range of 4 to 100 μm.

Thermal detectors coated with broadband radiation absorption structures offer a viable solution to extend spectral sensitivity beyond thermal infrared wavelengths. However, the pixel active area of these detectors are usually selected to be much larger than that of traditional infrared detectors to reduce radiometric measurement errors at the longer wavelengths. . The important thermal mass

of the large area pixel and matching absorption structure results in a rather long response time. One direct result of the detector's slow speed is the lower-than-expected apparent radiance due to image smearing as the target is acquired while in motion with respect to the detector. The long response time also forces the choice of longer time scales for signal integration which, in pushbroom scan configuration, augments the size of the projected instantaneous field of view. It is possible to shorten the response time by devising detectors with an increased rate of thermal conduction to the heat sink. However, this is done at the expense of the detector sensitivity.

The main purposes of this contractual work are:

1. Derive instrument requirements from the users and science requirement document (URD), the A-CCP mission constraints and spacecraft interface requirements;
2. Identify and investigate the instrument concepts having a strong potential to meet the challenges and make the required measurements of low temperature targets in the non-traditional far infrared spectral bands. Assess technological feasibility and risks of each of these concepts;
3. Identify the optimal instrument concept, demonstrate that it will be capable of meeting all the necessary requirements and that it can achieve Technology Readiness Level 6 by no later than April 2024;
4. Demonstrate the technical feasibility of implementing the selected instrument concept and delivering the qualified flight instrument by April 2028;
5. Establish a cost estimate for design, test, qualification and delivery of the instrument. Support the cost estimate with a detailed basis of estimation.

The vendor performing the work shall be hereinafter referred to as the 'Contractor'. The contractor's team, made up of persons employed by the contractor as well as persons working under sub-contracts, must include Canadian companies whose technologies (e.g. far infrared detectors, black body calibration systems) and expertise (e.g. thermal infrared remote sensing instrument design) will be used to realize the contract objectives.

In this document, the Canadian Space Agency is also referred to as 'CSA' or the 'Agency' and is the Customer. The Contractor will report directly to CSA.

1.3 SCOPE

This Statement of Work (SOW) defines the scope of the tasks for the Bidder to develop an optimized concept for the Thin Ice Clouds in Far-Infrared Experiment (TICFIRE) instrument and to perform related work described in section 1.2 above and elaborated in the rest of this SOW.

1.4 DOCUMENT CONVENTIONS

The following verbs, as used in this document, have specific meaning as indicated below:

- "shall" indicates a mandatory requirement.
- "should" indicates a preferred but not mandatory alternative.
- "may" indicates an option.
- "will" indicates a statement of intention or fact.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS DESCRIPTION

The following documents at the issue and revision level specified in Table 2-1 are applicable and form an integral part of this document to the extent specified herein. They can be obtained from the following File Transfer Protocol (FTP) link:

ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/

TABLE 2-1 APPLICABLE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
AD-1	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard	Rev. A	7 November 2008
AD-2	CSA-ST-GDL-0001	CSA Technology Readiness Levels and Assessment Guidelines	Rev. D	29 March 2019
AD-3	CSA-ST-FORM-0003	CTE Identification Workbook	Rev. B	March 2019
AD-4	CSA-SE-STD-0002	CSA Systems Engineering Contract Data Requirements List (CDRL) Compendium	Initial Release	23 June 2009

2.2 REFERENCE DOCUMENTS DESCRIPTION

The following documents provide additional information or guidelines that may clarify the contents of the SOW.

TABLE 2-2 REFERENCE DOCUMENTS

RD No.	Document Number	Document Title	Rev. No.	Date
RD-1	N/A	US Decadal Strategy for Earth Observation, http://nap.edu/24938	N/A	January 2018
RD-2	N/A	A-CCP Study Plan https://earth.gsfc.nasa.gov/missions/accp/links	N/A	4 December 2018
RD-3	N/A	Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. Potential for Canadian Contributions to A-CCP, presentation to the A-CCP workshop April 2019. ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	N/A	April 04 2019

RD-4	N/A	A-CCP mission level Science and Applications Traceability Matrix. https://earth.gsfc.nasa.gov/missions/accp/links	SATM-F	30 April 2020
RD-5	CSA-MICRO-RD-0004	Thin Ice Clouds in the Far InfraRed Experiment (TICFIRE) Microsatellite User Requirements Document (to be provided upon completion of the Non-Disclosure Agreement in Appendix C of this SOW)	Draft 3.0	30 April 2015
RD-6	DDD-TCF-M-0001	TICFIRE Microsatellite Mission Study Mission Concept Description (to be provided upon completion of the Non-Disclosure Agreement in Appendix C of this SOW)	P3	June 2015
RD-7	N/A	Thin Ice Clouds in the Far InfraRed Experiment User Requirements Document (for A-CCP) ftp://ftp.asc-csa.gc.ca/users/SESS/pub/A-CCP/	Version 2.1	20 July 2020
RD-8	N/A	Mission constraints and interface requirements as communicated by the NASA A-CCP Study Team.	N/A	October 2020 to June 2021
RD-9	N/A	A-CCP Quarterly Forum Presentations, Architecture Briefings and Schedule Updates. https://earth.gsfc.nasa.gov/missions/accp/links	N/A	2019-2021
RD-10		Guidelines on Costing (Treasury Board) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32600	N/A	2019
RD-11	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6th Ed.	2017
RD-12	ANSI/AIAA G-043	Guide for the Preparation of Operational Concept Documents	Rev. B	2018

3 WORK DESCRIPTION

This section describes the work that is required to complete the study. Many of the tasks require collaboration with the TICFIRE Science Team (Canadian universities and ECCC). Some of the tasks require collaboration with the NASA A-CCP Study Team.

3.1 TASKS

The main Tasks of this work, as well as related Applicable & Reference Documents and Deliverable Documents are listed in Table 3-1.

TABLE 3-1 TASKS, APPLICABLE & REFERENCE DOCUMENTS, DELIVERABLES

Tasks	Description	AD/RD	CDRL
T1.	Review of the A-CCP mission study and the A-CCP mission development timeline.	RD-1 RD-2 RD-9	
T2.	Review of the TICFIRE microsatellite URD and instrument concept (from 2015).	RD-5 RD-6	
T3.	Review of the user requirements stated in the A-CCP TICFIRE URD (2020), and as derived from the SATM.	RD-7 RD-4	
T4.	Review of mission constraints and interface requirements as communicated by the NASA A-CCP Study Team, as they become available.	RD-8	
T5.	Conversion of user requirements, mission constraints and interface requirements into Instrument Concept Design Requirements.		EN0
T6.	Analysis of the user requirements, A-CCP mission constraints and interface requirements and flow down of the instrument requirements for worst case observation conditions.		EN1
T7.	Investigation of available technology capabilities for components that are critical to development of an optimal instrument concept.		MD0
T8.	Identification of suppliers of key technologies for which there may be few suppliers globally. Determination of lead times for procurement of the key technologies, as suggested by the suppliers.		EN6
T9.	Assessment of design options and their impacts on instrument performance, mass, volume, power, and interface to spacecraft.		MD0 EN3
T10.	Development of an optimal concept that meets user requirements, satisfies NASA mission constraints, and makes best use of Canadian technologies and expertise		EN3

	in space-based infrared remote sensing instrument design and manufacture.		
T11.	Development of Instrument Requirements Specifications and Preliminary Interface Requirements for the recommended optimal baseline instrument concept. Demonstrate traceability to RD4, RD7 and RD8.		EN1 EN2 EN5
T12.	Development of the instrument concept of science operations, in consultation with the instrument science team (Canadian universities and ECCC) and with the NASA A-CCP Study Team.		OP0
T13.	Development of the Technology Readiness and Risk Assessment for the optimal instrument concept (including path to TRL 6 by April 2024).	AD-2 AD-3	MD1 MD2
T14.	Development of Mission Risk Assessment.		MD4
T15.	Development of a cost estimate (or range of possible costs) for the instrument to be designed, developed, qualified and characterized for Phases A through D (including support for AI&T, launch and commissioning).		MD3
T16.	Support to NASA for any technical questions that may arise during the contract period.		EN4
T17.	Describe Background Intellectual Property (BIP) and Foreground Intellectual Property		MD5

3.2 DETAILED R&D AND ENGINEERING ACTIVITIES

The Contractor is expected to derive the instrument requirements for TICFIRE, develop an optimal instrument concept, and to prepare an implementation plan as well as cost estimates for Phases A through D (including support for AI&T, launch and commissioning).

The following list of R&D activities refers to Table 3.1 Tasks. It provides more detail about the work to be accomplished by the Contractor, which shall include, but is not limited to:

1. Analyze users requirements, A-CCP mission constraints and interface requirements and flow down the instrument requirements for worst case observation conditions (T1 to T6).
2. In support of the instrument concept assessments, investigate the far infrared characteristics and in-orbit degradation of prospective detectors, detector package windows, interference and mesh filters, lens elements, beam dividers, and radiometric calibration sources (T7 and T8).
3. Identify and investigate the instrument concepts having a strong potential to meet the requirements in non-traditional far infrared spectral bands. Complete the Technology Trade-off Study. Prepare the Design Trade-off Study Report (T9). At a minimum, the factors to be considered in the trade-off analyses shall include:

- Band-to-band data co-registration approach (simultaneous vs temporal co-registration);
- Effects of spacecraft pointing stability and field of view (FOV) alignment and mapping on meeting the co-registration accuracy;
- Optical design options (single band and multi-band refractive optics, on-axis and off-axis reflective optics);
- Spectral separation strategies including in-field spectral separation, low-speed and high-speed temporal band separation, bandpass filter positioning (detector focal plane vs intermediate focus), beam splitting, and allocation of spectral bands per camera;
- Optics performance
- Temporal and spatial data averaging;
- Data dynamic range;
- System throughput;
- Effects of optical and detector point spread function (PSF) on the effective spatial resolution and radiometric accuracy;
- Calibration strategy and calibration frequencies of detector gain and offset coefficients;
- IFOV and area of interest (AOI) coverage;
- First order estimates of engineering budgets

4. Prepare the Instrument Requirements Specifications for the optimal baseline instrument concept. Demonstrate traceability to RD4, RD7 and RD8. Demonstrate that the selected instrument conceptual design shall meet all performance requirements. The selected instrument conceptual design shall include design margins for the instrument and major sub-systems of 50% for new designs, 30% for iterative designs, and 10% for existing designs. Prepare Preliminary Interface Requirements Document (IRD) for the recommended optimal baseline instrument concept (T10 and T11). Establish the specifications for the selected instrument concept by:
    - Refining the performance simulation for the athermal optics; performance metrics shall include spectral transmittance, relative illumination, modulation transfer function (MTF), PSF, and distortion;
    - Refining the required detector performance characteristics;
    - Performing preliminary optomechanical designs;
    - In collaboration with the TICFIRE Science Team, defining the instrument operation concept;
    - Defining the path-to-flight proximity electronics and control electronics for the camera(s), scene viewing selector, and on-board calibration system;
    - Defining the internal and external interface requirements;
    - Defining the environmental requirements;

- Performing the preliminary evaluation of instrument engineering budgets: mass, volume, power, data (with and without onboard data processing).

5. Devise the instrument Assembly, Integration and Test (AIT) approach and demonstrate the feasibility of delivering the qualified flight instrument by April 2028 (T10 and T11).
6. Prepare instrument science mission concept of operation. Demonstrate that the selected instrument conceptual design has no discrepancies with the instrument concept of operations (T12).
7. Perform a Technology Readiness and Risk Assessment for the optimal baseline conceptual design, and demonstrate that it can achieve Technology Readiness Level 6 by no later than April 2024. Identify the current technology development status of key elements of the instrument and the technology development plan. As much as possible, the development plan should be based on components that are free of ITAR restrictions (T13).
8. Identify and assess TICFIRE mission risks in meeting A-CCP requirements and time line (T14).
9. Evaluate the cost for the development, qualification, and delivery of the baseline instrument, Phases A through D (including support for AI&T, launch and commissioning). All assumptions used to create the estimate shall be listed. Any options or de-scope options that are included shall be clearly described. An assessment of the sensitivity of the cost to the different users and mission requirements shall be provided (T15).
10. Support NASA for any technical questions that may arise during the contract period in coordination with TA and provide Technical Reports about the work performed (T16).

3.3 MILESTONES, REVIEWS & MEETINGS

The contractor shall plan and perform the work in order to meet the following CSA milestones:

TABLE 3-2 MILESTONES, REVIEWS & MEETINGS

Description	Date
Kick-off Meeting	Contract Award + 2 weeks
Complete investigation and assessment of instrument concepts – initial release MD0, EN3	15 February 2021
Complete the Technology Readiness and Risk Assessment of the optimal baseline instrument concept – initial release MD1, MD2	1 March 2021
Review meeting (Milestone 1)	22 March 2021
Detailed evaluation of performance and engineering budgets for the optimal baseline instrument concept – initial release EN0, EN1, EN2	15 April 2021
Instrument Operation Concept – initial release OP0	31 May 2021
Review meeting (Milestone 2)	15 June 2021
Cost Estimation for Phases A-D – initial release MD3, MD4	30 August 2021
Completion – final versions of all deliverables	15 October 2021

Final Review Meeting	29 October 2021

The location of the meetings will be determined in consultation with the Technical Authority.

The contractor should include a budget for travel costs to the CSA for the Kick-Off Meeting and for the Final Review Meeting.

3.3.1 Kick-off, Progress, Milestone and Final Review Meetings Deliverables

The contractor shall conduct progress review meetings every two weeks.

For the Kick-off meeting the contractor shall produce CDRL PM2.

For each meeting defined in Table 3-2, and for the biweekly progress reviews, the contractor shall produce CDRL PM3, PM4, PM5 and PM6.

For milestone review meetings defined in Table 3-2, the contractor shall produce technical presentation packages as required to support review of the Mission, Engineering and Operations documents, and shall submit these to CSA three days in advance of the meetings.

The purpose of the Instrument (Mission) Requirements Review is to demonstrate the validity of the instrument requirements specifications, to examine the preliminary interface requirements and to ensure project readiness to proceed with the development of system requirements. The Contractor must demonstrate that the Instrument (Mission) Requirements Review entry and exit criteria are met, including the common entry and exit criteria, as per AD-02.

The deliverables for this review will be as per Table A-1.

The contractor shall deliver CDRL PM7 & PM8 to close the contract.

3.3.2 Cost Estimate

The Contractor must provide an indicative Cost Estimate for the science instrument, in accordance with Treasury Board (TB) guidelines (RD-10), as per Table 3-3 Science Instrument Cost Breakdown, for all phases leading to the development, implementation, operation and disposal. Along with the cost estimate, a justification for these costs must be included. The justification must describe the type of analysis (analogous, bottom-up, etc.), as well as the assumptions made (CDRL MD3). Cost estimates must provide sufficient granularity to allow costing estimating of the science instrument for the life cycle of the mission. This estimate is for information purpose and it will not be contractually binding for the Contractor to compete for subsequent phases if any.

TABLE 3-3 TEMPLATE FOR SCIENCE INSTRUMENT COST BREAKDOWN

Category		Phase A	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
	Gov FY (example)	FY20/21	Etc.					
Labour	Management							
	Technology Development							
	Design							
	Documentation							
	Reviews							

	Manufacturing							
	Assembly							
	Testing							
	Product Assurance							
	Science Team Support							
	Ground segment							
	Operations							
	Total Labour							
Non-Labour	Hardware / Software Procurement							
	Science Team Support							
	Tools, Equipment and Facilities							
	Travel and Living							
	Subcontractors							
	EEE Parts, Materials And Qualification Processes							
	Other Direct Charges							
	Total Non-Labour							
	Subtotal							
Risk	Risk Contingency							
Taxes	Applicable Taxes							
Total By Phase								
Total All Phases								

3.4 WORK BREAKDOWN STRUCTURE

The contractor shall propose a work breakdown structure [CDRL PM9] that describes a logical and realistic approach to managing the work. Each work package should:

- provide a brief description of the work to be accomplished,
- identify the person who will lead the work,
- identify the persons who will contribute to the work,
- quantify the number of hours that are allocated for each person contributing to the work,
- identify the start and end dates for the work package,
- identify progress milestones,
- identify deliverables from the work package,
- identify links to other work packages (dependencies).

3.5 SCHEDULE

The contractor shall provide a schedule as part of their technical proposal, describing the sequence and duration of work packages, expected achievements or indicators of progress in performing the work packages, progress review meetings, milestones and deliverables

3.6 ORGANIGRAM

The contractor shall provide an organizational chart showing roles and responsibilities as well as reporting and supervision hierarchy.

3.7 PROJECT MANAGEMENT

3.7.1 Project Planning, Performance and Leadership

The Contractor shall plan and manage the work to be performed under this contract in such a manner as to achieve project performance, scope, quality and schedule requirements of this SOW.

The Contractor shall provide the technical leadership and support necessary to ensure effective and efficient performance of all contract and sub-contract efforts and activities.

The Contractor shall dedicate experienced personnel, and implement sub-contracts as required for services of experts in Canadian industries and universities, in all the disciplines required to carry out the work.

The Contractor shall provide the necessary leadership to effectively manage the collaborations with scientists from ECCC and Canadian universities, as well as with the NASA A-CCP Study Team, in keeping with the project objectives.

3.7.2 Project Management Control

The Contractor shall establish and maintain a close management and technical interface with the Technical Authority (TA) in order to ensure a coordinated program effort that will meet or exceed the project objectives defined in Table 3-1 within budget and personnel availability constraints.

3.7.3 Project Management Reporting

The contractor shall produce monthly progress reports as per CDRL PM1.

3.7.4 Action Item Log

The contractor shall maintain Action Item log according to CDRL PM6.

3.8 INTELLECTUAL PROPERTY

The Contractor must complete the Contractor Disclosure of Intellectual Property CSA (CDRL MD5), identifying the Background Intellectual Property (BIP) and foreground Intellectual Property (FIP) that will be generated in this Phase 0 contract, the owners of the BIP and how it will be managed and coordinated among the various collaborators and entities involved.

4 CONTRACTOR DELIVERABLES

4.1 HARDWARE

No hardware is expected to be deliverable under this contract.

4.2 SOFTWARE

No software is expected to be deliverable under this contract.

4.3 DOCUMENTATION

The Contractor shall deliver all documentation requested in Appendix A.

The Contractor Shall interface with the TA to assure all documents in the CDRL are released and deposited according to CSA CADM instruction (CDRL PM0) or using agreed format and tailored DIDs.

The Contractor may propose to combine documents called by more than one CDRL into one document, but this is subject to prior approval from the CSA. Where this approval is granted, the document cover page must list all the CDRL numbers that are covered by this document.

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

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

Electronic documents must be prepared using the most appropriate tool (Microsoft Word, Excel, MS Project, etc.); released versions must be delivered in electronic format in both native format and pdf format. Schedules must be submitted in Microsoft Project format.

Documents and other data must be delivered via e-mail or direct transfer (FTP). For direct transfer, a notification of the document or data readiness and location on a contractor repository must be sent. In certain occasions, when specified in the Work Package, paper copies may be required.

Electronic documents or notifications of their availability on contractor repositories must be sent to the e-mail address of the CSA Project Manager.

Emails are to contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted. Hard copy and media deliverables are to be addressed to:

- Attention:
  Canadian Space Agency
  6767, Route de l'Aéroport
  Longueuil, QC, J3Y 8Y9
  Canada

At the end of each Work Package, all data, electronic files and documentation created by, or provided to the Contractor for the performance of the Work Package must be returned to CSA.

All simulation scenarios that have been considered (e.g. with STK) must be delivered in CD-ROM or DVD-ROM format.

All documentation must be written in English.

All documents must be provided 10 working days prior to the specified Review/Meeting unless otherwise indicated.

5 GOVERNMENT FURNISHED EQUIPMENT

No government furnished equipment is expected to be deliverable under this internal study. If applicable, any government furnished information must be returned to the Crown at the conclusion of the Contract.

6 ACRONYMS AND ABBREVIATIONS

This list contains the acronyms and abbreviations contained in this document. Those not contained in this list may be categorised as trademark or standard names used in the software industry.

A-CCP	Aerosols – Cloud, Convection, Precipitation
AIT	Applications Impact Team
ALI	Aerosol Limb Imager
AOI	Area of Interest
AR	As Required
ASAC	CSA Atmospheric Science Advisory Committee
BIP	Background Intellectual Property
CDRL	Contract Data Requirements List
CF	Contractor Format
CSA	Canadian Space Agency
DID	Data Item Description
DVD-ROM	Digital Versatile Disk - Read Only Memory
ECCC	Environment and Climate Change Canada
FIP	Foreground Intellectual Property
FOV	Field of View
FTP	File Transfer Protocol
FY	Fiscal Year
IFOV	Instantaneous Field of View
IP	Intellectual Property
IRD	Interface Requirements Document
MTF	Modulation Transfer Function
NASA	National Aeronautics and Space Administration
NRC	National Research Council
PSF	Point Spread Function
RD	Reference Document
RFP	Request for Proposal
SALT	Science and Applications Leadership Team
SATM	Science and Applications Traceability Matrix
SCC	Science Community Committee
SIT	Science Impact Teams
SIT-A	SIT - Aerosols
SIT-C	SIT – Clouds, Convection, Precipitation
SHOW	Spatial Heterodyne Observations of Water

SOW	Statement of Work
STK	Systems Tool Kit
TA	CSA Technical Authority
TBC	To Be Confirmed
TICFIRE	Thin Ice Clouds in Far InfraRed Experiment
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
URD	Users and Science Requirement Document

APPENDICES

A CONTRACT DATA REQUIREMENTS LIST (CDRL)

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

LEGEND:

1) DID No.

- CF = Contractor's format

2) Document Versions:

- D: Draft (under Version Control, expected to be updated – up to 50% complete and correct)
- P:Preliminary (under Version Control, expected to be updated - 70% complete and correct).
- IR: Initial Release (under Configuration Control, may well be revised during normal project life - 95-100% complete & correct).
- U: Update (expected revision, but not final; under Configuration Control, previous versions remain unchanged under Configuration Control).
- F: Final (under Configuration Control, normally not expected to be revised, but could be if necessary - 100% complete and correct).

3) Time Indicator:

- AR = As Required

TABLE A-1 – CDRL

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.0 MISSION DOCUMENTATION							
MD0	Technology Trade-off Studies	3.1	DID-005	15 February 2021	AR	15 October 2021	Approval
MD1	Technologies Development Plan	3.1	DID-006	1 March 2021	-	15 October 2021	Approval
MD2	Technology Readiness Level (TRL) Assessment Report	3.1	DID-004	1 March 2021	-	15 October 2021	Approval
MD3	Life Cycle Cost Analysis	3.2 f	DID-009	30 August 2021	-	15 October 2021	Approval
MD4	Mission Risk Analysis Report	3.2 a	DID-010	30 August 2021	AR	15 October 2021	Approval
MD5	Contractor Disclosure of IP	3.8	DID-120			15 October 2021	Approval
A.1 PROJECT MANAGEMENT							
PM0	General Preparation Instructions	4.3	DID-100	AR	AR	-	Info
PM1	Progress Report	3.8.3	DID-107	AR	Monthly	-	Info
PM2	Kick-Off Meeting Presentation	3.4.1	DID-108	AR	-	-	Info
PM3	Progress Presentation	3.4.1	CF	AR	AR	-	Info
PM4	Meeting Agenda	3.4.1	CF	AR	AR	-	Info
PM5	Minutes of Meetings	3.4.1	CF	AR	AR	-	Info
PM6	Action Items Log (AIL)	3.4.1	DID-112	AR	AR	-	Info
PM7	Phase Closure / Final Report	3.4	CF	15 October 2021	-	-	Info
PM8	Executive Report	3.4	CF	15 October 2021	-	-	Info
PM9	Work Breakdown structure	3.5	DID-102	Kick-off Meeting	-	-	Info

CDRL No.	Title	SOW Sect. No.	DID No.	Initial Release	Update	Final	Acceptance Category
A.2 ENGINEERING							
EN0	Instrument Concept Design Requirements	3.1	CF	15 April 2021	-	15 October 2021	Info
EN1	Instrument Requirements Specification	3.1	DID-400	15 April 2021	-	15 October 2021	Approval
EN2	Interface Requirements Document (IRD)	3.1	DID-500	15 April 2021	-	15 October 2021	Approval
EN3	Design Trade-off Studies	3.1	DID-629	15 February 2021	AR	15 October 2021	Approval
EN4	Technical Report	3.1	CF	AR	AR		Info
EN5	Requirements Traceability Matrix	3.1	DID-532	15 April 2021	-	15 October 2021	Approval
EN6	Long Lead Items List	3.1	DID-529	31 May 2021	-	15 October 2021	Info
A.3 OPERATIONS							
OP0	Mission / Science Operations Plan	3.1	DID-826	31 May 2021	-	15 October 2021	Approval

B DATA ITEMS DESCRIPTIONS (DIDS)

DATA ITEM DESCRIPTION

DID-004 – Technology Readiness Assessment Report

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

Issued periodically to document the execution of the Technology Readiness Assessment process.

PREPARATION INSTRUCTIONS:

The Technology Readiness Assessment (TRA) must be comprised of 2 parts:

1) A Technology Maturity Assessment to determine the technical maturity of each specific technology required, at a specific point in time, namely at the times specified in the CDRL, and
2) A Viability Assessment to determine the approach forward from the already achieved R&D results, including an assessment of:
    a) The Technology R&D Risk, i.e. to develop a clear understanding of the remaining "development hurdles" and the projected uncertainty in the likelihood of development success for novel technologies; and
    b) The R&D Cost and Feasibility, i.e. to determine the relative costs of achieving the next TRL by overcoming the "development hurdles" mentioned above, including challenges in providing a relevant environment and any required special R&D facilities; this step is identified as an "Advancement Degree of Difficulty Assessment" in the NASA Systems Engineering Handbook, Appendix G (NASA/SP-2007-6105 Rev. 1, December 2007).

The TRA must be performed against the hierarchical breakdown of the hardware and software configuration items of the system Product Breakdown Structure to achieve a systematic, overall understanding at the system, subsystem, and component levels and to ensure that the technologies with the lowest TRL are identified.

DATA ITEM DESCRIPTION

DID-005 – Technology Trade-off Studies

DID Issue: IR **Date: 2014-02-17**

PURPOSE:
To compare various available technologies and select the best-suited technology to supporting the selection between design choices so as to optimize the system design.

PREPARATION INSTRUCTIONS:
The Technology Trade-off Studies must ensure that a thorough and comprehensive set of options and alternatives is considered and analyzed for the system design, with consideration for all aspects of the system life cycle and all aspects of system life cycle cost.
The Technology Trade-off Studies shall include the following information as a minimum:

- Function to be filled or performed by the selected technology;
- Minimum or desired performance characteristics or specifications;
- Technical constraints of whatever nature (mass, dimensions, power consumption, etc.);
- Budget constraints;
- Schedule constraints;
- List of all candidate technologies;
- Comparative analyses of all candidate technologies with respect to each performance criteria and constraint;
- Summary of findings;
- Identification of the selected technology;
- Advantages and disadvantages of the selected technology and compromises made to arrive at this selection;
- Copies of, or references to, data used to make the analyses (published specifications, test data, independent analyses, etc.).

DATA ITEM DESCRIPTION

DID-006 – Technologies Development Plan

DID Issue: IR **Date: 2014-02-17**

PURPOSE:

To define and detail all technologies development activities to be performed in the early phases of the mission in order to maximize the chances of success in achieving the mission objectives within cost and schedule constraints.

PREPARATION INSTRUCTIONS:

The Technologies Development Plan must include functional and performance requirements, and a roadmap (mapping TRL to a timeline coordinated with the mission development schedule) for each Critical Technology.

The Technologies Development Plan must be developed in conjunction with the Technology Readiness Assessment Report and the Technology Trade-off Studies.

The Technologies Development Plan shall include the following data, tailored to the specific needs of each project. The Contractor's format is acceptable.

1. SCOPE

This DID establishes the content, format, maintenance, and submittal requirements for the Technologies Development activities. It is applicable to all technologies used in the system.

2. CONTENTS

This plan shall contain the following information, as a minimum:

c) A description of the Contractor's organisation, methods, and control to implement the technologies development work;

d) A description of the technologies development activities to be performed, detailing benefits, constraints, and objectives;

e) A detailed time-correlated sequence of technologies development milestones from contract-start date through to completion of design certification;

f) A description of support equipment, software, facilities, and tooling necessary for the technologies development activities;

g) A description of technologies development and breadboard tests planned at equipment level;

DATA ITEM DESCRIPTION

DID-009 – Life Cycle Cost Analysis (LCCA)

DID Issue: IR **Date: 2014-02-20**

PURPOSE:

To determine the overall cost of designing, building, testing, operating, maintaining and disposing of a space system.

PREPARATION INSTRUCTIONS:

The LCCA shall be structured on the system WBS and shall analyze all the costs attributed to the system during its life cycle. It shall include the following costs:

1) Initial capital costs, including project planning and management, engineering (design and development), manufacturing, testing, integration, launch and commissioning. Ground segment acquisitions and development shall also be included;
2) Operating costs, including operations personnel, consumables, training, simulations, etc.;
3) Maintenance costs if applicable;
4) Risk mitigation allowances;
5) Disposal costs.

DATA ITEM DESCRIPTION

DID-010 – Mission Risk Analysis

DID Issue: IR **Date: 2014-02-21**

PURPOSE:

To assess the likelihood and consequence of each identified risk.

PREPARATION INSTRUCTIONS:

The Mission Risk Analysis shall contain the following information, as a minimum:

Introduction (purpose, scope);

Applicable and Reference Documents;

Project Overview: Shall provide a brief overview of the project and its deliverables while focussing on perceived risk areas;

Risk categories or Risk Breakdown Structure to facilitate risk identification to a consistent level of detail. The following main categories shall be used for the first level of the risk breakdown structure:

Cost – Risks associated with system acquisition or development cost exceeding the budget,

Schedule – Risks associated with achieving designated milestones within the designated time frame,

Technical – Risks associated with the engineering process that may keep the system from meeting its technical specifications or may adversely affect overall system quality and performance, and

Programmatic – Risks associated with programmatic factors such as export control, regulations, changes to the project environment, force majeure, etc.;

Risk identification methodology describing the approach followed for identifying and documenting risks that might affect the mission.

Risks identified: for each identified risk, a statement shall identify the risk cause as well as its consequence using the following wording: *''there is a risk that* _____ (specify cause*) resulting in* _____ (specify consequence)''. Risks shall be grouped by category and identified to one or more specific work packages;

Risk analysis assessing the likelihood and consequence of each identified risk; this should take the form of the usual likelihood vs. consequence matrix.

DATA ITEM DESCRIPTION

DID-100 – General Preparation Instructions

DID Issue: IR **Date: 2013-12-19**

PURPOSE:

This DID specifies:

a) format requirements for the preparation and formatting of deliverable project documentation;

b) document and data delivery methods, notifications and identification requirements;

c) document and data structure requirements;

d) metadata requirements for all document and data submissions.

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

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. PREPARATION

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

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

WXYZ-CDRL-NUM-CIE_ContractNumber_sentYYYY-MM-DD

where:

WXYZ: A 4-8 letter acronym of the project

CDRL-NUM: The CDRL Identifier

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

ContractNumber: For example: _9F028-07-4200-03

_sentYEAR-MONTH-DAY: Date Tracking Number

1.2. ELECTRONIC DOCUMENTS FORMAT

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

1.1.1 Page Numbering

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

1.1.2 Document Numbers

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

1.3. DELIVERY, NOTIFICATIONS AND IDENTIFICATION REQUIREMENTS

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

Documents may be delivered via e-mail or direct transfer (FTP) or on DVD or CD-ROM disk.

1.1.3 E-mailed documents

E-mailed documents must be sent to:

CM_Receipt@space.gc.ca

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

1.1.4 Direct Transferred Documents

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

CM_Receipt@space.gc.ca

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

CSA-CM-ITAR@asc-csa.gc.ca

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

1.1.5 Documents Delivered on DVD or CD-ROM disk

Hard copy and media deliverables are to be addressed to:

CM Library, 6A-100

Attention: CSA XXXX Project

Canadian Space Agency

6767, Route de l'Aéroport

Longueuil, QC, J3Y 8Y9

CANADA

The DVD or CD-ROM label must show the following information:

a) Company Name

b) Document Title

c) Document Number and Revision Status

d) CSA SOW Number

e) CDRL Number and Title

f) Contract Number

2. DOCUMENT STRUCTURE AND CONTENT2.1 OVERALL

Except as otherwise specified, all documents must have the overall structure as follows:

g) Cover/Title Page;

h) Table of Contents;

i) Introduction;

j) Applicable and Reference Documents;

k) Body of Document; and

l) Appendices

2.2 COVER/TITLE PAGE

The title page must contain the following information:

m) Document Number and date: Volume x of y (if multivolume)

n) Rev. indicator / date of Rev.

o) Document Title

p) Project Name

q) Contract No.

r) CDRL Item No. or Nos., if one document responds to more than one CDRL, subject to prior approval from the PA.

s) Prepared for: Canadian Space Agency

t) Prepared by: Contractor name, CAGE Code, address, and phone number

u) Product tree identifier, if applicable

v) © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR].

2.3 TABLE OF CONTENTS

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

2.4 INTRODUCTION

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

w) Project description and background;

x) Identification (number, title) and a brief overview of the system, hardware, or software to which the document applies;

y) Purpose of the document;

z) Scope of the document (what it includes and what it does not include);

aa) Document conventions; and

bb) Roles and responsibilities of the participants and stakeholders.

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

2.5 APPLICABLE AND REFERENCE DOCUMENTS

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

2.6 BODY OF DOCUMENT

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

2.7 APPENDICES

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

3. METADATA ON DELIVERABLES

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

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

Provided by Supplier	Metadata Description	Comments
Yes	CSA Project Identifier	Project Acronym
Yes	Contract Identifier	PWGSC identifier
Yes	Contract Revision Identifier	PWGSC identifier
Optional	Contract Revision Date	
Yes	SOW Identifier	CSA Doc ID
Yes	SOW Revision Identifier	CSA Doc Revision ID
Yes	Document Type	Dwg, Doc, RFD, RFW, ECR, ECN, IP CR, IP CN/CD, QN, etc.
Yes	CDRL Identifier	Per CSA SOW (e.g. EN-006)
Yes	CDRL Sub-category Identifier	If multiple, separate subject documents per CDRL item (e.g. EN-006.03) (can be contractor defined)
Optional	Project WBS identifier	
Optional	SOW paragraph identifier.	
Optional	DID/ DRD Identifier	
Yes	Deliverable submission format	Electronic, Hard copy, On media (CD-ROM, etc.)
Yes	Deliverable Transmittal Identifier	e.g. CADM09-0123. Can also be a notification of delivery identifier
Yes	Deliverable Transmittal Date	
Yes	Originator's Organization Identifier	CAGE code, company name, short name, etc.
Optional	Document Author	
Yes	Deliverable Type	Dwg, Doc, RFD, RFW, ECR, ECN, NCR, Problem Report, IP CR, IP CN/CD, QN, etc.
Yes	Document Type	Specification, Design, Plan, Tech Note, Report, etc.
Yes	Originator's Document Identifier	
When applicable	Originator's Document Volume Identifier	
When applicable	Originator's Document Part Identifier	

Provided by Supplier	Metadata Description	Comments
When applicable	Originator's Document Issue Identifier	When both Issue and Revision are used concurrently to identify released documents
Yes	Originator's Document Revision Identifier	
Yes	Originator's Document Title	
Yes	Document Release Date	
Yes	Document Effective Date	Applicable to document changes, deviations, waivers,
Yes	Document Expiry Date	If applicable
When applicable	Originator's Authorizing ECN Identifier	Class 2 ECN approving document release and submission to customer
Yes	Document Maturity	Draft, Preliminary, Initial Release, Updated Revision, etc.
When applicable	Class	If deliverable is a change, deviation, waiver, etc. to a released item. (Class I, Class II)
Yes	Security Classification of Deliverable	Per Government of Canada definitions for Classified and Protected data (C,S,TS,PA,PB,PC)
Yes	Sensitivity of Document contents	Company Proprietary, Trade Secret, etc.
Yes	ITAR Content Indicator	Yes or No
Yes	Export Controlled Content Indicator	Yes or No
Yes	Affected Document Identifier	If deliverable is a change, deviation, waiver, etc. to a released document/drawing/model. Enables change-to-document, waiver-to-document relationships, etc.
Yes	Affected Document Revision Identifier	As above
Yes	Affected Document Title	As above
Yes	Product Breakdown Structure / Item Hierarchy Identifier	Critical for Item-to-Document Relationship

Provided by Supplier	Metadata Description	Comments
Yes	Associated Project/System Milestone Review	PDR, CDR, etc. When Reviews are at sub-system level, identify accordingly. e.g. Bus PDR
When applicable	Associated System Baseline	If different from Project Milestone
Yes	Filename of Deliverable	Filename and file type (for all representations submitted - .doc, .pdf, etc.). Original, revisable format to be delivered before contract completion.
Yes	Format of Deliverable / Application used to produce	MS WORD 2007, Project Scheduler 9, etc.
When applicable	Filename of Parent Deliverable Bundle	If part of a document Bill of Material
When applicable	Identification of Delivery Media	If physically delivered
When applicable	Originator's Repository Address of deliverable	To identify source location of document

DATA ITEM DESCRIPTION

DID-102 – CWBS and Work Package Descriptions

DID Issue: IR **Date: 2013-12-18**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

The Contractor shall prepare and maintain a WBS Dictionary made up of Work Package Descriptions (WPDs) for every element to the lowest level of the WBS. Each WPD shall include, as a minimum:

A unique identifier traceable to the WBS;

A title;

The name of the individual responsible for completion of the work;

The scope of the work package;

The start date and duration;

Required inputs and dependencies;

A description of every activity covered by the WPD including the level of effort and earned value measurement method for each activity, and all non-labour costs;

Assumptions;

Output and work package acceptance criteria;

Issue date;

Version number; and

List of deliverable with delivery milestone.

DATA ITEM DESCRIPTION

DID-107 – Progress Report

DID Issue: IR **Date: 2014-01-10**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

NOTE TO CSA PROJECT MANAGERS: The content required below includes all the information required for a large project. For smaller or Phase 0 or A projects, the CSA Project Manager may elect to tailor these requirements down to a suitable level, however, it is necessary to ensure that enough information is obtained to maintain control of the project.

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

Each progress report shall answer the following three questions:

1) Is the project on schedule?
2) Is the project within budget?
3) Is the project free of any areas of concern in which the assistance or guidance of the CSA may be required?

Each negative response must be supported with an explanation.

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

4) Summary outlook, including technical performance, work performed, schedule and cost status (at CWBS level 2), organization and key personnel changes and areas of concerns;
5) Financial status including actual and forecasted expenditures, by month, as compared to the original monthly planned expenditure profile;
6) *For cost reimbursable contracts:* Cost performance status in tabular form, with the following information provided for each Work Package (WP):
    a) Budgeted Cost of Work Scheduled (BCWS), current and cumulative,
    b) Budgeted Cost of Work Performed (BCWP), current and cumulative,

c) Actual Cost of Work Performed (ACWP), current and cumulative,

d) Cost variance (current and cumulative),

e) Budget at completion (BAC),

f) Estimate at completion (EAC),

g) Cost variance at completion, and

h) Cost Performance Index (CPI);

7) *For fixed price contracts:* Updated milestones payment plan;

8) A detailed integrated project schedule status including:

a) The schedule baseline,

b) Dependencies between activities,

c) Percent of completion for all activities,

d) List of completed milestones,

e) Critical path,

f) 1st level subcontractor's activities having impact on WP delivery date shall be provided, and

g) All other activities having an impact on WP delivery date shall be provided;

9) Schedule variances from the plan, including deviations from schedule and proposed corrective actions for significant variances;

10) Major meetings schedule update;

11) Status of the work in progress, specifically the work performed in the previous calendar period; sufficient sketches, diagrams, photographs, etc. shall be included, if necessary, to describe the progress accomplished;

12) The work projected for the next period, and estimated date of completion of next milestone;

13) Outline of technical and programmatic issues, with solutions recommended;

14) Contractual issues, including changes to activities and costs;

15) Subcontracts events, status and issues;

16) Equipment ordered, received, made and assembled;

17) Description of trips or conferences connected with the Contract during the period of the report;

18) Risk status report including previous issues resolved, status of on-going risks (changes, likelihoods and impacts), and identification of new risks, their likelihood and impact, and proposed mitigation action;

19) Product Assurance reporting:

a) A narrative section describing: significant accomplishments during the reporting period, audits performed, significant problems, recommended solutions, and corrective action status, significant changes in the PA Organization and Program related organizations,

b) Summary tables or updates as applicable:

i) Technical review action items, configuration baseline, non-conformances, failure analysis, audits (internal as well as at the subcontractors and their sub-tiers),

ii) Reliability analysis status,

iii) Inspection and Test Status,

iv) Deviations/Waivers status,

v) List of Class I Non-conformances,

vi) List of Class II Non-conformances,

vii) PA documentation status,

viii) PA Action Item Log,

ix) Contractor problem status, and

x) Status of GIDEP/ESA Alerts,

c) Software assurance highlights:

i) Assurance accomplishments and resulting metrics for activities such as, but not limited to, inspection and test, reviews, Instrument Provider/subcontractor surveys, and audits,

ii) Trends in metrics data (e.g., total number of software problem reports, including the number of problem reports that were opened and closed in that reporting period),

iii) Significant problems or issues that could affect cost, schedule and/or performance, and

iv) Plans for upcoming software assurance activities; and

20) Status of all action items from previous review(s) and meeting(s).

DATA ITEM DESCRIPTION

DID-108 – Kick-off Meeting Presentation

DID Issue: IR **Date: 2014-01-10**

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 shall contain the following information, as a minimum:

Review of major assumptions;

Review of contract deliverables;

Work requirements, WBS status and schedule;

Project's funding and expected cash-flow;

FIP and BIP;

Licensing issues if any;

Presentation to include the required copyrights and IP disclosure;

Other items as deemed appropriate

DATA ITEM DESCRIPTION

DID-112 – Action Items Log (AIL)

DID Issue: IR **Date: 2013-12-19**

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) Description of the action required;
4) Open Date;
5) Source of AI (e.g. PDR meeting, RID, etc.);
6) Originator;
7) Office of Prime Interest (OPI);
8) Person responsible (for taking action);
9) Target/Actual Date of Resolution;
10) Progress update;
11) Rationale for closure;
12) Status (Open or Closed); and
13) Remarks.

The date in column 9) will be the target date as long as the item is open, and the actual date once the item is closed.

DATA ITEM DESCRIPTION

DID-120 – FIP and BIP Disclosure

DID Issue: IR **Date: 2014-01-16**

PURPOSE:

To fully disclosure all FIP and BIP resulting from a Phase 0 contract.

PREPARATION INSTRUCTIONS:

The FIP Disclosure must contain the following information, as a minimum:

1) Introduction including the scope and the purpose;
2) List and description of all FIP resulting from the Phase 0 contract; and
3) List and description of all BIP required by CSA for use of the FIP resulting from the Phase 0 contract.

DATA ITEM DESCRIPTION

DID-400 – Requirements Document

DID Issue: IR **Date: 2014-01-23**

PURPOSE:

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

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

PREPARATION INSTRUCTIONS:

1) Requirements documents shall conform to norms of English usage for Systems Engineering:

   "shall" indicates a mandatory requirement

   "should" indicates a preferred but not mandatory alternative,

   "will" indicates statement of intention or fact

   "may" indicates an option.

2) Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be verifiable on the item as integrated.

3) All requirements shall be documented in the MBSE model and requirements documents expressed from the model *(Optional)*.

4) Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

5) There shall be one set of requirements for each node in the System Hierarchical Tree. Note that interface requirements (which are between two or more nodes) are in separate documents.

6) Requirements shall conform to the following standards for quality:

   a) They shall be unambiguously clear to the intended readership;

   b) There shall be one requirement per paragraph;

   c) Each requirement shall have a unique identifier (e.g. an ID number or paragraph number);

   d) They shall not define design solutions;

   e) They shall define their source and/or rationale

   f) They shall be verifiable, preferably by test;

g) They shall specify the conditions under which they apply; and

h) Performance requirements shall be quantified.

7) The Requirements Document shall comprise a number of sections, each defining a specific set of requirements. The document shall address all of the following categories of requirements, as applicable to the project:

1.1. Functional and performance requirements (see item 8) below);

a) External interface requirements (unless done in a separate document);

b) Resource allocation requirements,

c) Design requirements;

d) Construction requirements (see item 9) below);

e) Environmental requirements (see item 10) below),

f) Qualification and/or verification requirements;

g) Safety requirements

h) System environmental requirements associated with:

v) Storage, packaging and handling environment

vi) External stowage requirements, if any;

vii) Ground operations environment

viii) Integration to launch vehicle environment (for flight payload only)

ix) Launch environment (for flight payload only)

x) On-orbit environment (for flight payload only)

i) Operational requirements, if any;

j) Ground Support Equipment requirements, if any (unless done in a separate document); and

k) Other applicable requirements types.

8) Functional and performance requirements shall include, as applicable to the project:

a) Functional and performance requirements imposed on the system by the scientific needs (flow down from MRD);

b) Operating modes requirements;

c) Power requirements including:

i) Power consumption,

ii) Power transients,

iii) Voltage requirements;

d) Telemetry and Telecommand requirements;

e) Software requirements;

f) Other applicable requirements.

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

DATA ITEM DESCRIPTION

DID-500 – Interface Requirements Documents (IRD)

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

Interface Requirements Documents (IRD) define requirements on each of the two or more nodes sharing an interface to ensure that when connected physically or virtually they are compatible and together achieve their combined functions. The IRD serves as the parent for the Interface Control Document.

PREPARATION INSTRUCTIONS:

Interface requirements typically cover the following interface characteristics:

1) Electrical: power supply levels and consumption, digital and analogue signals, EMC;
2) Mechanical: loads, attachment locations, attachment methods, volume constraints;
3) Thermal transmission: heat loads and lifts, radiative properties, especially for enclosures;
4) Data: data to be passed and standards;
5) Synchronization: timing and delay requirements;
6) Optics: properties of optical rays transmitted between subsystems, e.g. focal length, focal point, aberrations of a telescopically focused image.

Some environmental requirements (e.g. transmitted mechanical vibration levels) can logically be placed into a Requirements Document or an IRD, it being the author's choice.

The following requirements apply to all interface requirements documents.

All requirements applicable at the interface between the subject items shall be documented. This should cover the standard items listed above.

Requirements documents shall define the requirements on the subject item (segment, subsystem, etc.) as a whole and shall not contain specific requirements on sub-items. All requirements shall be testable on the item as integrated.

Requirements shall conform to the following standards for quality:

7) They shall be unambiguously clear to the intended readership;
8) There shall be one requirement per paragraph;
9) Each requirement shall have a unique identifier (e.g. An ID number or paragraph number);
10) They shall not define design solutions;
11) They shall define their source and/or rationale;

12) They shall be verifiable, preferably via a direct measurement;

13) They shall specify the conditions under which they apply; and

14) Performance requirements shall be quantified.

Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.

Following are examples of IRDs that may be required, depending on the nature of the project:

15) Spacecraft-to-Launch Vehicle IRD

16) Spacecraft-to-Ground Segment IRD

17) Spacecraft Internal IRD (e.g. between Bus and Payloads)

18) Ground Segment Internal IRD

DATA ITEM DESCRIPTION

DID-529 – Long Lead Items List

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To identify hardware and software items with long procurement schedules. It supports cash flow planning by the Government.

PREPARATION INSTRUCTIONS:

The Long Lead Items List shall identify, as a minimum:

- All long lead items;
- The time frame, relative to the project schedule, when these items need to be ordered or fabricated; and
- The estimated cost of all identified items.

DATA ITEM DESCRIPTION

DID-532 – System Traceability Matrix

DID Issue: IR **Date: 2014-01-28**

PURPOSE:

To show how the system requirements flow into subsystem, sub-sub-system, unit, and SCD requirements.

PREPARATION INSTRUCTIONS:

The Traceability Matrix shall, as a minimum:

1) Contain all requirements in the project, down to Source Control Documents requirements;
2) Show how requirements are allocated to subsystems, and how they are decomposed and derived before application to subsystems; and
3) Point to analysis or budgeting documents as sources of requirements based on derivation and decomposition; the analysis is a step in between the parent requirement and the derived child requirement.

DATA ITEM DESCRIPTION

DID-629 – Design Trade-off Study

DID Issue: IR **Date: 2014-01-30**

PURPOSE:

To document studies performed to make design decisions.

PREPARATION INSTRUCTIONS:

The Design Trade-off Study may be used for decisions related to architecture, functionality, design, production, etc. The Design Trade-off Study may be prepared in the Contractor's format, and shall, as a minimum, contain the following information:

1) Purpose of the study;
2) Cases considered;
3) Criteria definitions;
4) Analysis description;
5) Analysis results;
6) Decisions.

DATA ITEM DESCRIPTION

DID-826 – Mission / Science Operations Plan

DID Issue: IR **Date: 2014-02-24**

PURPOSE:

To define the mission / science activities to be performed throughout the mission life cycle.

PREPARATION INSTRUCTIONS:

NOTE: This plan is initiated during Phase 0 and completed in Phase A. It eventually may be considered as a preliminary sub-plan to the Routine Operations Plan, which developed much later, during Phase C.

The Mission / Science Operations Plan shall contain the following information, as a minimum:

1) PI/Science Team structure, composition, roles, shift schedules, and management approach;
2) A demonstration that the Mission / Science Operations Plan responds to the operations requirements and is in line with the Concept of Operations (ConOps);
3) Characterized external interface requirements;
4) Rules for priority and decision-making during critical events and situations;
5) Preliminary communication and reporting protocols;
6) Preliminary sequence of operational activities and identification of corresponding procedures;
7) Preliminary overall schedule;
8) Required resources and initial conditions, particularly ground reception facilities and the Operations Center;
9) Preliminary anomaly detection, resolution and correction procedures; and
10) Preliminary contingency scenarios and possible recovery actions.