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

INVITATION TO QUALIFY (ITQ)

FOR

LUNAR EXPLORATION ACCELERATOR PROGRAM (LEAP) SCIENCE INSTRUMENT

FOR

CANADIAN SPACE AGENCY (CSA)

TABLE OF CONTENTS

List of Annexes to the Invitation to Qualify:
- Annex A Statement of Work

List of Attachments to Part 4 (Response Preparation Instructions):

- Attachment 1 to Part 4 – Financial Response Preparation Instructions
- Attachment 2 to Part 4 – Anticipated Requirements for Bid Solicitation
- Attachment 3 to Part 4 – Form 1: ITQ Submission Form
- Attachment 4 to Part 4 – Form 2: Project Reference Check Form

List of Attachments to Part 5 (Evaluation Procedures and Basis of Qualification):

- Attachment 1 to Part 5 Mandatory Evaluation Criteria

List of Attachments to Part 6 (Certifications):

- Attachment 1 to Part 6 Federal Contractors Program for Employment Equity - Certification

PART 1 - GENERAL INFORMATION

1.1 Introduction

This document states terms and conditions that apply to this Invitation to Qualify (ITQ). This ITQ is divided into eight parts plus attachment and annexes as follows:

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

Part 2: Overview of the Procurement Process: describes the phases of the procurement process;

Part 3: Respondent Instructions: provides the instructions, clauses and conditions applicable to this ITQ;

Part 4: Response Preparation Instructions: provides Respondents with instructions on how to prepare their Response to the ITQ and the evaluation criteria to be addressed;

Part 5: Evaluation Procedures and Basis of Qualification: describes how the Responses will be evaluated and the basis of qualification;

Part 6: Certifications and Additional Information: details the certifications to be provided in the Response; additional certifications may be included in a subsequent RFP, if any;

Part 7: Security Requirements: describes the anticipated future security requirements;

Part 8: Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract.

Refer to the Table of Contents for the list of annexes and forms.

1.2 Summary

(a) This Invitation to Qualify (ITQ) forms part of the Qualification Phase, which is the first phase of a multi-phase procurement process detailed in Section 2.1 by Public Works and Government Services Canada (PWGSC), on behalf of Canadian Space Agency (CSA), for Phases A through F of the Lunar Exploration Accelerator Program (LEAP) Science Instrument project.

The CSA has elected to participate in National Aeronautics and Space Administration (NASA)'s Payloads and Research Investigations on the Surface of the Moon (PRISM) ROSES-2021 F.10 PRISM call for potential lunar surface investigations in support of the science instrument project element of the LEAP portfolio. For more information on this program element, industry and academia can refer to the final text posted on the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) page for ROSES-2021 F.10 PRISM (https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7bAD1DEAD1-7060-2C93-8CD1-780AF8FC9D54%7d&path=&method=init).

The PRISM solicitation call, pertaining to this ITQ, will be led by NASA and was issued by NASA in September 2021 for launches in 2025 and early 2026. Under this PRISM solicitation call, NASA intends to select science instrument suites for two commercial lunar payload services (CLPS) deliveries, one expected to be at a South Polar location between Q4 2025 – early Q1 2026, and the other at the Gruithuisen Domes, a nearside silicic volcanic construct, between Q1-Q2 2025. Mobility capabilities are expected to be available for Gruithuisen Domes.

The work related to the Canadian science instrument includes Phases A through F for a typical space mission relevant to PRISM. The objective of the Phase A work will be to demonstrate and confirm the feasibility, value and benefits of the instrument for a space mission to the Moon, and to demonstrate the validity of the mission requirements as well as the development of the system requirements. Phases B, C, and D will be the preliminary, detailed and implementation phases respectively of the instrument project, whereas Phase E will be the operations phase and Phase F the closeout phase.

The anticipated maximum funding available for both missions is $16.9M Canadian Dollars (CAD), Applicable Taxes extra, with $5.6M CAD, Applicable Taxes extra, for the South Polar mission and $11.3M CAD, Applicable Taxes extra, for the Gruithuisen Domes mission. As a result of the anticipated maximum funding available for both missions, the total investigation costs will also be required to include an option(s) to descope the work for the South Polar delivery location of up to $2.8M CAD, Applicable Taxes extra, and for the Gruithuisen Domes delivery location of up to $5.5M CAD, Applicable Taxes extra, as specified in Table 1 below.

The total descoped cost for the proposed instrument must meet the minimum requirements for achieving the stated mission objectives and requirements as per Annex A Statement of Work. A draft Statement of Work is at Annex A.

Table 1 – Mission Cost Breakdown

Delivery Location	NASA's Cost Cap (USD), Inclusive of 20% Cost Reserve	NASA's Foreign Participation Cost Cap (Baseline Canadian Payload Cost) (CAD) Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Required Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve
South Polar	$20M	$8.4M[1]	Up to $2.8M
Gruithuisen Domes	$40M	$16.8M[1]	Up to $5.5M
Total	$60M	$25.2M[1]	Up to $8.3M

(1) The baseline Canadian payload costs (CAD) represent 1/3rd of NASA's cost cap (USD), inclusive of 20% cost reserve, converted into CAD dollars, applicable taxes extra, inclusive of 20% cost reserve.

These cost requirements would include a 20% cost reserve as noted in Table 1, as per the PRISM call, that will be held at the CSA and included in the overall budget. The CAD values shown in the third column of Table 1 are based on an exchange rate of 0.80 CAN$/US$ and will remain unchanged regardless of any changes to the CAN$/US$ exchange rate in the future.

(b) The purpose of this ITQ is to invite interested parties to submit a Response indicating their interest in, and qualifications for, the requirement. Based on these Responses, Canada intends to select, in accordance with the terms of this ITQ, a list of Qualified Respondents that will be provided with a conditional Letter of Support from CSA confirming available funding for the proposed work in support of their response to NASA's ROSES-2021 F.10 PRISM call which is a condition and prerequisite to participate in the subsequent phase of the procurement process should the partnered U.S. team proposal be selected by NASA as further detailed below in Section 2.1. Canada intends to qualify Respondents based on the criteria detailed in Attachment 1 to Part 5 Mandatory Evaluation Criteria. Those Respondents who meet all of the mandatory requirements of the ITQ through a formal evaluation conducted during the ITQ process will be hereinafter referred to as "Qualified Respondents".

(c) This ITQ is neither a Request for Proposal (RFP) nor a solicitation of bids. No contract will be awarded as a result of the activities during the ITQ phase. Canada reserves the right to modify, change, or terminate, at its sole discretion, any or all of the Phases of the procurement process at any time during the procurement process. Given that this ITQ may be cancelled by Canada, it may not result in any of the subsequent procurement processes described in this document. Respondents may also withdraw from the ITQ process at any time.

(d) A related Letter of Interest (LOI) on this requirement can be found here:

https://buyandsell.gc.ca/procurement-data/tender-notice/PW-ST-048-39153

(e) Respondents are invited to qualify in accordance with the terms and conditions of this ITQ in order to become “Qualified Respondents” for any possible later phase of the procurement process.

(f) The requirement is limited to Canadian goods and Canadian services.

(g) This procurement is 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).

(h) The Federal Contractors Program (FCP) for employment equity applies to this procurement; refer to Part 6 – Certifications and Additional Information and Attachment 1 to Part 6 Federal Contractors Program for Employment Equity - Certification.

(i) This ITQ requires respondents to use the epost Connect service provided by Canada Post Corporation to transmit their Response electronically. Respondents must refer to Part 3 – Respondent Instructions and Part 4 – Response Preparation Instructions for further information."

1.3 Debriefings

The Contracting Authority will notify unsuccessful Respondents after the Qualification Phase and provide a debriefing upon request. The unsuccessful Respondents should make the request to the Contracting Authority within fifteen (15) working days from receipt of the results of the Qualification Phase. Debriefings may be in writing, by telephone or in person. The Contracting Authority is to determine which method will be the most effective.

1.4 Phased Response Compliance Process

The Phased Response Compliance Process (PRCP) applies to this requirement.

PART 2 - OVERVIEW OF PROCUREMENT PROCESS

2.1 Overview

(a) The details outlined in Part 2 are provided for information purposes only. Canada reserves the right to delete or modify or add any named procurement phases, objectives or associated target dates as required.

(b) In support of this requirement, and although the procurement process remains subject to change or cancellation, PWGSC anticipates that the procurement process will be conducted in a multi-phased procurement approach as follows:

1) Phase 1 - Invitation to Qualify (ITQ) – Qualification Phase

The purpose of this phase will be to invite interested Canadian parties to submit a response indicating their interest in, and qualifications for, the requirement. The ITQ is being released by PWGSC in conjunction with NASA's PRISM call in September 2021 in time for interested Canadian parties to partner with a U.S. organization as part of their proposal on NASA's PRISM call. This ITQ will apply specifically to this specific PRISM call only. Any future NASA PRISM calls or similar NASA call processes, if applicable, will have a separate ITQ process associated with them. Interested Canadian parties that wish to be considered for future opportunities, if applicable, will be required to submit a response for each specific ITQ and call in accordance with the processes identified therein.

The ITQ identifies the technical, financial and policy evaluation requirements, as well as the set terms and conditions for any potential future contract(s) for Phases A through F of the LEAP Science Instrument project.

Those respondents who meet all of the requirements of the ITQ through a formal evaluation conducted by Canada during this ITQ process will be referred to as "Qualified Respondents" and will be provided with a conditional Letter of Support from CSA confirming available funding for the proposed work in support of their response to this NASA PRISM call. Participation in this ITQ and obtaining a Letter of Support from CSA will be a condition and prerequisite to participate in the subsequent phase of the procurement process should the partnered U.S. team proposal be selected.

2) Phase 2 - Request for Proposal (RFP) – Bidding Phase

If a U.S. team proposal with a Canadian Qualified Respondent is selected as part of the PRISM call selection process for one delivery location (herein referred to as NASA-selected Qualified Respondent), PWGSC will invite only the NASA-selected Qualified Respondent to participate in the RFP for Phases A through F of the project in order to solicit a formal technical and financial bid from the NASA-selected Qualified Respondent based on the final Statement of Work (SOW) that would be developed subsequent to this ITQ and take into account any NASA PRISM call requirements. As the set terms and conditions of any potential future contract will be established through this ITQ process, this RFP will establish the final Statement of Work and any outstanding contractual elements, such as the period of the contract, work authorization points and the basis of payment for each phase of the project. The RFP is anticipated for release by PWGSC in Spring of 2022 and the resulting contract, if any, for the LEAP Science Instrument (LSI) for Phases A through F is anticipated for award in Spring/Summer 2022.

Should U.S. team proposals with Canadian Qualified Respondents be selected as part of the PRISM call selection process for both delivery locations, PWGSC will proceed as described above but will invite both Qualified Respondents to participate in the corresponding RFP for Phases A through F of the project with the aim of awarding a contract for each delivery location.

Should the Canadian Qualified Respondent(s) be unable to satisfy the outstanding contractual elements described above or should PWGSC be unable to negotiate satisfactory terms and conditions, in its discretion, with the Canadian Qualified Respondent(s), no further consideration will be given to the Canadian Qualified Respondent(s)'s proposal.

The following Table 1 summarizes the objectives and target dates of each anticipated phase of the multi-phase procurement process.

Table 1: Summary of Anticipated Procurement Phases and Objectives

Procurement Phase	Objectives	Target Dates or Date Ranges
Letter of Interest (LOI) (Completed)	• LOI published on Buyandsell.ca: 9F052-200589/A (https://buyandsell.gc.ca/procurement-data/tender-notice/PW-ST-048-39153)	• Published March 2021 • Closed _____ (*insert month and year*)
Phase 1 - ITQ (Qualification Phase)	• Issue ITQ on Buyandsell.gc.ca • Receive Responses from Respondents • Evaluate Responses • Determine the list of Qualified Respondents • Provide Qualified Respondents with a Letter of Support	• Published September 2021 • Closing _____ (*insert month and year*)
Phase 2 - RFP (Bidding Phase)	• Issue RFP directly to all Qualified Respondents • Receive and evaluate bids in accordance with the RFP	• Spring 2022
Contract Award Phase	• Award the Contract(s) to the successful responsive Bidder(s)	• Spring/Summer 2022

2.2 Qualification Phase

(a) The Qualification Phase is the first phase of the anticipated procurement process.

(b) This ITQ defines the requirements for the Qualification Phase. The objective of the Qualification Phase is to qualify (Respondents for further consideration in the anticipated procurement process. Refer to Part 5 – Evaluation Procedures and Basis of Qualification for a more detailed explanation of the ITQ evaluation procedures and basis of selection of Qualified Respondents.

2.3 Bidding Phase

(a) The objectives of the anticipated Bidding Phase include:

(i) Issuing a solicitation to the Qualified Respondents as specified above in Section 2.1, b) for the acquisition of the requirement; and

(ii) Receiving and evaluating the bids submitted in response to the solicitation.

(b) The anticipated approach for the Bidding Phase has been described above in Section 2.1, b), and will be defined in detail in the solicitation document.

2.4 Contract Award Phase

(a) The objective of the anticipated Contract Award Phase is for Canada to award a contract(s) for one or both delivery locations to the responsive bidder(s) in accordance with the solicitation.

2.5 Anticipated Contract Period

(a) The term of any resulting contract and any applicable options to extend will be identified at the Bidding Phase.

PART 3 – RESPONDENT INSTRUCTIONS

3.1 Standard Instructions, Clauses and Conditions

(a) All instructions, clauses and conditions identified in the ITQ by number, date and title are set out in the Standard Acquisition Clauses and Conditions (SACC) Manual (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by PWGSC.

(b) Respondents who submit a Response agree to be bound by the instructions, clauses and conditions of the ITQ and accept the clauses and conditions of any resulting contract as specified at Part 8.

(c) The 2003 (2020-05-28) Standard Instructions - Goods or Services – Competitive Requirements, are incorporated by reference into and form part of the ITQ, except that:

(i) Wherever the term “bid solicitation” is used, it is substituted with “Invitation to Qualify”;

(ii) Wherever the term “bid” is used, it is substituted with “Response”;

(iii) Wherever the term “Bidder(s)” is used, it is substituted with “Respondent(s)”;

(iv) Subsection 05(4), which discusses a validity period, does not apply, given that this ITQ invites Respondents to qualify. Canada will assume that all Respondents who submit a Response wish to continue to qualify unless they advise the Contracting Authority that they wish to withdraw their Response;

(v) If there is a conflict between the provisions of Standard Instructions – Goods or Services – Competitive Requirements 2003 and this document, this document prevails;

(vi) SACC Manual clauses identified in the ITQ by number, date, and title are incorporated by reference into the ITQ, except that:

(A) Wherever the term “bid solicitation” is used, it is substituted with “Invitation to Qualify”;
(B) Wherever the term “bid” is used, it is substituted with “Response”;
(C) Wherever the term “Bidder(s)” is used, it is substituted with “Respondent(s)”;

(d) ***SACC* Manual Clauses**

SACC Manual clause A7035T (2007-05-25), List of Proposed Subcontractor

3.2 Joint Venture

(a) Respondents submitting Responses to the ITQ are requested to indicate the relevant company and/or organization names that are jointly submitting the Response in Attachment 3 to Part 4 - Form 1: ITQ Submission Form.

(b) If a Response is submitted by a joint venture, it must be in accordance with section 17 Joint Venture, of the SACC 2003 (2020-05-28).

3.3 Submission of Responses

Responses must be submitted only to the PWGSC Bid Receiving Unit via epost Connect by the date, time and place indicated in the ITQ.

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

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

Responses 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 responses through an epost Connect message if the Respondent is using its own licensing agreement for epost Connect.

Due to the nature of the ITQ, responses transmitted by facsimile or electronic mail to PWGSC will not be accepted.

3.4 Enquiries

(a) All enquiries must be submitted in writing to the Contracting Authority, at the email address identified below, no later than **ten (10)** calendar days before the closing date for submission of Responses to the ITQ. Enquiries received after that time may not be answered.

Contracting Authority
Public Works and Government Services Canada
Name: Sameer Ali Abbasi
Email address: sameerali.abbasi@tpsgc-pwgsc.gc.ca

(b) Respondents should reference as accurately as possible the numbered item of the ITQ to which the enquiry relates. Care should be taken by Respondents to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. 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 Respondents do so, so that the proprietary nature of the question(s) is eliminated, and the enquiry can be answered to all Respondents. Enquiries not submitted in a form that can be distributed to all Respondents may not be answered by Canada.

3.5 Applicable Laws

(a) The ITQ must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario, Canada.

(b) Respondents may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of its response, 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 Respondents. Respondents are requested to indicate the Canadian province or territory they wish to apply to any resulting document in their ITQ Submission Form.

3.6 Language for Future Communications

Respondents are requested to identify, in writing, in Attachment 3 to Part 4 - Form 1: ITQ Submission Form which of Canada's two (2) official languages (English or French) it chooses to use for future communications with Canada regarding this ITQ and any subsequent phases of the procurement process.

3.7 Improvement of Requirement during ITQ

Should Respondents consider that the requirements contained in the ITQ, including the Statement of Work at Annex A, could be improved technically, Respondents are invited to make suggestions, in writing, to the Contracting Authority named in the ITQ. Respondents must clearly outline the suggested improvement as well as the reason for the suggestion. Only suggestions that do not restrict the level of competition nor favour a particular Respondent may be given consideration provided they are submitted to the Contracting Authority in accordance with the article entitled "Enquiries - Bid Solicitation". Canada will have the right to accept or reject any or all suggestions.

3.8 Challenge and Recourse Mechanisms available to Respondents

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

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

PART 4 - RESPONSE PREPARATION INSTRUCTIONS

4.1 Response Preparation Instructions

(a) Respondents must submit their Response electronically in accordance with section 08 of the 2003 Standard Instructions of this solicitation document. The epost Connect system has a limit of 1GB per single message posted and a limit of 20GB per conversation.

(b) The Response must be organized in separate sections as follows:

(i) Section I: Technical and Managerial Response
(ii) Section II: Financial Response
(iii) Section III: Certifications

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

(d) Formats of electronic documents accessible by Canada include PDF and MS Office 2013.

4.2 Section I: Technical and Managerial Response

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

(b) The response must consist of the following:

(i) Substantiation of Technical and Managerial Compliance :

(A) **Mandatory Evaluation Criteria:** The Response must substantiate its compliance with and address clearly and in sufficient depth the mandatory technical evaluation criteria that are subject to evaluation as set out in Attachment 1 to Part 5 Mandatory Evaluation Criteria (Criteria Number M1 to M10). Each of the Mandatory Evaluation Criteria must be addressed in sufficient detail to permit the evaluation team to verify the Respondent's compliance. Simply repeating the statement contained in the ITQ is not sufficient. In order to facilitate the evaluation of the Response, Canada requests that Respondents address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, Respondents may refer to different sections of their Responses by identifying the specific paragraph and page number where the subject topic has already been addressed; where the reference is not sufficiently precise, Canada may request that the Respondent direct Canada to the appropriate location in the documentation.

(ii) ITQ Submission Form:

Respondents are requested to include a completed ITQ Submission Form, found at Attachment 3 to Part 4 - Form 1: ITQ Submission Form, with their responses. It provides a common form in which Respondents can provide information required for evaluation, such as

a contact name, the Respondent's Procurement Business Number, the language for future communications with Canada about this procurement process, etc. Using the form to provide this information is recommended. If Canada determines that the information required by the ITQ Submission Form is incomplete or requires correction, Canada will provide the Respondent with an opportunity to provide the additional information or make the correction. Providing the information when requested during the evaluation period is mandatory. If the Respondent has not submitted the requested information within the period set by the Contracting Authority, its response will be declared non-responsive.

(iii) Customer Reference Contact Information:

The Respondent must provide customer references. The customer reference must each confirm, if requested by PWGSC, the facts identified in the Respondent's response, as required by Attachment 4 to Part 4 - Form 2: Project Reference Check Form.

(A) If the information requested in this form is not provided with the Respondent's Response, it must be provided upon request by the Contracting Authority within the timeframe identified in the request.

(B) The form of question to be used to request confirmation from customer references is as follows:

Question to Customer Reference:

Has the Respondent provided your organization with *[describe the services and, if applicable, describe any required time frame within which those services must have been provided]*?

___ Yes, the Respondent has provided my organization with the services described above.

___ No, the Respondent has not provided my organization with the services described above.

___ I am unwilling or unable to provide any information about the services described above.

For each customer reference, the Respondent must, at a minimum, provide the name of the organization, name, and telephone number or e-mail address for a contact person. Respondents are also requested to include the title of the contact person. If there is a conflict between the information provided by the customer reference and the Respondent's response, the information provided by the customer reference will be evaluated instead of the information in the Respondent's response.

4.3 Section II: Financial Response

(a) In their financial response, Respondents must submit a total firm, all-inclusive Mission Cost estimate, customs duties included and Applicable Taxes extra, for the requirement contained in this ITQ as specified in Attachment 1 to Part 4 Financial Response Preparation Instructions.

(b) The response must consist of the following:

(i) Substantiation of Financial Compliance :

(A) **Mandatory Evaluation Criteria:** The Response must substantiate its compliance with and address clearly and in sufficient depth the mandatory financial evaluation criteria that are subject to evaluation as set out in Attachment 1 to Part 5 Mandatory Evaluation Criteria (Criteria Number M11 to M14). Each of the Mandatory Evaluation Criteria must be addressed in sufficient detail to permit the evaluation team to verify the Respondent's compliance. Simply repeating the statement contained in the ITQ is not sufficient. In order to facilitate the evaluation of the Response, Canada requests that Respondents address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, Respondents may refer to different sections of their Responses by identifying the specific paragraph and page number where the subject topic has already been addressed; where the reference is not sufficiently precise, Canada may request that the Respondent direct Canada to the appropriate location in the documentation.

(ii) Anticipated Requirements for Bid Solicitation:

The Respondent's response must include a signed copy of Attachment 2 to Part 4 - Anticipated Requirements for Bid Solicitation acknowledging that the Respondent has read and understood that Attachment 2 to Part 4 - Anticipated Requirements for Bid Solicitation are mandatory requirements that are expected to be included and evaluated as part of the Bidding Phase.

4.4 Section III: Certifications

Respondents must submit the certifications and additional information required under Part 6.

PART 5 - EVALUATION PROCEDURES AND BASIS OF QUALIFICATION

5.1 Evaluation Procedures

(a) Responses will be evaluated in accordance with the entire requirement of the ITQ including the technical and managerial mandatory evaluation criteria. Respondents that meet all of the mandatory requirements of this ITQ will qualify as a "Qualified Respondent" for subsequent phases of the procurement process. Only these Qualified Respondents will be eligible to participate in the Bidding Phase. Canada reserves the right to re-evaluate the qualification of any Qualified Respondent at any time during the procurement process. All Respondents will be notified in writing regarding whether or not they have qualified. Responses that do not meet or comply with each and every mandatory requirement will be declared non-responsive and will be disqualified.

(b) An evaluation team composed of representatives of Canada and Deloitte will evaluate the Responses.

(b) Each Response will be reviewed for compliance with every mandatory requirement of this ITQ.

(c) In addition to any other time periods established in the qualification process:

(i) **Requests for Clarifications:** If Canada seeks clarification or verification from the Respondent about its response, the Respondent will have two (2) working days or a longer period if specified in writing by the Contracting Authority to provide the necessary information to Canada; and

(ii) **Requests for Further Information**: If Canada requires additional information in order to do any of the following pursuant to the Section entitled "Conduct of Evaluation" in 2003, Standard Instructions - Goods or Services - Competitive Requirements:

(A) verify any or all information provided by the Respondent in its Response; or
(B) contact any or all references supplied by the Respondent (e.g., references named in the résumés of individual resources) to verify and validate any information submitted by the Respondent,

The Respondent must provide the information requested by Canada within two (2) working days of a request by the Contracting Authority.

(iii) **Extension of Time:** If additional time is required by the Respondent, the Contracting Authority may grant an extension at his or her sole discretion.

5.2 Phased Response Compliance Process

(a) Canada will use the Phased Response Compliance Process (PRCP) described below.

5.2.1 General

(a) Canada is conducting the PRCP described below for this requirement.

(b) Notwithstanding any review by Canada at Phase I or II of the PRCP, Respondents are and will remain solely responsible for the accuracy, consistency and completeness of their Responses and Canada does not undertake, by reason of this review, any obligations or responsibility for identifying any or all errors or omissions in Responses or in responses by a Respondent to any communication from Canada.

the Respondent acknowledges that the reviews in Phase I and II of this PRCP are preliminary and do not preclude a finding in phase III that the Response is non-responsive, even for mandatory

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

The Respondent also acknowledges that its response to a notice or a Compliance Assessment Report (CAR) (each defined below) in Phase I or II may not be successful in rendering its Response responsive to the mandatory requirements that are the subject of the Notice or CAR, and may render its Response non-responsive to other mandatory requirements.

(c) Canada may, in its discretion, request and accept at any time from a Respondent and consider as part of the Response, any information to correct errors or deficiencies in the Response that are clerical or administrative, such as, without limitation, failure to sign the Response or any part or to checkmark a box in a form, or other failure of format or form or failure to acknowledge; failure to provide a procurement business number or contact information such as names, addresses and telephone numbers; inadvertent errors in numbers or calculations that do not change the amount the Respondent has specified as the price or of any component thereof that is subject to evaluation. This shall not limit Canada's right to request or accept any information after the ITQ closing in circumstances where the ITQ expressly provides for this right. The Respondent will have the time period specified in writing by Canada to provide the necessary documentation. Failure to meet this deadline will result in the Response being declared non-responsive.

(d) The PRCP does not limit Canada's rights under Standard Acquisition Clauses and Conditions (SACC) 2003 (2020-05-28) Standard Instructions – Goods or Services – Competitive Requirements nor Canada's right to request or accept any information during the ITQ period or after ITQ solicitation closing in circumstances where the ITQ expressly provides for this right, or in the circumstances described in subsection (c).

(e) Canada will send any Notice or CAR by any method Canada chooses, in its absolute discretion. The Respondent must submit its response by the method stipulated in the Notice or CAR. Responses are deemed to be received by Canada at the date and time they are delivered to Canada by the method and at the address specified in the Notice or CAR. An email response permitted by the Notice or CAR is deemed received by Canada on the date and time it is received in Canada's email inbox at Canada's email address specified in the Notice or CAR. A Notice or CAR sent by Canada to the Respondent at any address provided by the Respondent in or pursuant to the Response is deemed received by the Respondent on the date it is sent by Canada. Canada is not responsible for late receipt by Canada of a response, however caused.

5.2.1.2 Phase I: Financial Response

(a) After the closing date and time of this ITQ, Canada will examine the Response to determine whether it includes a Financial Response and whether any Financial Response includes all information required by the ITQ. Canada's review in Phase I will be limited to identifying whether any information that is required under the ITQ to be included in the Financial Response is missing from the Financial Response. This review will not assess whether the Financial Response meets any standard or is responsive to all ITQ requirements.

(b) Canada's review in Phase I will be performed by officials of the Department of Public Works and Government Services.

(c) If Canada determines, in its absolute discretion that there is no Financial Response or that the Financial Response is missing all of the information required by the ITQ to be included in the Financial Response, then the Response will be considered non-responsive and will be given no further consideration.

(d) For Responses other than those described in c), Canada will send a written notice to the Respondent ("Notice") identifying where the Financial Response is missing information. A Respondent, whose Financial Response has been found responsive to the requirements that are reviewed at Phase I, will not receive a Notice. Such Respondents shall not be entitled to submit any additional information in respect of their Financial Response.

(e) The Respondents who have been sent a Notice shall have the time period specified in the Notice (the "Remedy Period") to remedy the matters identified in the Notice by providing to Canada, in writing, additional information or clarification in response to the Notice. Responses received after the end of the Remedy Period will not be considered by Canada, except in circumstances and on terms expressly provided for in the Notice.

(f) In its response to the Notice, the Respondent will be entitled to remedy only that part of its Financial Response which is identified in the Notice. For instance, where the Notice states that a required line item has been left blank, only the missing information may be added to the Financial Response, except that, in those instances where the addition of such information will necessarily result in a change to other calculations previously submitted in its Financial Response, (for example, the calculation to determine a total price), such necessary adjustments shall be identified by the Respondent and only these adjustments shall be made. All submitted information must comply with the requirements of this ITQ.

(g) Any other changes to the Financial Response submitted by the Respondent will be considered to be new information and will be disregarded. There will be no change permitted to any other Section of the Respondent's Response. Information submitted in accordance with the requirements of this ITQ in response to the Notice will replace, in full, only that part of the original Financial Response as is permitted above, and will be used for the remainder of the Response evaluation process.

(h) Canada will determine whether the Financial Response is responsive to the requirements reviewed at Phase I, considering such additional information or clarification as may have been provided by the Respondent in accordance with this Section. If the Financial Response is not found responsive for the requirements reviewed at Phase I to the satisfaction of Canada, then the Response shall be considered non-responsive and will receive no further consideration.

(i) Only Responses found responsive to the requirements reviewed in Phase I to the satisfaction of Canada, will receive a Phase II review.

5.2.1.3 Phase II: Technical and Managerial Response

(a) Canada's review at Phase II will be limited to a review of the Technical and Managerial Response to identify any instances where the Respondent has failed to meet any Eligible Mandatory Criterion. This review will not assess whether the Technical and Managerial Response meets any standard or is responsive to all ITQ requirements. Eligible Mandatory Criteria are all mandatory technical criteria that are identified in this ITQ as being subject to the PRCP. Mandatory technical criteria that are not identified in the ITQ as being subject to the PRCP, will not be evaluated until Phase III.

(b) Canada will send a written notice to the Respondent (Compliance Assessment Report or "CAR") identifying any Eligible Mandatory Criteria that the Response has failed to meet. A Respondent

whose Response has been found responsive to the requirements that are reviewed at Phase II will receive a CAR that states that its Response has been found responsive to the requirements reviewed at Phase II. Such Respondent shall not be entitled to submit any response to the CAR.

(c) A Respondent shall have the period specified in the CAR (the "Remedy Period") to remedy the failure to meet any Eligible Mandatory Criterion identified in the CAR by providing to Canada in writing additional or different information or clarification in response to the CAR. Responses received after the end of the Remedy Period will not be considered by Canada, except in circumstances and on terms expressly provided for in the CAR.

(d) The Respondent's response must address only the Eligible Mandatory Criteria listed in the CAR as not having been achieved, and must include only such information as is necessary to achieve such compliance. Any additional information provided by the Respondent which is not necessary to achieve such compliance will not be considered by Canada, except that, in those instances where such a response to the Eligible Mandatory Criteria specified in the CAR will necessarily result in a consequential change to other parts of the Response, the Respondent shall identify such additional changes, provided that its response must not include any change to the Financial Response. The Respondent's response to the CAR should identify in each case the Eligible Mandatory Criterion in the CAR to which it is responding, including identifying in the corresponding section of the original Response, the wording of the proposed change to that section, and the wording and location in the Response of any other consequential changes that necessarily result from such change. In respect of any such consequential change, the Respondent must include a rationale explaining why such consequential change is a necessary result of the change proposed to meet the Eligible Mandatory Criterion. It is not up to Canada to revise the Respondent's Response, and failure of the Respondent to do so in accordance with this subparagraph is at the Respondent's own risk. All submitted information must comply with the requirements of this ITQ.

(e) Any changes to the Response submitted by the Respondent other than as permitted in this ITQ, will be considered to be new information and will be disregarded. Information submitted in accordance with the requirements of this ITQ in response to the CAR will replace, in full, only that part of the original Response as is permitted in this Section.

(f) Additional or different information submitted during Phase II permitted by this section will be considered as included in the Response, but will be considered by Canada in the evaluation of the Response at Phase II only for the purpose of determining whether the Response meets the Eligible Mandatory Criteria. It will not be used at any Phase of the evaluation to increase any score that the original Response would achieve without the benefit of such additional or different information. For instance, an Eligible Mandatory Criterion that requires a mandatory minimum number of points to achieve compliance will be assessed at Phase II to determine whether such mandatory minimum score would be achieved with such additional or different information submitted by the Respondent in response to the CAR. If so, the Response will be considered responsive in respect of such Eligible Mandatory Criterion, and the additional or different information submitted by the Respondent shall bind the Respondent as part of its Response, but the Respondent's original score, which was less than the mandatory minimum for such Eligible Mandatory Criterion, will not change, and it will be that original score that is used to calculate any score for the Response

(g) Canada will determine whether the Response is responsive for the requirements reviewed at Phase II, considering such additional or different information or clarification as may have been provided by the Respondent in accordance with this Section. If the Response is not found responsive for the requirements reviewed at Phase II to the satisfaction of Canada, then the Response shall be considered non-responsive and will receive no further consideration.

(h) Only Responses found responsive to the requirements reviewed in Phase II to the satisfaction of

Canada, will receive a Phase III evaluation.

5.2.1.4 Phase III: Final Evaluation of the Response

(a) In Phase III, Canada will complete the evaluation of all Responses found responsive to the requirements reviewed at Phase II. Responses will be assessed in accordance with the entire requirement of the ITQ including the technical and financial evaluation criteria.

(b) A Response is non-responsive and will receive no further consideration if it does not meet all mandatory evaluation criteria of the ITQ.

5.3 Financial Evaluation

Mandatory Evaluation Criteria:

Each Response will be reviewed for compliance with the Mandatory Evaluation Criteria outlined in the ITQ. Any element of the ITQ that is identified specifically with the words "must" or "mandatory" is a mandatory requirement. Responses that do not comply with each and every mandatory requirement will be declared non-responsive and will be disqualified.

The mandatory financial criteria are described in Attachment 1 to Part 5 Mandatory Evaluation Criteria.

The PRCP will apply to all mandatory financial evaluation criteria.

5.4 Technical and Managerial Evaluation

Mandatory Evaluation Criteria:

Each Response will be reviewed for compliance with the Mandatory Evaluation Criteria outlined in the ITQ. Any element of the ITQ that is identified specifically with the words "must" or "mandatory" is a mandatory requirement. Responses that do not comply with each and every mandatory requirement will be declared non-responsive and will be disqualified.

The mandatory technical and managerial criteria are described in Attachment 1 to Part 5 Mandatory Evaluation Criteria.

The PRCP will apply to all mandatory technical and managerial evaluation criteria.

5.5 Reference Checks

(a) It is the responsibility of the Respondent to confirm in advance that their customer reference provided for the project reference will be available to provide a response and is willing to provide a reference.

(b) For the purpose of this evaluation, reference checks may be used to verify and validate the Respondent’s response. If a reference check is performed, Canada will conduct the reference check in writing by e-mail. Canada will send the reference check request directly to the customer reference for the project reference provided by the Respondent. The customer reference will have three (3) working days (or a longer period otherwise specified in writing by the Contracting Authority) from the date that Canada's e-mail was sent, to respond to Canada.

(c) The customer reference will be required, within two (2) working days after Canada sends out the reference check request, to acknowledge the receipt of the reference check request and identify

his or her willingness and availability to conduct such reference check. If Canada has not received the required response from the customer reference, Canada will notify the Respondent by e-mail, to allow the Respondent to contact its customer reference directly to ensure that he or she responds to Canada within the allotted time. The customer reference's failure to respond to Canada's request in a timely manner will result in non-consideration of the Respondent's claimed project experience.

(d) Notwithstanding sections (b) and (c), if the customer reference is unavailable when required during the evaluation period, the Respondent will be requested to provide an alternate customer reference for the same referenced project. Respondents will only be provided with this opportunity once for each referenced project and only if the original customer reference is unavailable to respond. The process as described in (b) and (c) is applicable for the reference check with the alternate customer reference. The period to respond for either the original customer reference, or the alternate customer reference, will be a total of three (3) working days each (or a longer period otherwise specified in writing by the Contracting Authority) in accordance with (b).

(e) Wherever information provided by a customer reference differs from the information supplied by the Respondent, the Respondent will be asked to clarify project reference information provided in its ITQ response. Canada will assess the following information during the evaluation of the Respondent's response: the Respondent's original project reference information; any information provided by the Respondent in response to clarification request(s); and any information supplied by the customer reference for the referenced project.

(f) A Respondent will not meet the mandatory experience requirement if:

(i) the customer reference fails to respond to Canada's request in a timely manner;
(ii) the customer reference states he or she is unable or unwilling to provide the information requested;
(iii) the information provided by the Respondent cannot be verified and validated by Canada; or
(iv) the client is itself an affiliate or other entity that does not deal at arm's length with the Respondent.

(g) Whether or not to conduct reference checks is at Canada's sole discretion. However, if Canada chooses to conduct reference checks for any given mandatory requirement, it will check the references submitted for that requirement by each Respondent that has not, at that point, been found non-responsive.

5.6 Financial Viability Assessment

Respondents must be financially viable to enter into this Qualification process. To determine the Respondents' financial viability, the Contracting Authority may, by written notice to the Respondents, require the submission of some or all of the financial information detailed below during the evaluation of the Responses.

The Respondent must provide the following information to the Contracting Authority within three (3) working days of the request or as specified by the Contracting Authority in the notice:

(a) Audited financial statements, if available, or the unaudited financial statements (prepared by the Respondent's outside accounting firm, if available, or prepared in-house if no external statements have been prepared) for the Respondent's last three fiscal years, or for the years that the Respondent has been in business if this is less than three years (including, as a minimum, the Balance Sheet, the Statement of Retained Earnings, the Income Statement and any notes to the statements).

(b) If the date of the financial statements in (a) above is more than five months before the date of the request for information by the Contracting Authority, the Respondent must also provide, unless this is prohibited by legislation for public companies, the last quarterly financial statements (consisting of a Balance Sheet and a year-to-date Income Statement), as of two months before the date on which the Contracting Authority requests this information.

(c) If the Respondent has not been in business for at least one full fiscal year, the following must be provided:

(i) the opening Balance Sheet on commencement of business (in the case of a corporation, the date of incorporation); and

(ii) the last quarterly financial statements (consisting of a Balance Sheet and a year-to-date Income Statement) as of two months before the date on which the Contracting Authority requests this information.

(d) A certification from the Chief Financial Officer or an authorized signing officer of the Respondent that the financial information provided is complete and accurate.

If the Respondent is a joint venture, the financial information required by the Contracting Authority must be provided by each member of the joint venture.

If the Respondent is a subsidiary of another company, then any financial information in (a) to (d) above required by the Contracting Authority must be provided by the ultimate parent company.

The Respondent is not required to resubmit any financial information requested by the Contracting Authority that is already on file at PWGSC with the Price Support Directorate of the Procurement Support Services Sector, provided that within the above-noted time frame:

(i) the Respondent identifies to the Contracting Authority in writing the specific information that is on file and the requirement for which this information was provided; and

(ii) the Respondent authorizes the use of the information for this requirement.

It is the Respondent's responsibility to confirm with the Contracting Authority that this information is still on file with PWGSC.

Canada reserves the right to request from the Respondent any other information that Canada requires to conduct a complete financial capability assessment of the Respondent. The Respondent also understands that a complete financial capability review of the Respondent may also be conducted during the subsequent bid solicitation process.

Confidentiality: If the Respondent provides the information required above to Canada in confidence while indicating that the disclosed information is confidential, then Canada will treat the information in a confidential manner as permitted by the Access to Information Act, R.S., 1985, c. A-1, Section 20(1) (b) and (c).

Respondents must submit their financial statements for the legal entity outlined in their Response. Canada reserves the right to request further information if required.

5.7 Basis of Qualification

(a) A Response must comply with the requirements of the ITQ, meet all mandatory evaluation criteria as specified in this ITQ, to be declared responsive.

(b) Respondents whose responses are deemed responsive will be deemed Qualified Respondents and be provided with a conditional Letter of Support from CSA.

(c) Only information included within the Respondent's response, or clarified upon request and accepted by the Contracting Authority, will be evaluated. Reference material outside of the Respondent's response will not be considered. It is the sole responsibility of the Respondent to provide sufficient information so that their responses can be properly evaluated.

(d) Should there be no Qualified Respondents after the ITQ Phase, Canada reserves the right to cancel any subsequent phases of the procurement process or to modify the requirements of the ITQ phase and re-publish the solicitation using the same or a different approach.

(e) Canada reserves the right to re-evaluate the qualification of any Qualified Respondent at any time during the procurement process. If information comes to the attention of Canada that calls into question any of the Qualified Respondent's qualifications under this ITQ, Canada may re-evaluate that Qualified Respondent. For example, if the Respondent's security clearance changes or lapses, so that the Respondent no longer meets the requirements of the ITQ, Canada may disqualify the Qualified Respondent. If Canada re-evaluates the qualification of any Qualified Respondent, Canada may request further information and, if the Qualified Respondent fails to provide it within two (2) working days (or a longer period provided by the Contracting Authority), Canada may disqualify the Qualified Respondent.

(f) Unsuccessful Respondents will not be given another opportunity to participate or be re-evaluated for the subsequent phases of the procurement process, unless Canada determines, in its sole discretion, that the circumstances require such a change.

(g) Canada reserves the right, in its sole discretion, to conduct a second qualification round among the unsuccessful Respondents if the first qualification round results in no Qualified Respondents. Should Canada elect not to conduct a second qualification round among the unsuccessful Respondents, Canada reserves the right to cancel any subsequent phases of the procurement process or to modify the requirements of the ITQ phase and re-publish the solicitation using the same or a different approach.

(h) If Canada determines that unsuccessful Respondents will be given a second opportunity to qualify, Canada will send written information to each unsuccessful Respondent regarding the reasons that Respondent was unsuccessful during the first qualification round, on the same day to all unsuccessful Respondents.

(i) Any Respondent who does not qualify as a result of any second qualification round conducted by Canada will not be given another opportunity to participate or be re-evaluated for any subsequent phase of this procurement process.

(j) The Contracting Authority will inform each Respondent in writing to notify them on whether or not they have qualified for a subsequent phase of the procurement process.

(k) Canada will also publish the list of Qualified Respondents on BuyandSell. Canada may not publish this list until after contract award.

PART 6 – CERTIFICATIONS AND ADDITIONAL INFORMATION

Respondents must provide the required certifications and additional information to be declared a Qualified Respondent.

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

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

6.1 Certifications Required with the Response

Respondents must submit the following duly completed certifications as part of their Response.

(a) **Integrity Provisions - Declaration of Convicted Offences**

In accordance with the Integrity Provisions of the Standard Instructions, all Respondents must provide with their Response, 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.

6.2 Certifications Precedent to Next Procurement Phase

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

(a) **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 Respondent must provide the required documentation, as applicable, to be given further consideration in the procurement process.

(b) **Federal Contractors Program for Employment Equity - Response Certification**

By submitting a Response, the Respondent certifies that the Respondent, and any of the Respondent's members if the Respondent 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 Response non-responsive if the Respondent, or any member of the Respondent if the Respondent is a Joint Venture, appears on the "FCP Limited Eligibility to Bid list during any subsequent procurement phase.

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 Respondent must provide the Contracting Authority with a completed annex titled Federal Contractors Program for Employment Equity - Certification, before the next procurement phase. If the Respondent is a Joint Venture, the Respondent must provide the Contracting Authority with a completed Attachment 1 to Part 6 Federal Contractors Program for Employment Equity - Certification, for each member of the Joint Venture.

6.3 Additional Certifications Precedent to the Next Procurement Phase

(a) **Canadian Content Certification**

This procurement is limited to Canadian goods and Canadian services.

The Respondent certifies that:

( ) a minimum of 80 percent of the total firm, all-inclusive Mission Cost estimate, custom duties included and Applicable Taxes extra, consist of Canadian goods and Canadian services as defined in paragraph 5 of clause A3050T. For more information on how to determine the Canadian content for a mix of goods, a mix of services or a mix of goods and services, consult Annex 3.6, Example 2, of the Supply Manual.

(i) *SACC Manual* clause A3050T (2020-07-01) Canadian Content Definition

(b) **Status and Availability of Resources**

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

(c) **Education and Experience**

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

PART 7 - SECURITY, FINANCIAL AND OTHER REQUIREMENTS

7.1 Security Requirements

(a) There are no security requirements for the ITQ. A Respondent is not required to have security clearance in order to become a Qualified Respondent.

(b) Security clearance and other security requirements will be identified in any resulting RFP.

(c) If security requirements are identified in any resulting RFP, Bidders are reminded to obtain the required security clearance promptly, if applicable. Any delay in the award of a resulting contract to allow the successful Bidder to obtain the required clearance will be at the entire discretion of the Contracting Authority.

(d) For additional information on security requirements, Respondents should refer to the Contract Security Program of Public Works and Government Services Canada (http://www.tpsgc-pwgsc.gc.ca/escsrc/introduction-eng.html) website.

7.2 Controlled Goods Requirement

SACC Manual clause A9130T (2019-11-28) Controlled Goods Program

PART 8 - RESULTING CONTRACT CLAUSES

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

8.1 Statement of Work

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

8.2 Work Authorization

8.2.1 Work Authorization – PRELIMINARY DESIGN PHASE (PHASE B)

Despite any other condition of the Contract, the Contractor is only authorized to perform the Work required to complete Systems Requirement Review, of the Contract as specified in Section 4.4 of the Statement of Work (insert "at a cost not to exceed $_____ ", if applicable). Upon completion of Systems Requirement Review, the Work will be reviewed before the Contractor is authorized to commence any Work for Phase B. Depending on the results of the review and evaluation of the Work, Canada will decide at its discretion whether to continue with the Work.

If Canada decides to continue with Phase B, the Contracting Authority will advise the Contractor in writing to commence work as specified in Section 5 of the Statement of Work. The Contractor must immediately comply with the notice.

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

8.2.2 Work Authorization – DETAILED DESIGN PHASE (PHASE C)

If Canada decides to continue with the Phase B, despite any other condition of the Contract, the Contractor is only authorized to perform the Work required to complete the Phase B of the Contract as specified in Section 5.7 of the Statement of Work (insert "at a cost not to exceed $_____ ", if applicable). Upon completion of the Preliminary Design Review, the Work will be reviewed before the Contractor is authorized to commence any Work for the Phase C. Depending on the results of the review and evaluation of the Work, Canada will decide at its discretion whether to continue with the Work.

If Canada decides to continue with the Phase C, the Contracting Authority will advise the Contractor in writing to commence work as specified in Section 6 of the Statement of Work. The Contractor must immediately comply with the notice.

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

8.2.3 Work Authorization – MANUFACTURING, INTEGRATION AND TEST (PHASE D)

If Canada decides to continue with the Phase C, despite any other condition of the Contract, the Contractor is only authorized to perform the Work required to complete the Phase C of the Contract as specified in Section 6.11 of the Statement of Work (insert "at a cost not to exceed $_____ ", if applicable). Upon completion of the Critical Design Review, the Work will be reviewed before the Contractor is authorized to

commence any Work for the Phase D. Depending on the results of the review and evaluation of the Work, Canada will decide at its discretion whether to continue with the Work.

If Canada decides to continue with the Phase D, the Contracting Authority will advise the Contractor in writing to commence work as specified in Section 7 of the Statement of Work. The Contractor must immediately comply with the notice.

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

8.2.4 Work Authorization – OPERATIONS (PHASE E)

If Canada decides to continue with the Phase D, despite any other condition of the Contract, the Contractor is only authorized to perform the Work required to complete the Phase D of the Contract as specified in Section 7.9 of the Statement of Work (insert "at a cost not to exceed $_____ ", if applicable). Upon completion of the Acceptance Review and Pre-Ship Review, the Work will be reviewed before the Contractor is authorized to commence any Work for the Phase E. Depending on the results of the Acceptance Review, Pre-Ship Review, and evaluation of the Work, Canada will decide at its discretion whether to continue with the Work.

If Canada decides to continue with the Phase E, the Contracting Authority will advise the Contractor in writing to commence work as specified in Section 8 of the Statement of Work. The Contractor must immediately comply with the notice.

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

8.3 Standard Clauses and Conditions

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

8.3.1 General Conditions

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

8.3.2 Supplemental General Conditions

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

8.4 Security Requirements

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

(to be inserted at Phase 2- RFP, if applicable)

8.4.2 Contractor's Sites or Premises Requiring Safeguarding Measures

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

(to be inserted at contract award)
Street Number / Street Name, Unit / Suite / Apartment Number
City, Province, Territory / State
Postal Code / Zip Code
Country

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

8.5 Non-disclosure Agreement

The Contractor must obtain from its employee(s) or subcontractor(s) the completed and signed non-disclosure agreement, attached at Annex "D" *(to be inserted at Phase 2- RFP)*, 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.

8.6 Term of Contract
8.6.1 Period of the Contract

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

8.7 Authorities
8.7.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Sameer Ali Abbasi
Title: Contracting Specialist
Public Works and Government Services Canada
Acquisitions Branch
Directorate: Space Programs and Procurement Directorate

Address: Terrasses de la Chaudière, 4th Floor
10 Wellington Street
Gatineau, Quebec
K1A 0S5

Telephone: 873-354-4921

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

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

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

The Project Authority for the Contract is:

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

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

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

8.7.3 Technical Authority *(to be inserted at contract award)*

The Technical Authority for the Contract is:

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

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

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.

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

The Contractor's Representative for the Contract is:

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

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

8.8 Proactive Disclosure of Contracts with Former Public Servants

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

8.9 Payment

8.9.1 Basis of Payment

8.9.1.1 For the work described in the Statement of Work at Annex A:

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B *(to be completed at Phase 2 - RFP)* for a cost of *$ _____(to be inserted at contract award)*. Customs duties are included and Applicable Taxes are extra.

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

8.9.2 Milestone Payments - Subject to Holdback

1. Canada will make milestone payments in accordance with the Schedule of Milestones detailed in Annex B, Basis of Payment and the payment provisions of the Contract, up to 90 percent of the amount claimed and approved by Canada if:

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

   b. the total amount for all milestone payments paid by Canada does not exceed 90 percent of the total amount to be paid under the Contract;

   c. all the certificates appearing on form PWGSC-TPSGC 1111 have been signed by the respective authorized representatives;

   d. all work associated with the milestone and as applicable any deliverable required have been completed and accepted by Canada.

2. The balance of the amount payable will be paid in accordance with the payment provisions of the Contract upon completion and delivery of all Work required under the Contract if the Work has been accepted by Canada and a final claim for the payment is submitted.

8.9.3 SACC Manual Clauses

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

8.9.4 Electronic Payment of Invoices – Contract *(if accepted by the Contractor in its bid at Phase 2 - RFP)*

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

a. Visa Acquisition Card;

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

8.10 Invoicing Instructions

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

   Each claim must show:

   a. all information required on form PWGSC-TPSGC 1111;

   b. all applicable information detailed under the section entitled "Invoice Submission" of the general conditions;

   c. the description and value of the milestone claimed as detailed in the Contract.

2. Applicable Taxes must be calculated on the total amount of the claim before the holdback is applied. At the time the holdback is claimed, there will be no Applicable Taxes payable as it was claimed and payable under the previous claims for progress payments.

3. The Contractor must:

   i. Prepare and certify one (1) original of the claim form PWGSC-TPSGC 1111 and send a PDF copy by e-mail to the Contracting, Project, and Technical Authorities as identified under sub-articles 7.5.1, 7.5.2, and 7.5.3 of the contract with copy to the following CSA e-mail address: asc.facturation-invoicing.csa@canada.ca;

   ii. If mailed, the Contractor must prepare and certify **one (1) original and two (2) copies** of the claim form PWGSC-TPSGC 1111, and forward **one (1) copy** to the Contracting Authority and **one (1) original and one (1) copy** to CSA's Financial Services using the following mailing address for appropriate certification by the Project Authority or Technical Authority identified herein after inspection and acceptance of the Work takes place:

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

   The Project Authority or Technical Authority will then forward the original and one (1) copy of the claim to the Contracting Authority for certification and onward submission to the Payment Office for the remaining certification and payment action.

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

8.11 Certifications and Additional Information

8.11.1 Compliance

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

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

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

8.11.3 *SACC Manual* Clauses

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

8.12 Applicable Laws

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

8.13 Priority of Documents

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

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

8.14 Foreign Nationals (Canadian Contractor)

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

8.15 Insurance

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

8.16 Shipping Instructions – Delivered Duty Paid

Goods must be consigned and delivered to the destination specified in the contract:

Incoterms 2000 “DDP Delivered Duty Paid” CSA St-Hubert, Quebec where the Contractor deliverables are to be shipped to the CSA and Incoterms 2000 “DDP Delivered Duty Paid” United States location where operations are to be performed, the designated ground support facility, NASA or the NASA payload provider preparation facility (to be determined) where the Contractor deliverables are to be shipped to either the United States location where operations are to be performed, the designated ground support facility, NASA or the NASA payload provider preparation facility (to be determined).

8.17 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”.

8.18 Canadian Space Agency’s Directive on Communications with the Media

1. Definitions

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

2. Communication Activities Format

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

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

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

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

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

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

3. Communication Activity Coordination Process

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

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

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

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

ANNEX A
STATEMENT OF WORK

The Statement of Work (SOW) for Lunar Exploration Accelerator Program (LEAP) Science Instruments - Phases ABCDEF, initial release, dated September 8, 2021 appended to the bid solicitation is to be inserted at this point and forms part of the document.

ATTACHMENT 1 TO PART 4 - FINANCIAL RESPONSE PREPARATION INSTRUCTIONS

The document Financial Response Preparation Instructions (Attachment 1 to Part 4) appended to the ITQ is to be inserted at this point and forms part of this document.

ATTACHMENT 2 TO PART 4 - ANTICIPATED REQUIREMENTS FOR BID SOLICITATION

It is anticipated that any future bid solicitation will include the MANDATORY requirements detailed in this attachment.

By submitting a Response to this ITQ, the Respondent certifies, acknowledges and agrees that:

( ) the maximum funding for the LEAP Science Instrument (LSI) Phases A, B, C, D, E, F for both missions is $16.9M Canadian Dollars (CAD), Applicable Taxes extra, with $5.6M CAD, Applicable Taxes extra, for the South Polar mission and $11.3M CAD, Applicable Taxes extra, for the Gruithuisen Domes mission. As a result of the anticipated maximum funding available for both missions, the total investigation costs will also be required to include an option(s) to descope the work for the South Polar delivery location of up to $2.8M CAD, Applicable Taxes extra, and for the Gruithuisen Domes delivery location of up to $5.5M CAD, Applicable Taxes extra.

( ) The Respondent accepts the clauses and conditions of any resulting contract as specified in Part 8 - Resulting Contract Clauses for the LEAP Science Instrument (LSI) for Phases A through F.

( ) There are no redundant costs for work already covered under another contract(s) with Canada or with any other company. If the proposed scientific instruments are currently being developed or were developed under a separate contract with Canada, the difference between the work carried out in such contract(s) and the proposed incremental work should be clearly explained as specified in Attachment 1 to Part 4 - Financial Response Preparation Instructions.

Respondents are required to acknowledge that they have read and understand the anticipated mandatory requirements listed above in this attachment by signing below and including a signed copy of this attachment in their response.

On behalf of the Respondent, I confirm that I have read, understood and agree to the anticipated mandatory requirements detailed in this attachment entitled, Anticipated Requirements for Bid Solicitation.

Authorized representative of Respondent

Name: _____

Title: _____

Signature: _____

Date: _____

ATTACHMENT 3 TO PART 4: FORM 1: ITQ SUBMISSION FORM

Respondent's full legal name	
(a)	
Respondent's Procurement Business Number	
(b)	
Authorized Representative of Respondent for evaluation purposes (e.g. clarifications)	
(c)	Name:
	Title:
	Address:
	Telephone #:
	Email:
If submitting a response to the ITQ as a joint venture, the Respondent must provide each joint venture member's full legal name and address [*Respondent to add more rows if more than two (2) joint venture members*]	
(d)	Joint venture member full legal name:
	Joint venture member address:
(e)	Joint venture member full legal name:
	Joint venture member address:
Canada's Official Language in which the Respondent will communicate with Canada during the ITQ process – indicate either English or French	
(f) ☐ **English** ☐ **French**	
(e) Jurisdiction of any resulting document(s): Province or territory in Canada the Respondent wishes to be the legal jurisdiction applicable to any resulting contract (if other than as specified in ITQ)	
ITQ Submission Requirements: It is the Respondent's sole responsibility to ensure their response addresses all requirements outlined in the ITQ.	
Respondent Authorization	
(h)	Name:
	Address:
	Email:
	Signature of authorized representative of Respondent
	Telephone #:
	Date:

ATTACHMENT 4 TO PART 4: FORM 2: PROJECT REFERENCE CHECK FORM

(a)	**Mandatory Requirement Number (from Attachment 1 to Part 5 Mandatory Evaluation Criteria)**		
(b)	Respondent Full Legal Name (if the Respondent is a joint venture, the full legal name of the joint venture member for the referenced project)		
(c)	Description of the referenced project, success achieved, services provided and the date(s) and period of time the services were provided		
(d)	Name of client organization for the referenced project and size of the client's organization, including number of employees and locations		
(e)	Name of customer reference for the referenced project		
(f)	Client organization and customer reference affiliation with the Respondent (or joint venture member)		
	Please indicate accordingly	Are Not Affiliated	Are Affiliated
(g)	Name of organization the customer reference is currently working for (if the customer reference is no longer working for the client organization identified for the referenced project)		
(h)	Title of customer reference (while working on the referenced project)		
(i)	Current telephone number of customer reference		
(j)	Current e-mail address of the customer reference		
(k)	Role of the customer reference in the referenced project		

ATTACHMENT 1 TO PART 5: MANDATORY EVALUATION CRITERIA

1. Mandatory Requirements

(a) Respondents must meet all of the mandatory requirements in this Attachment 1 to Part 5 Mandatory Evaluation Criteria. In accordance with Part 5 - Evaluation Procedures and Basis of Qualification of the ITQ, Canada may contact the customer reference for the referenced project(s) to validate Respondent's responses. Responses will be assessed in accordance with the entire requirement of the ITQ including the mandatory evaluation criteria.

1.2 Substantiation of Technical and Managerial Compliance – Mandatory Evaluation Criteria

(a) Respondents must respond to the corresponding mandatory requirements explaining, demonstrating, substantiating and justifying their experience and qualifications. Respondents are requested to utilize the unique number and associated title of each mandatory requirement in their responses. Respondents are requested to indicate where each mandatory requirement is met in their response by entering a reference to where it is located in their response (e.g. volume/binder number, page number, etc.). Respondent's responses to the mandatory requirements will be evaluated in accordance with Section 5.4.

(b) Respondents are requested to submit a completed "Attachment 4 to Part 4: Form 2 – Project Reference Check Form", for each project referenced in response to a corresponding mandatory requirement(s).

(c) Respondents must provide the minimum number of reference project(s) indicated in each mandatory requirement. If more than the required number of reference project(s) is provided, Canada will decide in its discretion which projects will be evaluated.

(d) Criteria Number M1 to M10 in Attachment 1 to Part 5 - Mandatory Evaluation Criteria include an overall page limit suggestion of 25 pages as a guidance to Respondents for the preparation of Section I: Technical and Managerial Response. This overall page limit suggestion excludes the forms required as per the ITQ, CVs, and the appendices and attachments specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions. However, if the overall page limit suggestion is exceeded for the applicable criteria number M1 to M10, Canada will still take into consideration any information provided in any pages in excess of the overall page limit suggestion as set out for the applicable criteria number M1 to M10 shown in Attachment 1 to Part 5 – Mandatory Evaluation Criteria in the evaluation of the Response.

1.3 Substantiation of Financial Compliance – Mandatory Evaluation Criteria

(a) Respondents must respond to the corresponding mandatory requirements explaining, demonstrating, substantiating and justifying their experience and qualifications. Respondents are requested to utilize the unique number and associated title of each mandatory requirement in their responses. Respondents are requested to indicate where each mandatory requirement is met in their response by entering a reference to where it is located in their response (e.g. volume/binder number, page number, etc.). Respondent's responses to the mandatory requirements will be evaluated in accordance with Section 5.3.

(b) The Respondent's response must include a signed copy of Attachment 2 to Part 4 - Anticipated Requirements for Bid Solicitation acknowledging that the Respondent has read and understood that Attachment 2 to Part 4 - Anticipated Requirements for Bid Solicitation are mandatory requirements that are expected to be included and evaluated as part of the Bidding Phase.

Science Merit and Alignment With Canadian Science Priorities		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment
M1	The Respondent must demonstrate that the scientific objectives pursued with the proposed instrument are aligned with one or more Canadian science priorities (RD-01). To demonstrate that it meets this requirement, the Respondent must provide an explanation, supported by a literature review, on how the proposed instrument is aligned with one or more Canadian science priorities as presented in the Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond (2017, RD-01).	Met / Not Met
M2	The Respondent must demonstrate that the investigation would advance knowledge in the proposed scientific discipline. To demonstrate that it meets this requirement, the Respondent must provide an explanation, supported by a literature review, to the effect that if the science objectives are met, the science return will be of merit and that the study is new and original, and has the potential to impact the science discipline.	Met / Not Met
M3	The Respondent must demonstrate that the proposed science instrument is suitable for the investigation. To demonstrate that it meets this requirement, the Respondent must provide an explanation, supported by a literature review to describe the appropriateness of the science instrument needed to reach the science objectives.	Met / Not Met
Organization Capacity		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment

M4	The Respondent must demonstrate that it has provided space research and development services in the space sector to at least two organizations in the past seven (7) years from the date of ITQ closing. To demonstrate that it meets this requirement, the Respondent must provide a minimum of **2 project examples** as required by Attachment 4 to Part 4 - Form 2: Project Reference Check Form, with references for the organizations where research and development services in the space sector were provided within the past 7 years from the date of ITQ closing.	Met / Not Met
Technology Feasibility		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment
M5	The Respondent must provide the current Technology Readiness Level (TRL) of the science instrument and explain, with credible arguments, the proposed path to reach TRL 9 during the PRISM timeframe. To demonstrate that it meets this requirement, the Respondent must provide a current assessment of the proposed instrument TRL that is supported by a review of previous work. It must also provide a coherent TRL roadmap for the science instrument that explains the work that would be conducted to develop all critical systems. A definition of the TRL levels is found in CSA Technology Readiness and Assessment Guidelines (2019, AD-01).	Met / Not Met
Science Feasibility		

M6	The Respondent must provide the current Science Readiness Level (SRL) of the science instrument and explain, with credible arguments, the proposed path to reach SRL 9 during the PRISM timeframe. To demonstrate that it meets this requirement, the Respondent must provide a current assessment of the proposed instrument SRL that is supported by a review of previous work. It must also provide a coherent SRL roadmap for the science instrument that explains the work that would be conducted within each SRL to reach SRL 9. A definition of the SRL levels is found in CSA SE Scientific Readiness Level Guidelines (2019, AD-03).	Met / Not Met
Team Capability		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment
M7	The Respondent must demonstrate that it has the qualifications, expertise, and experience of delivering similar projects in the space sector. The proposed team, along with the key roles and responsibilities of each team member, must be suitable to manage a project of this size, scope, and complexity. The Respondent must include the following **information** at a minimum: 1. The availability of the key technical, scientific and managerial expertise as required to undertake the proposed project. 2. The team's technical, scientific and managerial expertise and qualifications as required to execute the project, supported by CVs. 3. A description of the team's experience and ability to manage and complete similar projects.	Met / Not Met
Project Implementation Plan		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment

M8	The Respondent must demonstrate that the completeness and effectiveness of its proposed implementation plan will lead the project to successful completion. To demonstrate that it meets this requirement, the Respondent must provide an **Implementation Plan** that is complete, well defined and coherent. The Implementation Plan must include: 1. A description of the methodology that is logical and well suited for the proposed work to be carried out; 2. A schedule including milestones for the instrument development and the overall mission; 3. A Work Breakdown Structure including Work Packages as specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions; 4. A resource allocation matrix, including sub-contractors; and 5. A description of all identified risks known at this stage (likelihood and impact matrix) along with mitigation strategies (CSA TRRA guidelines [AD-01]).	Met / Not Met
Gender and Diversity		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment
M9	The Respondent must demonstrate that its organization has a Gender and Diversity Plan. The Respondent must provide their organization's **Gender and Diversity Plan** that demonstrates the Respondent's approach to ensuring diversity by striving to achieve representation in the Respondent's organization, within the senior management structure and working level of designated groups as defined in the Employment Equity Act (women, persons with disability, Indigenous Peoples, visible minorities).	Met / Not Met
Socio Economic Development Benefits		
Criteria Number	Mandatory Technical Evaluation Criteria	Assessment

M10	The Respondent must demonstrate if and how a contract with the Government of Canada could provide socio economic benefits for at least one of the following: social enterprises[1] and/or small businesses (a company of less than 100 employees employed in Canada), including indigenous businesses. The Respondent must supply a presentation or a plan describing the socio economic benefits for at least one of the following: social enterprises[1] and/or small businesses (a company of less than 100 employees employed in Canada), including indigenous businesses. **Social Enterprise[1]** Social enterprise is a business model that seeks to achieve social, cultural or environmental objectives through the sale of goods and services. A social enterprise can be for-profit or non-profit as long as the majority of net profits is directed toward the achievement of a social benefit in its community (e.g., reducing environmental impacts of its products, creating jobs or providing training opportunities for the unemployed, or providing healthcare, etc.) with limited distribution to shareholders and owners.	Met / Not Met
Mission Cost		
Criteria Number	Mandatory Financial Evaluation Criteria	Assessment

M11	The Mission Cost estimate must be completed as per the Cost Breakdown Structure Template (Attachment A).
	
	The Respondent's submission must be a total firm, all-inclusive Mission Cost estimate in Canadian dollars, Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included, for the work to be performed for all phases of the LSI project in alignment with other components of the Response. As specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions, the Mission Cost estimate:
	
	• The Respondent must provide a Mission Cost Estimate with a BoE for Phases A, B and C at Level 1 CBS by submitting the completed Attachment A-2;
	  ○ The components of the Response must be well justified providing insight on the method of development of the estimate.
	  ○ The components of the Response must give confidence in the feasibility of the investigation remaining within budget.
	  ○ The estimates must be developed using one of the following estimating methods: Parametric Estimating, Analogous Cost, Delphi Cost Estimation, or Bottoms-Up
	
	• The Respondent must provide an Indicative Estimate for Phases D, E and F at Level 1 CBS by submitting the completed Attachment A-2.
		Met / Not Met

M12	As specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions, The Respondent must demonstrate that the Mission Cost Estimate: • Include the 20% cost reserve; • Will not exceed the $5.6M CAD, Applicable Taxes extra, for the South Polar mission or $11.3M CAD, Applicable Taxes extra, for the Gruithuisen Domes mission.	Met / Not Met

M13	As specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions, The Respondent must submit a descoping option using Attachment A-3 which: Will not exceed the cost limits set by Canada in Table-1 for the applicable delivery location.	Met / Not Met
M14	As specified in Attachment 1 to Part 4 – Financial Response Preparation Instructions, the Respondent's cost estimate adheres to the following Ground Rules and Assumptions: • All estimated costs include inflation. • The CAD values shown in the third column of Table 1 of Section 1.2 of the ITQ are based on an exchange rate of 0.80 CAN$/US$ and will remain unchanged regardless of any changes to the CAN$/US$ exchange rate in the future. • Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included. • Include mark-ups and profits. All and any other material assumptions must be documented in the Respondent's ITQ submission.	Met / Not Met

ATTACHMENT 1 TO PART 6: FEDERAL CONTRACTORS PROGRAM FOR EMPLOYMENT EQUITY – CERTIFICATION

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

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

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

Complete both A and B.

A. Check only one of the following:

( ) A1. The Respondent certifies having no work force in Canada.

( ) A2. The Respondent certifies being a public sector employer.

( ) A3. The Respondent certifies being a federally regulated employer being subject to the Employment Equity Act.

( ) A4. The Respondent certifies having a combined work force in Canada of less than 100 permanent full-time and/or permanent part-time employees.

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

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

OR

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

B. Check only one of the following:

( ) B1. The Respondent is not a Joint Venture.

OR

( ) B2. The Respondent is a Joint venture and each member of the Joint Venture must provide the Contracting Authority with a completed Attachment 1 to Part 6 Federal Contractors Program for Employment Equity - Certification. (Refer to the Joint Venture section of the Standard Instructions)

Canadian Space Agency | Agence spatiale canadienne

CSA-LEAP-SOW-0003

Canadian Space Agency

Lunar Exploration Accelerator Program Science Instruments (LSI)

Phase ABCDEF Statement of Work (SOW)

Draft - ITQ

8 September, 2021

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REVISION HISTORY

Rev.	Description	Initials	Date
Draft ITQ	Initial draft release to support the ITQ		2021-09-08

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 PURPOSE

This draft Statement of Work (SOW) provides potential responders to Invitation To Qualify (ITQ) 9F052-200589/B with a comprehensive description of the Programmatic, Engineering, and Safety and Mission Assurance tasks that must be accomplished by any chosen qualified supplier, once a contract for the development and build of a Lunar Accelerated Exploration Program (LEAP)s Science Instrument (LSI) has been awarded.

This SOW supplements the agreement made with the partnered NASA payload provider as accepted by Payloads and Research Investigations on the Surface of the Moon (PRISM)(AD-09. This SOW is also in addition to the requirements imposed by PRISM (AD-06), and CLPS platform and spacecraft requirements (AD-10).

A revised version of this SOW will be issued as part of a bid solicitation for an actual contract.

1.2 BACKGROUND AND CONTEXT

In February 2019, the Government of Canada announced the Lunar Exploration Accelerator Program (LEAP) as part of a new National Space Strategy to “position Canada’s commercial space sector to help grow the economy and create the jobs of the future”. The Federal Budget 2019 confirmed that the Canadian Space Agency (CSA) can access up to $150 M over five years starting in 2019-20 for LEAP to “help small and medium-sized enterprises develop new technologies to be used and tested in lunar orbit and on the Moon’s surface”.

The strategy enables Canada and its space sector to grow the economy and create the jobs of the future by advancing science, developing and demonstrating space technologies and participating in new commercial and science mission opportunities linked to our participation in lunar exploration while generating benefits for Canadians in space and on Earth.

Concurrently National Aeronautics and Space Administration NASA is soliciting proposals for Payloads and Research Investigations on the Surface of the Moon (PRISM) for investigations that include the development and flight of science-driven suites of instrument payloads. These will be delivered to the lunar surface by a Commercial Lunar Payload Services (CLPS) provider. This PRISM call is for science investigations that will be delivered to the lunar surface to predetermined lunar landing sites.

These deliveries will go to either a South Polar location targeted between Q4 2025 and early Q1 2026 , or the Gruithuisen Domes in the Northern Hemisphere (Mare Imbrium) between Q1 and Q2 2025. Mobility, via a rover, is expected to be available as a service to the Gruithuisen Domes delivery, whereas the South Polar delivery will be on a static lander. The landers and rovers are not expected to survive more than a single lunar days (9-10 Earth days).

The work to be completed by the Canadian instrument provider(s) will be funded through CSA on a no-exchange-of-fund basis, contingent upon execution of an implementing Agreement between the U.S and Canada. The CSA will negotiate an Implementing Agreement with NASA during the Phase A. However, it is at the discretion of the Contractor as to whether or not it is necessary to enter into any arrangements with the NASA payload provider in order to meet the requirements of this SOW.

The Work, through this Statement of Work (SOW), will focus on scientific instruments that will be mounted and fully operational on a rover, or on a lander.

1.3 OBJECTIVE

The objective of the LSI program is to design, build, test, and then deliver the LSI to the NASA payload provider for integration within the PRISM payload. Once integrated, the Contractor must support the NASA payload provider throughout integration with the NASA/CLPS provider for transport to the moon; followed by support to lunar surface operations.

The Work to be performed in each of the LSI program phases is:

Phase A:

1. Review the instrument concept and determine the detailed system requirements;
2. Phase end review: SRR or SDR

Phase B:

1. From the system requirements, develop the preliminary design;
2. Phase end review: Preliminary Design Review (PDR)

Phase C:

1. Mature the preliminary design into a detailed design;
2. Perform necessary development testing;
3. Phase end review: Critical Design Review (CDR)

Phase D:

1. Complete the build and qualification/acceptance testing of the protoflight model (PFM);
2. Demonstrate the ability for operations using the CSA Exploration Development Operations Centre (ExDOC) facility;
3. Deliver the accepted instrument to the NASA payload provider for integration within the payload;
4. Support the NASA payload provider throughout the integration with the CLPS provider platform (rover or lander);
5. Support launch processing;;
6. Phase end review: (Flight Readiness Review) FRR;

Phase E:

1. Commission the instrument;
2. Perform lunar surface operations during one lunar day ;
3. Decommission instrument;

Phase F:

1. Analyse science data;
2. Create, submit, and publish science and research findings as per PRISM requirements;

3. Close the project;

Throughout all of these phases, the Contractor must support reviews as required by the NASA payload provider (AD-10), PRISM (AD-06), and CLPS (AD-10).

The primary goal as defined in this SOW is to generate the activities, development and delivery of an instrument to be integrated with a NASA payload provider under the umbrella of PRISM. In addition, preparatory Work is required to define and support the follow on operations and scientific reporting in the form of documents, meetings, reviews and other means of communication to attain the objective stated above.

1.4 SCOPE

This SOW defines the Work to be performed for Phases ABCDEF of a scientific instrument contribution to a potential future NASA-led lunar surface mission. The requirements and deliverables as well as the scientific, technical, programmatic, and administrative tasks to be performed during Phases ABCDEF are also described. Included in the scope of this SOW is the Work resulting from the agreements made with the NASA payload provider (AD-09); the PRISM call for science investigations that will be delivered to the lunar surface (AD-06); and integration with the CLPS provided platform and spacecraft (AD-10).

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 following list:

1. This SOW;
2. the PRISM call for science investigations that will be delivered to the lunar surface (AD-06);
3. the CLPS platform and spacecraft requirements document (AD-10);
4. the NASA payload provider and LSI agreement (AD-09);

1.5 DOCUMENT CONVENTIONS

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

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

2 DOCUMENTS

2.1 APPLICABLE DOCUMENTS (AD)

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

The following documents of the exact issue date and revision level shown are applicable and form an integral part of this document to the extent specified herein; they can be obtained from the File Transfer Protocol (FTP) links provided in Table 2-1.

TABLE 2-1 – APPLICABLE DOCUMENTS

AD No.	Document Number	Document Title	Rev. No.	Date
AD-01	CSA-ST-GDL-0001	CSA Technology Readiness and Assessment Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/CSA-ST-GDL-0001 - TRRA Guidelines//	D	Mar, 2019
AD-02	CSA-ST-FORM-0003	Critical Technology Element (CTE) Identification Criteria Worksheet ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/CSA-ST-FORM-0003 - Critical Technologies Elements (CTE) Identification Worksheet/	B	Mar, 2019
AD-03	CSA-SPEX-GDL-0001	CSA SE Scientific Readiness Level Guidelines ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Science-Definition-Studies/2017	Draft 2.0	June, 2017
AD-04	CSA-SE-STD-0001	CSA Systems Engineering Technical Reviews Standard ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/CSA-SE-STD-0001 - Technical Reviews Standards/	B	May, 2020
AD-05	CSA-SMA-RD-0009	CSA Generic Product Assurance Requirements (PAR) – Class C	P1	June, 2021
AD-06	NSPIRES - Solicitations Summary (nasaprs.com)	F.10 Payloads and Research Investigation on the Surface of the Moon https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7bAD1DEAD1-7060-2C93-8CD1-780AF8FC9D54%7d&path=&method=init	Latest	
AD-07		*reserved*		
AD-08		*reserved*		

AD No.	Document Number	Document Title	Rev. No.	Date
AD-09	TBD	NASA payload provider and LSI agreement		
AD-10	TBD	CLPS platform and spacecraft requirements document		
AD-11	CSA-SE-PR-0001	System Engineering Methods and Practices	C	May 2020
AD-12	GSFC-STD-7000A	General Environments Verification Standard	A	August 2013
AD-13	CSA-SE-GDL-IR	SE Mission Tailoring Guidelines	IR	July 2020
AD-14		*reserved*		

2.2 REFERENCE DOCUMENTS

The following documents provide additional information or guidelines that either may clarify the contents or are pertinent to the history of this document. Some links to the documents are provided in Table2-2, a copy of the other documents can be provided upon request to CSA.

TABLE2-2 – REFERENCE DOCUMENTS

RD	Document Number/Source	Revision	Title	Date
RD-01	ftp://ftp.asc-csa.gc.ca/users/ExP/pub/Publications/Science%20Priority%20Reports/		Canadian Space Exploration - Science and Space Health Priorities for Next Decade and Beyond	2017
RD-02	https://www.globalspaceexploration.org/wordpress/	3rd version	Global Exploration Roadmap (GER)	2018
RD-03	https://www.nasa.gov/content/commercial-lunar-payload-services		NASA Commercial Lunar Payload Services website	
RD-04	https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32600		Guidelines on Costing (Treasury Board)	2019
RD-05	CSA-SE-STD-0002	A	Contract Data Requirements List (CDRL) Compendium	2020
RD-06	CSA-SE-GDL-IR	IR	Systems Engineering (SE) Mission Tailoring Guidelines	July, 2020
RD-07	https://www.nasa.gov/content/commercial-lunar-payload-serviceshttps://nspires.nasaprs.com/external/solicitations/su	Latest	Commercial Lunar Payload Services | NASA	

RD	Document Number/Source	Revision	Title	Date
	mmary.do?solId=%7bAD1DEAD1-7060-2C93-8CD1-780AF8FC9D54%7d&path=&method=init			
RD-08	NID 8715.128	Latest	Planetary Protection Categorization for Robotic and Crewed Missions to the Earth's Moon https://nodis3.gsfc.nasa.gov/OPD_docs/NID_8715_128_.pdf	
RD-09	NPR 7120.8A	Latest	NASA Procedural Requirements Subject: NASA Research and Technology Program and Project Management Requirements	
RD-10	Apogy Website		https://projects.eclipse.org/proposals/apogy	
RD-11	N/A		Xcore documentation (Eclipse Foundation)	
RD-12	N/A		Core Flight System Documentation and Open Source Code (NASA Goddard) https://cfs.gsfc.nasa.gov/	
RD-13	ANSI/AIAA G-043-2012		Guide to the Preparation of Operational Concept Documents https://arc.aiaa.org/doi/10.2514/4.105487.001	2012
RD-14	NPR 7120.5E	Rev E	NASA Space Flight Program and Project Management Requirements https://nodis3.gsfc.nasa.gov/npg_img/N_PR_7120_005E_/N_PR_7120_005E_.pdf	August 2012
RD-15			*reserved*	
RD-16	SLS-SPEC-159	Rev H	Cross-Program Design Specification for Natural Environments (DSNE)	2020
RD-17	NASA-STD-5017	Rrev A	NASA Space Mechanisms Handbook	
RD-18	AIAA S-114-2005		AIAA Moving Mechanical Assemblies	
RD-19	AFSPCMAN91-710V3		AIR FORCE SPACE COMMAND MANUAL 91-710, VOLUME 3	May 2019

RD	Document Number/Source	Revision	Title	Date
			https://static.e-publishing.af.mil/production/1/afspc/publication/afspcman91-710v3/afspcman91-710v3.pdf	
RD-20	GSFC-STD-7000B	B	General Environments Verification Standard https://standards.nasa.gov/standard/gsfc/gsfc-std-7000	April 2021
RD-21	NID 8000-108 NPR 8000.4A		NASA Procedural Requirements: Agency Risk Management Procedural Requirements https://nodis3.gsfc.nasa.gov/OPD_docs/NID_8000_108_.pdf	Oct. 2016

3 WORK REQUIREMENTS

3.1 GENERAL TASKS

The Contractor must provide the management, technical and scientific leadership, technical and scientific subject matter experts in all applicable disciplines, and the support necessary to ensure effective and efficient performance of all project efforts and activities. The Contractor must approach Phases ABCDEF with the objective of developing the required elements to fulfill the objectives of LSI within budget and schedule.

The Work requirements that must be accomplished by the Contractor are detailed in the following sections.

1) Project Management (Section 3.2)
2) Safety and Mission Assurance (Section 3.3)
3) Engineering and Science (Section 3.4)
4) Phase A (Section 4)
5) Phase B (Section 5)
6) Phase C (Section 6)
7) Phase D (Section 7)
8) Phase E (Section 8)
9) Phase F (Section 9)

Appendices A, B, and C list the Deliverables, the Contract Data Requirements List (CDRL), and the CDRL items Data Item Descriptions (DIDs).

3.2 PROJECT MANAGEMENT

The Contractor must provide, either directly or through subcontracts, all facilities, personnel, equipment, materials and services necessary to perform the Work specified in this SOW. Exceptions are defined within this document, and include the use of NASA and CSA facilities and required personnel for certain tests and verification.

The Contractor must manage the project to effectively achieve project technical, scope, quality, cost and schedule requirements of this SOW.

The Contractor must provide the management, technical leadership, and support necessary to ensure effective and efficient performance of all project efforts and activities. The Contractor must dedicate experienced personnel to the project in all the disciplines required to carry out the Work.

The Contractor personnel must establish and maintain a close management and technical interface with the CSA Project Authority (PA) to assure a coordinated program effort to meet or exceed the project objectives.

The Contractor must include, within its program management structure, the necessary leadership to effectively manage the performance of subcontractors in keeping with the project objectives.

The Contractor must include, within its program management structure, the necessary leadership to effectively establish and maintain a close management and technical relationship with the partnered NASA payload provider partner, and the assigned PRISM, and the assigned CLPS representatives in keeping with the project objectives.

3.2.1 Project Management Control

The Contractor must develop and implement the Project Management Plan (PMP), as per Contract Deliverable Requirements List (CDRL) PM-01.

The Phases ABCDEF Contractor Work Breakdown Structure (CWBS) and project schedule must be updated to reflect initial contract agreement and must be presented by the Contractor at the Kick-Off Meeting (KOM), and subsequently updated as per CDRLs PM-04 and PM-07.

The Contractor must establish and maintain a project management control system to effectively integrate the approved scope of Work with the schedule, budget, quality and potential risk issues, maintain all project status data, and provide visibility and assurance to the CSA PM that the project is on schedule and that it is meeting contract and performance requirements.

The management control system must track, control and report project schedule and deviations to the schedule, as well as technical, performance, quality and risk issues through the Monthly Progress Report as per CDRL PM-09.

The Contractor must support the CSA/NASA in the development of a Joint Project Implementation Plan (JPIP) (CDRL PM-25), (or similar document), between all parties involved (e.g., CSA, Contractor, NASA, CLPS provider, science team). The JPIP will describe at a minimum, but not limited to:

1) Main deliverables of each partner and their due dates;
2) Technical support required by the Contractor to:
    a) NASA Payload provider partner;
    b) PRISM;
    c) CLPS Contractor;
3) Meeting schedule between the partners;
4) Communications channels.

3.2.2 Division of Responsibilities

The LSI will be a partnership of universities, NASA/PRISM, NASA/CLPS, NASA/Science Mission Directorate (SMD), CSA, and the space industry. The Contractor will be responsible for the overall execution of the Work described in this SOW. CSA will review the deliverables identified in Appendix A to ensure they comply with the requirements of this SOW. Disposition will be provided as per the approval category for each CDRL. The CSA Project Authority (PA) will be responsible for the management of the project on behalf of the CSA and will be the official representative of the CSA to the Contractor throughout this project. The PA will be supported by the S&MA lead/authority and the Technical Authority (TA) representing CSA engineering disciplines. The Contracting Authority (CA) is responsible for authorizing any changes to the proposed scope of Work and contract. Deliverables from this contract and required at the international partner level will be submitted by, or on behalf of, the CSA.

The Contractor must provide a collaborative review process leading up to formal reviews. The formal review process is intended to close the milestone. In order to maximize the odds of success in a class C project, there must be collaboration to reduce and minimize any issues brought up in between review cycles.

In addition, given the inherent nature of the collaborative effort with the NASA payload provider, the Contractor must support the NASA payload provider partner in their reviews, both internally to the payload, and in the context of PRISM and CLPS.

3.2.3 Project Team Organization

The Contractor must produce and maintain a project organization to support the Work required under this SOW. The Contractor must provide and maintain a current Project Organizational Chart, showing personnel assignments by name and function and showing Subcontractor reporting relationships.

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

The Contractor must identify other key personnel who are considered essential to the execution of the contract including the science team. A Scientific Lead must be designated who serves as the key contributor to the science planning, design and utilization of the instrument. A Deputy Scientific Lead must be nominated, they must assist the Scientific Lead in delivering the scientific products required throughout the Mission and would assume its role should the Scientific Lead be unable to complete their duties The Contractor must assign personnel with appropriate qualifications and experience to all positions within the project organization.

The Contractor must provide in the Monthly Progress Report (CDRL PM-09) any variation in key personnel assignments by name and function. Replacement of personnel identified as key personnel must be approved in writing by the CSA Project Manager (PM) and the Contracting Authority.

3.2.3.1 Subcontract Management

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

Copies of subcontractor documentation must be delivered to the CSA.

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

3.2.4 Work Breakdown Structure

The project must be planned, controlled and directed by the Contractor using a Contractor Work Breakdown Structure (CWBS) that organises and defines the total Work scope of the project, based on the Product Tree (CDRL ENG-89).

The Contractor must establish and maintain a CWBS Dictionary (per CDRL PM-04) defining the Work to be done against each CWBS element identified in the CWBS by means of a Work Package Description (WPD) for each such element. Updates to the CWBS Dictionary must be provided along with the CWBS updates by the Contractor as per CDRL PM-04.

3.2.5 Project Schedule

The Contractor must prepare a detailed schedule based on the CWBS (CDRL PM-07). This schedule must identify tasks, task durations, dependencies between tasks, and the critical path. The Contractor must deliver with the Monthly Progress Report, the project schedule in native format as per CDRL PM-07. A Gantt chart figure must be included in the monthly report.

NOTES:

1. Reviews marked with an asterisk (*) are Major Control Gates at the system level. Others are Interim Reviews.
2. Formality of review commensurate with Class C mission

Table 3-1 shows a proposed project milestones schedule. It is presumed that a Mission Concept Review (MCR) and a Mission Requirements Review (MRR) will have been held in previous phases (Phase 0 or Pre-Phase A). Alternatively, similar information can be obtained from the accepted proposal made to PRISM. A Mission Concept Checkpoint (MCC) review will be held early in Phase A.

TABLE 3-1 – PROPOSED PROJECT MILESTONES AND SCHEDULE

Milestones	Date	Location	Applicability	Notes
Contract Award (CA)			**Start of Contract**	
Misc.			**Supporting Meetings**	
Monthly Progress Reports (MPR)	Monthly	Virtual	Required	
Technical Interchange Meetings (TIM)	Ah-hoc	Virtual/TBD	As needed	Applicable to all Phases. Assume 10 total in person. Separate from collaborative reviews.
Support to PRISM	TBD	TBD	Required	Account for 5 additional reviews of 2 days each with NASA/PRISM in US
Support to CLPS	TBD	TBD	Required	Account for 5 additional reviews of 2 days each with NASA/CLPS in US
Phase A:			**System Definition and Technology Development**	**Est. 2.25 years from CA to AR**
Kick-off Meeting (KOM)	CA + 2 weeks	CSA	Required	
Mission Concept Checkpoint (MCC)	CA+ 1 month		Required	May be combined with the KOM
Operational Requirements Review (OpRR)	CA+2 months		May be omitted as a stand-alone meeting	Combined with the SRR
Systems Requirement Review (SRR)*	CA+2 months	CSA	Required	
Systems Definition Review (SDR)*	CA+2 months		Required	Combined with SRR
Phase B:			**Preliminary Design and Tech Dev**	
Preliminary Qualification Status Review (PQSR)	CA+8 months	TBD		Can be combined with PDR

Milestones	Date	Location	Applicability	Notes
Preliminary Design Review (PDR)*	CA+8 months	CSA	Required – System Level	TIMs at lower levels
Phase C:			**Detailed Design and Technology Completion**	
Test Readiness Reviews (TRR)	As needed	Contr.	Required	Engineering and Development Models and Prototypes
Test Data Reviews (TDR)	As needed	Contr.	Required	Engineering and Development Models and Prototypes
Qualification Status Review (QSR)	CA+15 months	TBD	Required	Could be combined with CDR
Mission Operations Review (MOR)	TBD	TBD	Required – System Level	(As a support to the NASA payload provider)
Critical Design Review (CDR)*	CA+15 months	CSA	Required – System Level	TIMs at lower levels
Phase D:			**Manufacturing, AIT, Launch Preparation, Launch and Commissioning**	
Manufacturing Readiness Review (MRR)	CA+16 months	Contr.	Required – System Level	
Test Readiness Review (TRR)	CA+18 months	Contr.	Required – System Level	
Test Data Review (TDR)	CA+22	Contr.	Required – System Level	
Flight Validation and Verification Review (FVVR)	CA+23	Contr.	Recommended – System Level	Held after the integration of the Flight System and prior to the compatibility test
Ground Validation and Verification Review (GVVR)	CA+23	Ground Sys location (ExDOC)	Recommended – System Level Combined with FVVR	Held after the integration of the Ground System and prior to the compatibility test

Milestones	Date	Location	Applicability	Notes
Compatibility Test Review (CTR)	CA+23	Ground Sys location	Recommended – System Level	Held after a successful compatibility test between the Flight and Ground Systems.
Acceptance Review (AR)*	L-11 CA+24 months	Contr.	Required – System Level	TIMs at lower level
Operations Readiness Review (ORR)*	L-10	TBD	Recommended	Could be combined with AR
Pre-Shipment Review (PSR)	L-9 months (schedule driver,)	Contr.	Required – May be combined with AR	Held prior to the shipment of the Flight System to the payload provider. Note: CLPS requires the integrated payload for launch integration 9 months before launch. Contractor must negotiate delivery schedule with PRISM payload provider.
Flight Readiness Review (FRR)*	L-6 months	TBD	Recommended	Held after final integration test (instrument/payload/CLPS)
Launch Readiness Review (LRR)*	L-1 month	Contr.	Required – System Level	Held after the Flight System is integrated into launch vehicle and launch preparation has been successfully completed.
Phase E:			**Operations**	
Commissioning Review (CR)*	After launch	TBD	Recommended (system level)	Held at the beginning of Phase E, after the LEOP and commissioning. Given mission duration, TIM seems appropriate.
Decommissioning Review (DR)*	After mission operations	CSA	Required (system level)	Held at the end of Phase E
Phase F:			**Decommissioning & Science Publication**	

Milestones	Date	Location	Applicability	Notes
Science Pre-Publication Review (SPPR)	5 months after DR	CSA	Required (TBC)	New review to discuss science obtained before publishing per PRISM
Final Review (FR)*	SPPR + 2 weeks	CSA	Required	Closes off the project.

NOTES:

1. Reviews marked with an asterisk (*) are Major Control Gates at the system level. Others are Interim Reviews.
2. Formality of review commensurate with Class C mission

3.2.6 Risk Management

The Contractor must establish and maintain a comprehensive risk management program, and describe this in a Risk Management Plan (RMP) (CDRL PM-08). Risks and mitigation analyses must include risks to LSI performance, reliability, schedule, integration, and safety. The Contractor must identify and implement risk reduction/resolution activities. The Contractor must assess and report the status of each risk element in the Monthly Progress Report (CDRL PM-09), during progress reviews, and at each formal technical review.

3.2.7 Project Management Reporting

The Contractor must write and deliver monthly reports as per CDRL PM-09. Monthly reports must identify decisions taken during the reporting period resulting in schedule changes. The reports must summarize the Work accomplished during the past month and briefly mention the tasks planned for the coming month. The reports must also summarize the progress of the previous month's planned Work and explain any changes. The reports must present an updated milestones schedule tables with rationale for any schedule changes. The reports must be sent to the Project Authority and the Contracting Authority every month and no later than 10 Working days after the end of the month covered by the report.

3.2.7.1 Final Report

The Contractor must produce and deliver a final report as close out to the project, per the Project Final Report CDRL PM-23. The Final Report must encompass all the Work done for the entire project. It must be a comprehensive summary of the project Work with the emphasis on the problems encountered, solutions implemented, successes encountered and lessons learned. The Contractor must hold a Final Review (FR), with the CSA, at the end of the project.

3.2.8 Action Item Log

The Contractor must maintain a detailed Action Item Log (AIL) throughout the project to track actions resulting from design reviews, status reviews, Web- or teleconferences as per CDRL PM-15. The AIL must be delivered, in Microsoft (MS) Office Excel or Word format, each month. The AIL is not included in the monthly report (CDRL PM-09).

3.2.9 Project Reviews and Meetings

The Contractor is responsible for providing agendas and minutes of all pertinent meetings held between the Contractor and CSA as per CDRL PM-13 (Meeting Agenda) and CDRL PM-14 (minutes of meeting). To all reviews and meetings in this SOW, the Contractor must provide access to CSA personnel and third parties identified by CSA, for example, NASA and representatives from other government departments that CSA may identify. Minutes will primarily report decisions and action items. The following meetings are planned for this project.

3.2.9.1 Kick Off Meeting

The Contractor must hold a Kick Off Meeting (KOM) at the CSA's facility in St-Hubert (CDRL-PM-09) or by videoconference of teleconference, if the time and location is acceptable to the CSA. This meeting will serve to introduce key team members and will review the updated management plans initially provided with the proposal, the requirements of the Work, schedules, deliverables and risks. Any contractual and any other outstanding issues must be addressed at the KOM. Further, the KOM will serve to validate the system requirements and the project readiness to proceed with the project. All key participants under the contract must attend.

As part of the kick-off meeting, the Contractor must provide the equivalent of the end of Phase 0 deliverables as identified in the CDRL list.

Typically, this must include the mission requirements, a mission/system/operations concept, and preliminary system (instrument) requirements, science objectives and user needs. Given the nature of the collaboration under PRISM, the Contractor must also provide supplemental mission requirements that are derived from their NASA payload provider partner, and any additional requirements that may have may been added as part of the PRISM selection process.

It is during the KOM that some flexibility with respect to high level TRL instruments can be evaluated, and determine the appropriate path through the milestones.

3.2.9.1.1 High TRL Instrument

In the case where the Contractors instrument is already at a TRL-5/6, some flexibility in how to proceed through the standard phases is permitted. In order to support that flexibility, the Contractor much demonstrate to CSA's satisfaction material to support the TRL-6 designation per AD-01.

3.2.9.2 Monthly Progress Review Meetings

The Contractor must hold monthly progress reviews at its facilities or by Web-conference, as agreed with the PM. The Monthly Progress Review presentations (CDRL PM-10) must be based on the most recent Progress Reporting (CDRL PM-09) and must review technical progress, significant technical issues, schedule, deliverables, quality assurance activities, risks and Action Items Log (AIL CDRL PM-15). It must also address contractual and any other outstanding issues. The monthly progress presentation is delivered at the meeting to CSA.

The requirement for a Monthly Progress Review will be waived when it coincides with the month of a Technical Review, including the Monthly Progress Presentation.

3.2.9.3 Weekly Teleconference Meetings

The Contractor must hold weekly teleconference meetings with PA/ Technical Authority (TA), and the duration should be limited to one hour. The weekly teleconference is mainly to address technical issues and to discuss progress. The Contractor must prepare a weekly agenda with a list of points to be discussed and the agenda is distributed by email to the team in Contractor format. The Contractor must prepare a summary of the weekly teleconference and the summary is distributed to the project team in Contractor format.

3.2.9.4 Formal Technical Reviews

The Contractor must conduct the formal technical reviews listed in the SOW in the manner and sequence described in the CSA Technical Reviews Standard (AD-04).

The purpose of each of these reviews is provided in dedicated subsections of this SOW.

The Contractor must use the common Entry and Exit Criteria contained in the AD-04, in the conduct of these reviews, as well as the Entry and Exit Criteria specific to each review.

In addition, the Contractor must notify CSA of their Subcontractor reviews, within a minimum of seven (7) business days' notice, and invite CSA to those reviews.

3.2.9.5 Configuration Control Review Board

Management and supervision of project document baseline and configuration change evaluation process is delegated to the CSA PA. For that purpose, the CSA PA will form a team that will be called the Configuration Control and Review Board (CCRB). The CCRB will be responsible for document or change evaluation process.

The CCRB is responsible for the review process. It will ensure that realistic evaluation periods are established and met and that accurate, concise, integrated evaluation reports are submitted to the PM.

The CCRB will approve all program and system documentation that defines the identification of the LSI; its external and internal interfaces; and, all proposed Class 1 changes, deviations and waivers to the system and its defining documentation.

The CCRB will meet as required.

3.2.9.6 Ad-Hoc Meetings

The Contractor may request Ad-hoc Meetings with the CSA PA/(SA)/TA whenever required to resolve unforeseen and urgent issues. The selection of participants will depend on the nature of the issue.

The CSA PM may also request such Ad-hoc Meetings with the Contractor, in which the Contractor must participate.

3.2.9.7 Other

The Contractor must support meetings convened by:

1. the NASA Payload provider;
2. PRISM related meetings, per AD-06 and RD-09, these include:
    a. The program reviews consist of KDP (Key Decision Points) reviews, including the Authority to Proceed (ATP), Program Approval, Program Assessment Reviews

(PARs), and Closeout; internal reviews, called PSRs (Program Status Review); and IAs (Internal Assessment)

3. CLPS integration related meetings.

3.2.10 Document Deliverables

The Contractor must prepare and deliver the documents as requested in the CDRLlist in Appendix B, and in accordance with the relevant Data Item Descriptions (DIDs) in Appendix C.

Documents submitted by the Contractor will be approved or reviewed in accordance with the Approval Category of each deliverable.

The English language must be used throughout. All documents must comply with the General Preparation Instructions specified in DID-100 of Appendix C.

Système International (SI) units must be used wherever possible in all documentation. Converted values must be supplied for all non-SI quantities.

The delivery schedule for all documentation is defined in Appendix B. Where two or more deliveries of the same document are required, the subsequent delivery may be satisfied by a statement indicating that the previous issue of the document still applies (referenced by title, document number and issue), if this is the case.

The Contractor must obtain approval from the CSA PM as per the document approval procedures below for all CDRL documents listed in Appendix B and marked as Approval Category “A”.

3.2.10.1 Documents Delivered for Approval

The term “Approval”, as used in this document and in other documents referred to herein, means written approval by the CSA PA, of documents submitted by the Contractor. Once approved, the document is authorized for further use by the CSA. The CSA does not take responsibility for the validity of the data, or statements, and the Contractor is fully responsible for the content and secondary effects derived there from. The document may not be changed without the CSA PA’s approval. No request or document for which approval is required may be acted upon or implemented by the Contractor until such approval is provided. Such requests and documents will be reviewed promptly by the CSA PA and the necessary written approval or disapproval will be provided after their receipt by CSA. In the event of a failure by the CSA PM to approve or disapprove the document within fifteen (15) Working days, the documents may be deemed approved.

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

3.2.10.2 Documents Delivered for Review

The term “Review” as used in this document and in all other documents referred to herein means, unless specifically stated otherwise, a CSA review of the documents submitted for that purpose by the Contractor. The acceptance by the CSA PM of a document for review implies that the document has been reviewed, commented on, revised as necessary, and has been determined by the Contractor to meet the requirements.

CSA PM will provide concurrence on the recommendation of the TA. The CSA does not take responsibility for the validity of the data or statements, and the Contractor is fully responsible for the content and secondary effects derived there from. In the event that the CSA PM does not concur with a document submitted for review, the CSA PM will so notify the Contractor within fifteen (15) Working days of the document submission. Such notification will include a full explanation of the reasons for the lack of concurrence and will recommend the additions, deletions and/or corrections, which the CSA PM deems are beneficial to the project.

The Contractor must notify the CSA of the rationale to not implement the changes suggested by the CSA insofar as the changes are in accordance with the relevant DID and this SOW. If written notification of concurrence is not provided by the CSA PA within fifteen (15) Working days of the receipt of the document, the document must be deemed to have been reviewed and accepted by the CSA PA without comment.

3.2.10.3 Documents Delivered for Information

This section provides information regarding documents not listed in the CDRL list and sent to CSA for information. If required, CSA will inform the Contractor should the document be sent for review through the approved Configuration Management (CM) delivery process (ref: DID-100).

3.2.10.4 Technical Notes

The Contractor must prepare engineering reports or documents in the form of informal Technical Notes (TNs) which are required to address and resolve individual technical problems that occur during the contract. The purpose of these TNs is to document and exchange technical information on the progress of the Work and technical issues. Copies of all TNs dealing with significant technical or quality issues must be delivered to the CSA PM for review, in accordance with CDRL-ENG-95.

3.2.11 Intellectual Property

The Contractor must explicitly define the Foreground Intellectual Property (FIP) generated during the execution of the contract and report this in the Intellectual Property (IP) Disclosure Report (CDRL PM-21). This document must also identify the Background Intellectual Property (BIP) (CDRL PM-20) that is required to use the FIP, including the owner of the BIP.

All IP which needs to be described in documents or presented at technical reviews must be available to the CSA and third parties for the purpose of this Work. The Contractor must identify the need for Non-Disclosure Agreement (NDAs) and must be responsible for putting those NDAs in place in time for the respective reviews.

All documents containing proprietary information must identify this on the front cover and on each page per DID-100 of Appendix C.

3.3 SAFETY & MISSION ASSURANCE

Requirements for Safety and Mission Assurance are specified in the baselined CSA Product Assurance Requirements (PAR) [AD-05]. The PAR, the Work specified in the following sub-sections, as well as the Safety and Mission Assurance (S&MA) CDRLs specified in Appendix B.3, are reflective of a CSA Class C level of risk tolerance.

The CSA PAR [AD-05] must be accounted for in the Contractor Project Management Plan (CDRL PM-01) or the System Design and Development Plan (i.e. TRM) (ENG-23)and the System Design Document (CDRL ENG-130). Coordination with the payload provider partner, NASA PRISM and the CLPS Lander Contractor will also be required to ensure the do-no-harm requirements can be met.

Any proposed update to a S&MA CDRL listed in Appendix B.3 as needing CSA approval at Appendix B.3 must require CSA re-approval.

The Contractor must flow down applicable requirements of the CSA PAR to their subcontractors and suppliers.

3.3.1 Product Assurance Implementation Plan

The Contractor must provide a Product Assurance Implementation Plan (PAIP) (CDRL SMA-02) at the SRR, including an appended compliance matrix (CDRL SMA-03). The Contractor must implement the CSA-approved PAIP.

The Contractor PA Representative must be responsible to verify that the Work executed and delivered by subcontractors and suppliers conforms with the applicable requirements of the CSA PAR.

3.3.2 PA Lines of Communication and Reporting

The Contractor must appoint a Product Assurance Representative with independent* line of reporting and access to senior management.

* This means that the Product Assurance Representative is solely responsible for PA matters, with a line of reporting separate from Project Management.

3.3.3 Quality Assurance Program

The Contractor must implement a Quality Assurance (QA) Program per the CSA-approved PAIP (CDRL SMA-02).

3.3.3.1 Audits

Audits are conducted as a risk mitigation to hardware, software, and process procurement activities. Risk retirement is therefore commensurate with the timely closure of open Work and action items resulting from these audits.

The Contractor must conduct audits as defined in the CSA-approved PAIP (CDRL SMA-02) against an approved audit schedule, which lists the subContractors, suppliers, and associated processes and procedures to be audited during the life of the project.

The Contractor's audit process must include the method of submission of the results and the corrective action mechanism to be followed.

The Contractor must conduct tracking and evidence-based closure of audit actions, before the affected processes and procedures are used for the project. The Contractor must also be responsible to conduct follow-up audits when deemed necessary, for the closure of specific items.

The Contractor must produce and deliver Audits Reports (CDRL SMA-39).

The Contractor must report on the status of audit action items at Mission PDR and Mission CDR.

3.3.3.2 Inspections

The Contractor must identify Key Inspection Points (KIP) in Manufacturing Plans (CDRL ENG-53).

The TA must have the right to identify, perform, and delegate independent Mandatory Inspection Points (MIPs) at Contractor KIPs and test points identified in the Contractor's Manufacturing Plans.

The Contractor must notify the TA with a minimum of five (5) business days advance notice of MIPs, identified in the Manufacturing Plans.

3.3.3.3 Configuration and Data Management (CADM)

The Contractor must develop and implement a CADM Plan (CDRL SMA-04). The CADM plan may be incorporated as part of the PAIP, as long as the CADM Plan DID contents are met.

3.3.3.4 Handling, Storage and Shipping

The Contractor must deliver and implement a Storage, Transport and Handling Plans (CDRL SMA-08).

3.3.3.5 Non-Conformance Review Board

The Contractor must convene and conduct Non-Conformance Review Board (NCRB) meetings to classify and document the proper dispositions of non-conforming items. The Contractor PA Representative must chair NCRB meetings.

The Contractor must notify the TA of any Class 1 NCRB meetings, as soon as practical but not later than within 48 hours of the occurrence of the non-conformance.

The Contractor must document and deliver resulting dispositions of NCRB meetings in Non-Conformance Reports (CDRL SMA-36).

CSA S&MA must be a member of the Class 1 NCRB, with approval rights to all Class I NCRB dispositions.

A list of Class II NCRBs and their dispositions must be delivered for TA review as part of the Monthly Project Report (CDRL PM-09).

3.3.4 Qualification Program

The Contractor must implement a Qualification Program per the CSA-approved PAIP (CDRL SMA-02).

3.3.4.1 Qualification Status Reviews

The Contractor must hold Qualification Status Reviews (QSR) to review supporting evidence of qualification for each qualified unit. The Contractor must convene and chair QSRs.

The Contractor must plan for, and complete all qualification Work and QSRs ahead of the Mission CDR.

The TA must be invited to participate in QSRs.

3.3.4.2 Qualification Acceptance Data Package

The Contractor must deliver a Qualification Acceptance Data Package (CDRL SMA-31) at least fifteen (15) Work days ahead of a Qualification Status Review (QSR), for any qualification Work performed.

The Contractor must develop teaming arrangements and establish all necessary mechanisms (e.g. non-disclosure agreements, contractual provisions, etc.) with Subcontractors and suppliers to obtain evidence of qualification and share it with CSA for QSRs, including for heritage COTS units and assemblies.

3.3.4.3 Qualification Status List

The Contractor must deliver a preliminary version of the Qualification Status List (QSL) (CDRL SMA-26) at the Mission PDR, and a final version at the Mission CDR.

The Contractor must update the Qualification Status List (QSL) (CDRL SMA-26), until it is demonstrated that RIDs and action items affecting all lower level QSRs are closed, and that all required Requests For Deviations (RFD)/Request For Waiver (RFW) have been dispositioned.

3.3.5 Reliability Assurance

3.3.5.1 Failure Modes, Effects, and Criticality Analysis

The Contractor must perform and deliver a Failure Mode, Effects, and Criticality Analysis (FMECA) (CDRL SMA-10) in accordance with the PAR:

a) At piece-part level for each Category D unit, for delivery at unit-level formal reviews;

b) At unit level for the integrated system, for delivery at the Mission PDR (preliminary) and Mission CDR (final).

3.3.5.2 Derating and Parts Stress Analysis

The Contractor must ensure that all EEE parts are derated.

The Contractor must provide evidence of EEE parts derating in accordance with the following tailored approach:

a) Category A or B unit: seek unit vendor confirmation that EEE parts were derated, including to which derating standard, and provide the attestation at unit QSR;

b) Category C unit: Per Category A and B unit approach when there is no change to EEE part(s), and per Category D unit approach for any change involving EEE part(s);

c) Category D unit: deliver Parts Derating and Stress Analysis Report (CDRL SMA-12).

3.3.5.3 Worst Case Analysis

The Contractor must deliver a Worst Case Analysis (CDRL SMA-13) in accordance with the CSA PAR, for units that are not Category A or B, and units that do not have flight heritage (per section 4.5 definition in the PAR). The WCA must cover the nominal mission duration specified in the MRD [MM-10].

3.3.5.4 Radiation Analysis

The Contractor must deliver a Radiation Susceptibility Analysis (CDRL SMA-18).

3.3.6 EEE Parts

EEE Parts requirements are tailored in the CSA PAR based on heritage and unit categorization (i.e. A, B, C, and D as specified in para 4.2 of the CSA PAR).

The Contractor must conduct an Electrical, Electronic and Electromechanical (EEE) Parts Program per the CSA-approved PAIP (CDRL SMA-02).

The Contractor must deliver and maintain a Declared Components List (DCL) (CDRL SMA-22), which covers:

a) All EEE parts contained in Category D units; and,

b) All modifications to Category C units which involve EEE-related changes.

For Category D units, and EEE-related modifications to Category C units, the use of non-standard parts (as defined in the CSA PAR) must receive TA approval prior to procurement, through a Contractor-delivered Non-Standard Part Approval Request (NSPAR) (CDRL SMA-32).

3.3.7 Mechanical Parts, Materials and Processes

The Contractor must conduct a Mechanical Parts, Materials and Processes program per the CSA-approved PAIP (CDRL SMA-02).

The Contractor must deliver a Declared Mechanical Parts List (DMPL) (CDRL SMA-23), Declared Materials List (DML) (CDRL SMA-24), and Declared Processes List (DPL) (CDRL SMA-25). The Contractor may combine the DMPL, DML, and DPL into a single document as long as the content of each associated DID is met.

The Contractor must only use those Mechanical Parts, Materials or Processes that are declared in the CSA-approved: Declared Mechanical Parts List (DMPL) (CDRL SMA-23), Declared Materials List (DML) (CDRL SMA-24), and Declared Processes List (DPL) (CDRL SMA-25).

3.3.8 Software PA Program

The Contractor must implement a Software PA (SPA) Program for both the Space and Ground Segments software.

As part of the SPA, the Contractor must deliver Software Criticality Analysis and Classification (CDRL SMA-19), in accordance with the categories specified in the PAR. The Contractor must also deliver the following Software Development Plans, and implement them once CSA-approved:

- Software Development Plan (CDRL ENG-31); and,

3.3.9 Firmware and FPGA Development

Firmware and FPGA requirements have been tailored in the PAR for different levels of design maturity and heritage.

The Contractor must ensure that all Firmware and FPGA development activities are conducted in accordance with the CSA PAR.

The Contractor must deliver a Version Description Document (VDD) (CDRL ENG-148).

3.3.10 Contamination Control

Contamination Control requirements have been tailored in the PAR according to the contamination sensitivity of equipment.

The Contractor must deliver a Contamination Analysis Report (CDRL SMA-06).

The Contractor must deliver and implement a Contamination Control Plan (CDRL SMA-16).

3.3.11 Deviations and Waivers

3.3.11.1 Definitions

The Contractor must use the following applicable definitions:

- Deviation: a variance approved for a planned departure from requirements prior to manufacturing.
- Waiver: a variance approved for an item found to depart from specified requirements in an unplanned manner during or after manufacturing, but nevertheless considered suitable for use “as is”, or after repair, by an approved method.
- Class I (or major) RFD or RFW (CDRL SMA-33 or SMA-34): a non-conformance or departure to project requirements or specifications that affects a system, spacecraft or ground segment end item.
- Class II (or minor) RFD or RFW (CDRL SMA-33 or SMA-34): a non-conformance or departure to the requirements or specifications not covered by a Class I RFD or RFW.

3.3.11.2 Submission

The Contractor must submit Class I RFDs or RFWs to the TA for approval.

The Contractor must provide a list of Class II RFDs and RFWs in the Monthly Progress Report (CDRL PM-09).

The TA must have the right to ask for, review, and reclassify Class II RFDs and RFWs in case of discrepancy with the applicable definitions of section 3.3.11.1.

3.3.12 End Item Data Package

End Item Data Packages (EIDPs) constitute centralized document repositories that will serve as basis to accept an end item. EIDPs may also be used in the context of anomaly investigation during Operations (Phase E).

The Contractor must deliver separate End Item Data Packages (CDRL SMA-29), for each deliverable end-items.

3.3.13 Safety

The Contractor must conduct all project Work in conformity with the Safety Program defined in the CSA-approved PAIP (CDRL SMA-02).

The Contractor must generate hazard reports and ensure each one is closed prior to the expected hazard occurrence.

The Contractor must produce and deliver a Safety Assessment Report (CDRL SMA-17) on the status* of the safety program at Mission PDR and at Mission CDR.

*As a minimum, this must include a status update of all existing hazard reports.

3.4 ENGINEERING AND SCIENCE

For the purposes of this section, the term ‘system’ is expected to be focused on the Canadian instrument. The deliverables, analyses, etc. are to be created with the instrument in mind.

3.4.1 Systems Engineering

The Contractor must use accepted CSA’s Systems Engineering Methods and Practices (SEMP) such as described in (AD-11) or their equivalent.

The Contractor may optionally prepare their own SEMP. Otherwise, a description of the system engineering practices envisaged must be included in the PMP.

All engineering activities should be tailored to those of a Class C mission. Guidelines for such tailoring are given in CSA’s Mission Tailoring Guidelines (AD-12). For Class C missions, the emphasis will be on collaborative, highly interactive interactions among the PRISM mission team and the Contractor’s team and CSA.

3.4.2 Verification Process

The Contractor must produce a System Test Plans (CDRL ENG-174) and Prototyping and Breadboarding Test Plans (CDRL ENG-208) for verifying the requirements. Testing must be the

preferred approach except where there is a clear justification accepted by the CSA PA in accordance with CDRL ENG-174.

Verification and Test Plans must be complemented by analysis reports, test specifications, procedures, and upon test completion by test reports.

As a minimum, the following aspects require verification:

1. Vibration and shock (CDRL ENG-198)
2. Mass properties (CDRL ENG-199)
3. Thermal/Vacuum (CDRL ENG-201)
4. EMI/EMC (CDRL ENG-203)
5. Off-gassing (CDRL ENG-206)
6. Instrument integration includes:
    i. Integration with the NASA payload package (CDRL (ENG-189)
    ii. Communication with the chosen operations facility
    iii. Pre-launch site testing (CDRL ENG-196)
7. Radiation
    iv. Based on the radiation model and analysis results (CDRL ENG-118) this test may be waived at CSA's discretion;
8. Regolith tolerance
    - This should be combined with the TVAC test (Dusty TVAC aka DTVAC)

Additional test procedures and reports deliverables will be negotiated with CSA based on the LSI instrument.

3.4.3 Requirements Validation and Traceability

The Contractor must establish traceability between requirements from the top down, and identify overlaps, omissions and contradictions, and suggest changes needed to establish a consistent requirements baseline. Traceability of requirements must be established and maintained throughout the project.

The Contractor must validate the LSI to demonstrate that the instrument will meet the intended mission operational objectives. This activity complements the verification activity. All validation related activities must be included in the verification CDRLs.

3.4.4 Model Philosophy

The LSI project has been identified as being a CSA-designated Class C mission. The model philosophy thus will be:

- Breadboards, as required by the System Design and Development Plan (CDRL ENG-23), for basic essential function or element testing;
- Development Test Models (DTM), as required by the System Design and Development Plan (CDRL ENG-23), for more representative essential function or element testing, likely with relevant environments; and/or
- Engineering Model(s) (EM), high fidelity models for extensive functional and environmental testing;
- Protoflight Model (PFM), final model ready for launch, subjected to qualification and acceptance testing. (Qualification testing at reduced duration);
- Flight Spare, not required (TBC).

3.4.5 Analyses

As part of the design process, the Contractor must undertake analyses of technical aspects of the design relevant to the instrument and integration with the partnered NASA payload provider, as specified in the subsequent paragraphs.

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

The System Design Document (CDRL ENG-130) must present a summary of the analyses performed, results, trade-offs and problems encountered. Analyses as well as all supporting models developed must be provided per CDRL ENG-96. Analyses may be provided as Technical Notes or integrated into other formalized documentation (e.g. System Design Document).

The analyses and models must evaluate the end-to-end LSI system, including its subsystems, interfaces and integration into the larger PRISM payload, and ultimately CLPS lander/rover. The analyses and models provided must include, but are not limited to:

a) 3D Computer Assisted Drawings (CAD) Models of the instrument with all major physical elements (CDRL ENG-97)

b) Electrical Power and Distribution (CDRL ENG-102)

c) Structural analysis (CDRL ENG-98)

d) Mass Model (CDRL ENG-99)

e) Thermal analysis (CDRL ENG-101)

f) Radiation susceptibility analysis(CDRL ENG-118)

g) Coupled Loads (CDRL ENG-115)

h) Instrument specific analysis, including performance analysis, operational diagrams (e.g., flowcharts, state and control diagrams)

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

3.4.5.1 Other Analyses

The Contractor must perform all other analyses required by the System Verification Plan (CDRL ENG-174).

3.4.6 Mathematical Models

The Contractor must provide mechanical, structural, thermal, assembly models as specified in this section.

3.4.6.1 Finite Elements Models

The Contractor must deliver Structural Mathematical Finite Element Model (FEM) models (CDRL ENG-98) including proper documentation to show the main features of the models themselves and results of standard quality checks. The models, reproducing the structure in its static and dynamic main characteristics, must be delivered in an agreed format to CSA. The structural mathematical model must be detailed enough to predict the dynamic loads to size the structure elements, and the interface loads in particular, with sufficient accuracy. This means that it must be able to reproduce the low frequency modes with an upper limit to the frequency range to be defined on a case-by-case basis.

The finite element model must be accompanied by a clear description of the model itself and of the assumption made in the model, particularly concerning the boundary conditions at the hard mounted Interfaces. The Contractor must update the FEM for the CDR to address issues with the model delivered at PDR.

3.4.6.2 CAD Models

The Contractor must provide Computer Assisted Drawing (CAD) models as per CDRL ENG-96.

The Contractor must provide the native file of the 3D models of the LSI design as a complete assembly, together with all lower level models. In addition to the native CAD file, a version suitable for viewing (such as a 3D pdf – TBC) must be provided.

The contractor must deliver a CAD model to the partnered NASA payload provider. The contractor may prepare a reduced model that will at a minimum provide external features.

3.4.6.3 Optical and LiDAR Models – as needed

The Contractor must deliver the Optical models for all passive sensors (e.g. Optical, Infra-red (IR)) as per CDRL ENG-116. The optical models must reproduce the unit behaviour for all sensors from an optical point of view.

The Optical models must be regularly updated and delivered according to the design maturity.

3.4.6.4 Thermal Models

The Contractor must deliver the Thermal models per CDRL ENG-101. The Thermal models must reproduce the unit behaviour from a thermal point of view, therefore must be representative for the following characteristics:

1) Contact area
2) Overall dimensions
3) Radiative Area
4) Thermo-optical properties
5) Conductance
6) Dissipations in each mode (stand-by, operating, survival, etc.)

The Thermal models must be regularly updated and delivered according to the design maturity. A reduced thermal model will also be delivered for NASA integration.

3.4.6.5 Stereolithographic (SLA) Models

The Contractor must develop one full size 3D model of the LSI instrument for delivery at CDR. The Contractor will arrange for delivery to CSA.

The Contractor must develop:

1. one full-size stand-alone solid 3D model of the LSI space segment for delivery at the Phase D CDR;
2. one TBD scale sized SLA model of the entire payload package, including the lander/rover for delivery at AR. These models (LSI, payload, and lander/rover) should be modular.)
    i. After AR the Contractor must transfer the model to the location where the instrument will be operated;

    CSA may request two of these models.

The contractor must deliver all of these models to the CSA at FR.

3.4.7 Drawings and Parts Lists

The Contractor must prepare and maintain design drawings, schematics, layout with listing of Drawings, Change Notices, etc. (CDRL ENG-02, ENG-22, ENG-153).

3.4.8 Engineering Budgets & Technical Performance Measures

The Contractor must establish and maintain mass, power and data budgets (CDRL ENG-01), which must identify component by component mass, subsystem power demand, and instrument data rate.

The Contractor must report the status of these budgets monthly as part of the Monthly Project Report.

In collaboration with CSA, the Contractor must identify and track Technical Performance Measures (TPM's, CDRL ENG-94). These will be used to track the evolution of parameters that are critical to the achievement of mission success. The Contractor must report the status of these TPM's at technical reviews, or as requested.

3.4.9 Technology Readiness and Risk Assessment (TRRA)

The Contractor must conduct a Technology Readiness and Risk Assessment (TRRA) in accordance with the requirements of the CSA TRRA guidelines [AD-01].

The main steps of the TRRA are:

1) Logically breakdown the system into technology elements (PBS CDRL ENG-89);
2) Classify technology elements as critical or non-critical using the criteria defined in the Critical Technology Elements (CTE) Identification Worksheet [AD-02] and provide sufficient rationale for that classification in the Workbook (CDRL TBD) and the TRRA Report (CDRL MM-05). In completing the Workbook, the Contractor must use a Target TRL of TRL-6, unless otherwise specified by CSA.
3) Prepare a report according to CDRL MM-05.

For purposes of technology development, the Contractor should also provide, in the TRRA report (CDRL MM-05) and the System Design and Development Plan (CDRL ENG-23), the driving requirements, required technology development, cost estimate, and schedule to reach the next Target TRL for the CTEs.

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

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

Note: It is likely that a TRRA will have be carried out in an earlier Phase 0 or pre-Phase A, program and only an update(s) will be needed in Phase A.

3.4.10 Technology Development Plan

The Contractor must prepare a Technology Development Plan, as in MM-07, including the timeline and sequence of required technology developments to reach TRL 6. The TDP must show how the technology development plan and associated TRL progression aligns with the system's mission phases/milestones versus the NASA mission phases/milestones.

3.4.11 Science Readiness Levels

The Contractor must follow the planning framework provided in the Science Readiness Level Guidelines (AD-03) which will help ensure readiness for data products, science analyses and results, and consequently ensure mission outcomes and maximize science impact.

3.4.12 Traceability of Science Objectives

The Contractor must inure that the Science Objectives for the instrument are aligned with the Canadian scientific priorities for Lunar exploration as outlined in RD-01 and with the PRISM call science priorities as defined in AD-07.

3.4.13 Technical/Scientific Notes

The Contractor must prepare Technical/Scientific Notes (TN) (CDRL ENG-95) if required to address and resolve technical or scientific problems that occur during the program. The purpose of these TNs is to document and exchange technical information on the progress of work on a relatively informal basis.

These notes cannot be used as a means of satisfying the requirement for a CDRL item, unless accepted by the CSA.

4 DEFINITION PHASE (PHASE A)

The primary objectives of Phase A are to define systems and interface requirements, including the flow down of mission level requirements to the system level, validate the concept definition and design, and identify critical technologies and associated risks. At the end of Phase A, CSA should have all the necessary technical products needed by LSI to advance their instrument design. In support of future project phases, CSA should also have all technical and programmatic information necessary to make an informed decision about the LSI interfaces for subsequent programmatic steps.

4.1 MISSION CONCEPT CHECKPOINT

The Contractor must prepare and conduct a Mission Concept Checkpoint (MCC) meeting. The purpose of the MCC is to describe the system conceptual design proposed to meet the mission requirements as defined by PRISM. The format of the meeting will be to review the PRISM mission requirement, the instrument design, the instruments role in the NASA payload, and the science objectives the instrument will address.

The concept design, analyses, science objectives and related information must be summarized in a Review Presentation (CDRL PM-26) and must include at a minimum the CDRLs as per the due date and version in the CDRL to meet the entry criteria of the MCC. To pass this review, the Contractor must demonstrate that mission requirements have been flowed down to the concept under design and that the project is ready to proceed with the design of the system level requirements and the baselining of the concept.

During this review, PRISM mission requirements may be supplemented by CSA to address missing CSA science objectives as described in section 4.2.

4.2 SCIENCE OBJECTIVES AND REQUIREMENTS DOCUMENT

The Contractor must produce inputs in the form of Science Objectives and Requirements Document (CDRL SCI-01) for what would be the Canadian contribution to the PRISM host mission. The Science Objectives must be aligned with the Canadian scientific priorities for Lunar exploration as outlined in RD-01 and with the PRISM call science priorities as defined in AD-07.

The CDRL SCI-01 document will capture and summarize the pertinent scientific mission goals that can be addressed by the scientific instrument, assumptions and scientific objectives, identify the stakeholders and provide a clear articulation of observation requirements, data and applications needs, processing and distribution requirements, calibration, validation and characterization requirements, as expressed by the user community. Detailed information on the validation of the investigation can be found in AD-03.

A science traceability matrix must be completed as part of this Work. An example is provided in Table 4-1. This matrix includes requirements from level 1 to 3. Level 1 requirements are the sciences objectives that should be well defined and justified by a literature review. Level 2 requirements are the required measurements including precision and accuracy with sampling needs in time and space. Level 3 requirements are the performance and functional requirements needed

to produce the data products of required sensitivity and the needed distribution of measurements in time and space.

Level 3 requirements should also include the key flight and ground software requirements needed for science activity commanding and data acquisition, processing and archiving. This matrix must be reviewed, updated and included in the CDRL SCI-01 document, accompanied by a narrative description that explains the rationale for the establishment of the instrument functional requirements to meet the science measurement requirements. This matrix provides systems engineers with fundamental requirements needed to design the mission, and can be used to show clearly the effects of any de-scoping or loss of elements on the achievement of the science objectives.

The document describes in detail the instrument prototype, the performance model, sensitivity studies undertaken in this study, as well as the end-to-end data processing and analysis approaches planned to meet the baseline science objectives. Results of the validation studies undertaken in this study or past studies are presented and are sufficient to support confirmed requirements values and proposed success criteria.

The Contractor must define the science instrument data processing architecture and requirements. These activities must include a description of the tools required to intake raw instrument data, data storage management, and Level 0 to Level 2 processing algorithms.

TABLE 4-1 – SCIENCE TRACEABILITY MATRIX

Science Goals	Science Objectives	Science Measurement Requirements		Instrument Functional Requirements			Mission Functional Requirements (top level)
		Observables	Physical Parameters	Mandatory		Target	
Goal 1 Etc	Objective 1	Absorption line Morphological feature Rate of change of observable phenomenon	% abundance of absorber Size of feature Duration of event	Vertical resolution	XX km	ZZ km	Observing strategies: requires yaw and elevation manoeuvres (orbiter), or, traverse and instrument positioning (rover) Launch window: to meet nadir and limb overlap requirement (orbiter) ,or, to achieve landing site (rover) Need YY seasons to trace evolution of phenomena Need YY months of observation to observe variability of phenomena
				Horizontal resolution	XX deg x XX lat x XX lon	ZZ deg x ZZ lat x ZZ lon	
				Temporal resolution	XX min	ZZ min	
				Precision	XX K	ZZ K	
				Accuracy	XX K	ZZ K	
	Objective 2 to N			Repeat above categories			

4.3 CANADIAN SCIENCE PLAN

The Canadian science investigation must be described and planned through the end of the science mission. This plan [CDRL SCI-02] must include a description, methodology, and plan for both instrument support activities and science investigation activities for Phases B-F. The plan must also include project management elements for Phases B-F, including a detailed schedule and milestones, science team member roles and responsibilities with key interfaces to the PRIMS Mission.

The Contractor must prepare a Science Roadmap [CDRL SCI-02], demonstrating that Science Readiness Level (SRL)-6 can be achieved by the CDR. Road mapping activities may include laboratory analysis, numerical modeling, or field Work in a relevant environment, Planetary and Contamination Control, and sample curation and analysis. The analogue operational environment, test scenarios and operations planning tools to be implemented are described.

Similarities and differences of the terrestrial analogue environment used or to be used to the anticipated planetary environment are identified and discussed. Uncertainties and limitations of the study approach with respect to the expected space operations environment and planned mission capabilities are identified and discussed. The description of the Calibration and Characterization including a selection of minimum calibration target suite must be included. A forward plan for the development of the data processing tools must be included with a data archiving strategy. These activities must be documented by the Contractor, linked through a verification matrix to the appropriate mission requirements they are addressing.

4.4 SYSTEMS REQUIREMENT REVIEW

The Contractor must prepare and conduct a System Requirements Review (SRR) meeting. The purpose of this review being to demonstrate the validity of the system requirements and the project readiness to proceed with the preliminary design.

The SRR must meet the objectives, entry and exit criteria detailed in the Systems Engineering Technical Reviews Standard [AD-04]. The SRR deliverables must include the SRR Data Package as per CDRL PM-16, the presentation as per CDRL PM-26 and the specific applicable deliverables as per Table B.3.

As this milestone is expected to also include the equivalent of an Operational Requirements Review (OpRR), and a Systems Definition Review (SDR), additional objectives include demonstrating the operational concept allows for achieving the science objectives as set out in the MCC, and the matching system concept and functional architecture definition that is intended to meet those system requirements.

The SRR must include the following:

- Science concept
- Operations Concept (the concept must be based on the science instrument mission operations concept and must be documented in the Operations Concept Document [CDRL OPS-03]. The operations concept must produce the required distribution of measurements in time/space.)
- Operations requirements
- External requirements:
  - with the partnered NASA payload
  - With ExDOC
- System requirements
- System definition
- Requirement tracing to the mission requirements

5 PRELIMINARY DESIGN PHASE (PHASE B)

Preliminary design is the initial portion of the complete instrument design effort. The Preliminary design review (PDR) is performed with the CSA to ensure that the design is proceeding in the desired manner, and that important issues are addressed before they become embedded into the instrument design.

The preliminary design is completed after the PDR.

5.1 PRELIMINARY DESIGN

The Contractor must develop an initial design of the instrument such that it will permit verification that the design meets the requirements. The Hardware (H/W) and Software (S/W) Design Reports may be separate. The System Design Document (CDRL ENG-130) and Software Design Document (CDRL ENG-140) must include drawings and architecture elements, as well as justification elements through analysis.

The Contractor must produce layout drawings, assembly drawings, System Interface Control Document (ICD) drawings, per CDRL ENG-70, that are not already provided under another CDRL.

All analyses performed as part of the design process must be submitted to the CSA for review, along with the corresponding models that are due at the PDR per the CDRL list (Appendix B.3).

5.2 SOFTWARE PRELIMINARY DESIGN

The Contractor must produce, maintain, and implement the Software and FPGA (if applicable) development plans per CDRL ENG-31 to reflect the SW development process implemented for both space and ground segments.

The Software Design Document (CDRLs ENG-140 and ENG-141) must be highly modular; the intent is to be able to replace or simulate any major function software package with minimal impacts as well as to be able to port or re-use software packages, the Contractor must use where applicable the Unified Modeling Language (UML) version 2, where possible, for documenting items such as, but not limited to:

- Class diagram,
- State diagram,
- Sequence diagram,
- Deployment diagram.

If applicable, a FPGA design document, as per CDRL ENG-141, must also be produced.

5.2.1 Software Requirements Development

The Contractor must develop the software requirements as a part of the design. The Contractor must deliver System Requirements document as per (CDRL ENG-01) and, if applicable, a FPGA Requirements. Software functionality must meet the functionality and on-board processing requirements as defined in CDRL MM-09.

The Contractor must develop Software Version Description Documents (VDDs) as per CDRL ENG-148 to describe all as-built configurations of the software.

If applicable, the Contractor must develop a FPGA VDD, as per CDRL ENG-149, to describe all as-build FPGA configurations. This may be included in the Software VDD (CDRL ENG-148) instead of a separate CDRL.

5.2.2 Data Processing Software Preliminary Design

The Contractor must provide the software preliminary design for the end-to-end data processing (data pipeline). This must include software necessary to produce data required to meet the science requirements (Level 1) and, if applicable, to produce any additional data (Level 2). All algorithms that need to be produced and simulations that need to be run for validation must be presented.

5.3 INTERFACE CONTROL DOCUMENT

The Contractor must prepare and deliver an Interface Control Document (ICD) per CDRL ENG-70. The ICD must address all the External Systems Interface Requirements (CDRL MM-04).

Note that ICDs must be developed jointly with the NASA payload provider and CLPS provider. All negotiated interface requirements must be included in CDRL MM-04. At the Contractors discretion, CDRL ENG-70 may be split into an internal ICD, and an external ICD suitable for distribution with external partners.

5.4 SUPPORT EQUIPMENT DESIGN

The Contractor must develop a plan (CDRL ENG-23) and a preliminary design (CDRL ENG-130) of dedicated supporting equipment needed for testing. The plan and preliminary design is to be documented in CDRL ENG-23.

5.5 VERIFICATION PLANNING

The Contractor must complete the space and ground segments System Test Plan (CDRL ENG-174) by defining how each LSI system and subsystem will be verified relative to its requirements. The System Test Plan must also include integration with the NASA payload, and the CLPS provided services.

5.6 UPDATED CANADIAN SCIENCE PLAN

The Canadian Science Plan (CDRL SCI-02) must include a publication and science dissemination plan that is developed and used to prioritize further development of data analysis approaches and tools. A public engagement plan is also included to plan and budget for procurement of models, animations etc.

5.7 PRELIMINARY DESIGN REVIEW (PDR)

The Preliminary Design Review is a detailed initial iteration of the LSI design. LSI design includes all space and ground segment elements, not only the main products, but also supporting systems such as ground/test support equipment. The Contractor must prepare and hold a PDR meeting; at which time the preliminary design of the LSI will be reviewed and all interface requirements will have been demonstrated per PDR exit criteria.

The purpose of this review is to demonstrate that the preliminary design meets the requirements (including software requirements) and is feasible within the appropriate margins (mass, power, thermal, etc.) including cost and schedule constraints, that requirements have been flowed down to all levels, that interfaces have been defined that meet requirements, and that the project is ready to proceed with the detailed design. The Contractor must demonstrate that risks associated with technology readiness are understood and mitigated. This information must be summarized in a Review Presentation and satisfy the exit criteria (CDRL PM-16).

Instructions for preparing for and conducting a formal PDR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA.

6 DETAILED DESIGN PHASE (PHASE C)

6.1 DETAILED DESIGN

The Contractor must develop the design of the LSI to meet the exit criteria of a Critical Design Review, and such that the Contractor demonstrates readiness to manufacture. This design must be presented in the updated Design Document (CDRL ENG-130) and drawings (CDRL ENG-153). All analyses performed as part of the design process must be finalized and submitted to the CSA PA for review, along with the corresponding models.

6.2 SOFTWARE DETAILED DESIGN

The Contractor must update and finalize the software documentation and must submit them to the PA.

The Contractor must update the Software Version Description Documents (VDDs) throughout the project (CDRL ENG-148 and ENG-149) to describe all as-built configurations of the software.

6.3 DETAILED DESIGN VERIFICATION

The Contractor must perform verification activities of the detailed design to demonstrate that it complies with the requirements. The Contractor must update the planned verification information with the actual verification data including demonstrating compliance with all the requirements, including references to the detailed technical (analysis or test) data that demonstrates compliance to the requirements.

6.4 DEVELOPMENT/ENGINEERING MODEL (EM) TESTING AND RESULTS REVIEW

The Contractor must fabricate and test DTMs (or EMs) as required to validate the design. Test Readiness and Test Data Reviews (TRR, TDR) must be conducted for each test. Results from EM test must demonstrate that required accuracy and precision for the required derived data products will be met under ambient conditions for a representative science scenario, and indicate that the science requirements documented in SCI-01 will be met using the ProtoFlight Model (PFM) of the instrument in the science operations environment.

Calibration targets must be well documented. Resulting data products acquired and processed using preliminary flight and ground software are assessed for quality and archived for use by the operations team for troubleshooting. All instrument EM model functional and performance idiosyncrasies and data artifacts that are discovered during test and characterization are well documented and assessed for impact to investigation implementation and Level 1 & 2 requirements. Clear understanding is demonstrated of which measurement error terms are not well represented under the specific test configuration used. The summary of the performance parameters should be included in an updated and maintain version of the Technical Performance Measures Report (ENG-94).

6.5 SUPPORT EQUIPMENT DETAILED DESIGN

The Contractor must develop a detailed design of all LSI dedicated Ground Support Equipment (GSE) needed for assembly, integration, testing and operations. Support equipment drawings and/or specifications must be provided to the CSA PM (CDRL ENG-130).

Supporting equipment includes dedicated jigs, targets, emulators, optical GSE, Computer GSE.

6.6 LSI OPERATIONS SIMULATOR (TBC)

The Contractor must deliver the final version of the LSI Operations Simulator (LOS) for integration with both ExDOC and the NASA/CLPS facilities that simulate delivery vehicle interfaces and functions. This simulator will be used for operations product development and will include the LSI ground segment and an emulation of the space segment. The Contractor may elect to incorporate the Engineering Model into the LOS to replace emulated functions upon approval by CSA PM.

6.7 LAUNCH PACKAGING FLIGHT SUPPORT EQUIPMENT DETAILED DESIGN

The Contractor must develop a detailed design of any launch packaging flight support equipment that might be needed for launch and deployment operations. Flight Support equipment drawings and/or specifications must be provided to the CSA PM (CDRL ENG-130).

6.8 VERIFICATION AND VALIDATION DETAILED PLANNING AND TESTING

The Contractor must develop System Test Requirements (CDRL ENG-181) that addresses all of the Mission Requirements (CDRL MM-10), and System Requirements (CDRL ENG-01).

The Contractor must develop the detailed Test Procedures that verify all of the System Test Requirements (CDRL ENG-181) (CDRL ENG-189, ENG-195, ENG-196, ENG-198, ENG-199, ENG-201, ENG-203, ENG-206, ENG-235, ENG-236) and Test Reports (CDRL ENG-208, ENG-209, ENG-216, ENG-218, ENG-219, ENG-221, ENG-223, ENG-226, ENG-242A) needed for verification and validation according to the System Verification plan (CDRL ENG-174).

The Contractor may combine all of the test procedures into CDRL ENG-181 provided all of the above listed test procedure CDRLs are easily and clearly delineated to allow for testing by different teams and/or locations. Similarly, the Contractor may combine all of the test reports into CDRL ENG-209.

6.9 UPDATED CANADIAN SCIENCE PLAN

The Canadian Science Plan (SCI-02) is updated to include a final plan for FM calibration and characterization, and updated plans for data processing and analysis, and data management and archive, reflecting lessons learned from EM test, including justification for any additional tests, additional calibration targets, changes to data acquisition and data processing software, and archive documentation. Based on EM characterization, optimal parameters for instrument performance are selected for flight instrument production. The updated plan for test and characterization includes contingency for further optimization of the instrument design based on results of environmental

test. The plan must contain an incompressible test list for flight instrument test includes sufficient science characterization and calibration activities to ensure science success.

6.10 MISSION OPERATIONS REVIEW

The Contractor must prepare and conduct a Mission Operations view (MOR) meeting, which demonstrates that all aspects of operations have been incorporated into the system, plans and schedules. The intent of the meeting is to include operational requirements and needs from the NASA payload provider which may attend the meeting.

Instructions for preparing for and conducting the MOR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA, and NASA partners as required.

6.11 CRITICAL DESIGN REVIEW (CDR)

The Contractor must prepare and conduct a CDR meeting, at which time the detailed design of the LSI and its interfaces will be reviewed. The purpose of this review is to demonstrate that the detailed design meets all the system, interface and design requirements and is feasible within the cost and schedule constraints, and that the project is ready to proceed with the manufacturing production. The Contractor must demonstrate that risks associated with technology readiness are minimized and understood. This information must be summarized in a Review Presentation and satisfy the entry and exit criteria (CDRL PM-26, AD-04).

Instructions for preparing for and conducting a formal CDR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA.

7 MANUFACTURING, INTEGRATION AND TEST (PHASE D)

7.1 MANUFACTURING READINESS REVIEW (MRR)

The MRR will kick-off Phase D activities. Prior to the start of ProtoFlight Model (PFM) Manufacturing and assembly, the Contractor must ensure that formally approved documentation is available, including special processes descriptions, flow diagrams, plans, process control methods as well as personnel and facility certification and must be described in Manufacturing, Assembly, Integration and Test Plan (CDRL ENG-53A).

The Contractor must manufacture and assemble the LSI in accordance with the approved design, and with the planned verification executed at each assembly stage.

The purpose of the MRR is to demonstrate the readiness of the Contractor to proceed with production of the system.

Instructions for preparing for and conducting a formal MRR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA.

7.2 GROUND SEGMENT (TBR)

The operator interactions with the space segment will be performed from multiple locations including the CSA Exploration Development Operations Centre (ExDOC) in St-Hubert, Quebec, and the science team institutions, as well as potentially other locations for remote support (such as on-call real-time support).

Operations will take place for a period prior to launch for operator's training and procedures development and validation, Operational Readiness Tests, up until mission completion. The ground segment will also provide data to support outreach activities.

The CSA ground segment capabilities are:

- Send commands to the instrument;
- Receive, display and monitor rover telemetry;
- Archive complete telemetry and commands history;
- Conduct operation playback from the archived telemetry and commands history;
- Assess health and trending of key system performance parameters;
- Provide mission planning tools, including support for team meeting and shift handoff support;
- Provide voice loops for local and remote team members;
- Disseminate science instrument data and selected rover telemetry to the science team;
- Disseminate selected telemetry and science data to external users such as International Partners and the Canadian public.

7.2.1 LSI Operator Console

The LSI operator console will be at the ExDOC and all Command and Control (C&C) will be enabled through the LSI Ground Segment (LGS) software that will be integrated to the ExDOC. This console will provide engineering support to TBD during instrument operations and will support full C&C of the LSI for operations and all system re-configuration.

All complete system level testing must incorporate both the lunar and ground segments to the extent possible at the time of the test. All Compatibility-level testing (e.g. CTRs) will include both segments, either at engineering or flight maturity levels. Testing that includes the LGS will utilize CSA and potentially NASA facilities to host and execute full system testing.

7.2.2 NASA

The LSI may be operated from an alternative facility. This may include a NASA facility as determined by PRISM or the NASA payload provider facility. The Contractor must identify all additional operations facilities intended of being used in CDRL OPS-03.

7.3 PROTOFLIGHT MODEL (PFM) TESTING

The Contractor must fabricate and test the PFM for LSI. The PFM will be used to complete the qualification testing described in the LSI PAR document (AD-04). The PFM will also be used to validate the science investigation by using calibrated PFM data products that will allow verification of the science requirements before launch. The Contractor must conduct a Test Readiness Review (TRR) prior to the start of any formal qualification or acceptance testing of the delivered hardware and software items. The Contractor must seek approval by the CSA PM to proceed with formal testing. Testing must allow for the training of the science operations and final validation of the science plans for the mission operations phase. A data package must be provided to CSA in accordance with CDRL PM-16. The detailed test sequence must be as identified in the approved Verification and Test plan (CDRL ENG-174).

LSI must be subjected to functional tests as well as to environmental tests on the on-orbit, lunar segment and its launch packaging as specified in the LSI System Requirements document (AD-01) and in the LSI PAR document (AD-04).

7.3.1 Instrument Acceptance Test Activities

The Contractor must conduct a Test Readiness Review (TRR) prior to the start of any formal acceptance testing of the delivered hardware and software items. The Contractor must seek approval by the CSA PA to proceed with acceptance testing. A data package must be provided to CSA in accordance with CDRL PM-16.

Test results that demonstrate the acceptability of the deliverables must be presented in Test Reports .

CSA must be invited with ten (10) business days warning to prepare travel for witnessing the test.

7.3.2 Ground Segment Acceptance Test Activities

The Contractor must conduct a Test Readiness Review (TRR) prior to the start of any formal acceptance testing of the delivered ground segment software items to be integrated to the CSA ExDOC. The Contractor must seek approval by the CSA PM to proceed with acceptance testing. A data package must be provided to CSA in accordance with CDRL PM-16.

Test results that demonstrate the acceptability of the deliverables must be presented in Test Reports (See section 6.8).

The Contractor must update the Requirements Traceability Verification and Compliance Matrix (CDRL ENG-181) to replace the previous verification data with the actual verification data including references to evidence which show the compliance.

CSA must be notified with at least ten (10) business days warning to prepare for supporting the test.

7.3.3 Science Verification and Validation

The Science Verification and Validation Report (SCI-03) must demonstrate that level 1 to 3 science requirements will be achieved in the science operations environment, through results from PFM test, updated instrument performance model, updated model simulations, results from analogue operations test and/or other analysis.

7.3.4 Compatibility Test Review (CTR)

The purpose of the CTR is to demonstrate that the LSI Flight System, NASA provided payload and CLPS provided H/W can successfully communicate according to system requirements, interface requirements and ICD parameters. This CTR will also demonstrate that the ExDOC ground consoles can successfully communicate according to system requirements, interface requirements and ICD parameters for that operational interface.

Instructions for preparing for and conducting a formal CTR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA, NASA payload provider and the CLPS provider.

7.4 DATA MANAGEMENT AND ARCHIVE PLAN

The Contractor must provide a Data Management and Archive Plan (CDRL SCI-04) that will contain the data processing pipeline and analysis process that has been tested with simulated science data and using flight instrument performance characteristics. Descriptions and headers of each data product must be documented. The science algorithms for derived data products that have been implemented in software, optimized and documented must be included. Science analysis tools and models that have been implemented according to plans should be ready for operations and must be included in the document.

7.5 SCIENCE OPERATIONS SOFTWARE USER MANUAL

The Contractor must provide a Science Operations Software User Manual (CDRL SCI-05) that will document all science activity commanding and quick look science analysis that have been developed from the tested Uplink and Downlink software.

7.6 UPDATED CANADIAN SCIENCE PLAN

The Canadian Science Plan (SCI-02) must be updated to include final plans for primary Science Operations, Data Processing and Analysis, Data Product Management and Archive, and Sample Curation and Analysis, reflecting lessons learned from PFM test, implementation of the planetary protection and contamination control plan, and analogue science operations test and training. A nominal staffing plan and plan for operations facilities for primary science operations, as well as an anomaly resolution plan must be included. Extended calibration and validation campaigns as needed during science operations are described, for example, plans to acquire science data during checkout and commissioning for test of data processing algorithms. Resources are assigned for continued development of science algorithms and analysis tools and a quick second release following results of check- out/commissioning.

The public engagement plan must be updated and must contain a draft schedule of events, and models, animations etc. A press release for launch must be coordinated with CSA and team partners.

7.7 DOCUMENTS UPDATE TO AS-BUILT

The Contractor must update the Design documentation (CDRL ENG-130, ENG-140, ENG-141) and drawings (CDRL ENG-02 and ENG-22) to the as-built condition.

This will include the information needed to support a planetary protection II-L as required.

7.8 PACKAGING, STORAGE, TRANSPORT AND HANDLING

The Contractor must provide Packaging, Storage, Transport and Handling Procedures (CDRL SMA-27) for the hardware deliverables, and to identify necessary procedures to be implemented following delivery (CDRL ENG-196).

The Contractor must also provide a transportation container for moving the LSI in its launch box from the Contractor’s facility to NASA’s payload provider preparation facility. The container should be able to dampen out transportation loads and vibrations to a level lower than to which the LSI and its launch box is designed to withstand.

7.9 PFM ACCEPTANCE AND PRE-SHIP REVIEW

The Contractor must hold an Acceptance Review and Pre-Ship Review for LSI at the end of Phase D at the Contractor facilities. This review will have full NASA and CLPS participation. The purpose of this review is to demonstrate that the as-built and as-coded LSI meets the agreed set of requirements and can be accepted, and that all open items (including but not limited to RIDs, Actions, Non Conformance Report (NCRs) have been closed and EIDP (CDRL SMA-29), and the Qualification Acceptance Data Package (CDRL SMA-31) are complete and approved. This information must be summarized in a Review Presentation (CDRL PM-26) and satisfy the entry and exit criteria (AD-04).

7.10 LAUNCH / OPERATIONS READINESS REVIEW (L/ORR)

The Contractor must support the NASA/CLPS Launch and Operations Readiness Review as specified in the JPIP.

Instructions for preparing for and conducting a formal ORR are given in AD-04. These should be tailored for a Class C mission in accordance with AD-12, in consultation with CSA.

8 OPERATIONS (PHASE E)

The operation phase starts after launch of the spacecraft with the NASA payload and provided instrument. This phase ends with the Decommissioning Review (DR). Actual commissioning and operations will occur during the illuminated portion of a single lunar day.

Actual operations are expected to occur from CSA/ExDOC, yet the Contractor must budget operations being performed at a designated NASA facility for the duration of surface operations. The Contractor must also budget for at least 2 days prior to operations, and two days after operations are completed (TBC).

8.1 LAUNCH AND TRANSIT TO LUNAR SURFACE

The launch, space transit from to Lunar orbit, and subsequent Landing on the designated landing site may require some support from the Contractor (TBC). It is possible there will be opportunities to perform some limited commissioning yet this should be expected.

The Contractor is expected to support NASA during this phase, which may include basic monitoring of the instruments health.

8.2 COMMISIONNING

Once the spacecraft has delivered the mission system to the lunar surface, the Contractor must support surface activities. Notionally, this will consist initially of a commissioning phase. The commissioning of the instrument will be performed as per the Commissioning Plan CDRL OPS-10.

The Contractor will prepare material to support the Commissioning Review (CR). Given the limited duration of this phase, the material is expected to cover what was accomplished, any irregularities encountered, and if required remedial steps along with recommendations per System Contingency Operation Procedures (CDRL OPS-21).

The completion of the CR enables instrument surface operations.

8.3 LUNAR SURFACE OPERATIONS

Actual operations will be performed as per the Mission/Science Operational plan (CDRL OPS-04) using Nominal Operation Procedures (CDRL OPS-20), and if required Contingency Operation Procedures (CDRL OPS-21) to enable achievement of the minimal operational science success and the delivery of calibrated and validated data products and associated document to the Planetary Data System as requested by PRISM and to a Canadian data repository.

For planning purposes, the Contractor must plan for continuous operations during the entire lunar surface operations window (e.g.: 24/7), including provisions for back-up personnel.

The Contractor is advised that CSA will send at least one representative during operations. CSA will cover the CSA personnel travel and living expenses under its own budget.

8.4 UPDATED CANADIAN SCIENCE PLAN

If applicable, the Contractor must update the Canadian Science Plan (SCI-02) to respond to discoveries and anomalies or issues that have been discovered in science operations. New flight and ground software releases are planned as needed to maintain existing Level 1 requirements, with adequate allocation of resources. Plans for further development of data algorithms, data analysis tools and approaches and new validation and calibration activities, are defined to respond to discoveries, with adequate justification if new resources are sought.

If applicable, draft plan for an extended science operations phase is defined with sufficient detail for approval.

8.5 DECOMMISSIONING REVIEW (DR)

Once the mission director announces the end of the operations phase, the Contractor must hold a Decommissioning Review. The purpose of the DR is to confirm readiness to proceed with the safe decommissioning and disposal of mission assets with particular attention to leaving the instrument in a safe state and all mission data is archived. NASA will be invited during this review to support the greater mission decommissioning activity.

This phase of the project is completed once the DR is completed.

9 DECOMMISSIONING AND SCIENCE PUBLICATION

9.1 SCIENCE PUBLICATION (PHASE F)

Once the operational phase is completed, the Contractor must review the publication plan that was included in the Canadian Science Plan (SCI-02) and update it as necessary. The Work to be done is to complete the planned data analysis activities and analyse the obtained data and prepare scientific papers as per PRISM and CSA guidelines (SCI-06).

Note: If there is no substantive change to the plan, this can be addressed with a TIM.

9.2 SCIENCE PRE-PUBLICATION REVIEW (SPPR)

Before publishing mission results, the Contractor must conduct a Science Pre-Publication Review.

The intent of this review is to give CSA the opportunity to review the results and the suitability for publication. Details of this review are TBD.

The Contractor must successfully pass this milestone before formally publicly publishing results.

10 DELIVERABLE ITEMS

The Contractor must design, manufacture, test, and deliver the LSI and associated software specified in Appendix A.

Formal acceptance of the deliverables will be carried out at the Contractor's premises, unless otherwise specified by the CSA PA.

The Contractor must deliver all documentation described in the SOW and the CDRL items listed in Appendix B.

All delivered items will become and remain the property of the CSA.

APPENDICES

A CONTRACTOR DELIVERABLES

A.1 HARDWARE DELIVERABLES

The Contractor must deliver all hardware listed Table A-1. All items are delivered to CSA but may be shipped according to the instructions below.

TABLE A-1 – HARDWARE DELIVERABLES

Description	Quantity	Delivery Date	Shipped to
LSI Breadboards and Shipping Container	As built	AR*	CSA
LSI full-scale SLA Models and shipping container	1	CDR	CSA
LSI EM, and Shipping Container	1	AR*	CSA
LSI Flight Model, Launch Packaging Flight Support Equipment and Shipping Container	1	PSR	NASA
Sized LSI SLA model and shipping container	1	TRR	TBD**
Sized LSI SLA model and shipping container	1	FR	CSA

*Note: At CSA's discretion, CSA may choose to let the Contractor retain possession.

** Location will be the actual location where operations are performed. For the purposes of cost estimation, assume this will be in the United States.

A.2 SOFTWARE DELIVERABLES

The Contractor must deliver all binaries listed in Table A-2. All binaries must be delivered on media that is directly compatible with the each respective delivered hardware. One set of the binaries must be installed on the delivered hardware. All delivered non- Commercial Off The Shelf (COTS) binaries developed on the project must include the compiled files, design documentation, users' manuals, test results and associated plans and procedures. The binaries must be executable.

TABLE A-2 – SOFTWARE DELIVERABLES

Description	Delivery Date	Shipped to
Engineering release of LOS	CDR	CSA
LSI software binaries, FPGA source code, etc	TRR	CSA
Ground Segment API binaries (software/firmware)	TRR	CSA/NASA*
PFM binaries (software/firmware)	AR	CSA
Final release of LOS	TRR	CSA/NASA*

*: This will be shipped to CSA and the designated ground support facility either at ExDOC or NASA payload provider preparation facility (TBD)

A.3 DOCUMENTATION DELIVERABLES

The Contractor must deliver all documentation (CDRL items) listed in Appendix B, in the formats defined in the CDRL list and Appendix C. All documents must comply with the Deliverable Document and Data Requirements specified in DID-100 – General Preparation Instructions.

B CDRL LIST

This Appendix defines the documentation, computer models, and analyses to be delivered by the Contractor.

B.1 ABBREVIATIONS USED

TABLE B-1 – CATEGORY OF APPROVAL

ABBREVIATION	DEFINITION
A	Approval
R	Review

LEGEND:

1) DID No.

- CF = Contractor's format
- DIDs are provided in Appendix B, these are consistent with the documentation that should be produced in a Phase 0 project as detailed in the Contract Data Requirements List (CDRL) Compendium (RD-05)

2) Document Versions (this refers to the version of the document that will be delivered though the duration of the Phase 0 contract):

- 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 and 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).

B.2 DISTRIBUTION AND COPIES

All documents must be provided in the format specified in the relevant DID, ten (10) Working days prior to the specified Review/Meeting unless otherwise indicated. Paper copies are not required.

B.3 CDRL TABLE

The following is a preliminary list of CDRLs. The CSA will NOT request all of the CDRLs. In many cases, especially for the analysis type documentation, these have to be relevant for the specific instrument being developed and should be reviewed with CSA. CSA may waive CDRLs if determined by CSA to not be relevant..

In addition given the inherent collaboration with a NASA payload provider, it is preferable to have one document that meets both CSA and the NASA payload partner provider needs. In such cases, where needed, an addendum or annex can be used as a way of providing delta information if and where needed.

TABLE B-1 –CDRL LIST

CDRL No.	Title	DID No.	SOW reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
	Mission Documentation																												
MM-04	**External Systems Interfaces Requirements**		5.3			IR			U							F													A
MM-05	**Technology Readiness and Risk Assessment (TRRA) Report**	013	3.4.9 3.4.10		IR				U	U						F													A
MM-07	**Technologies Development Plan**	006	3.4.10		IR				U	F																			A
MM-09	Mission & Science Operations Plan	826	5.2.1		IR	IR				U						U	F													A
MM-10	**Mission Requirements Document**	008	3.3.5.3 6.8		IR				F																					A
MM-11	**System Conceptual Design**				IR				F																					A
	Project Management																												
PM-01	**Project Management Plan**	101	3.2.1 3.3	KO																										A
PM-03																														
PM-04	**CWBS and Work Package Descriptions**	102	3.2.1 3.2.4	KO					IR	U						F														A/R
PM-06	**Project Cost Estimate**								IR	U						F														A
PM-07	**Project Schedule**	105	3.2.1 3.2.5						IR	U						F														A
PM-08	**Risk Management Plan**	106		KO																										A
PM-09	**Progress Report**	107	3.2.1 3.2.3 3.2.6	M																										R

CDRL No.	Title	DID No.	SOW reference	Other	Contract Award	A				B		C					D											Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
			3.2.7 3.2.8 3.2.9.2 3.3.3.5 3.3.11.2																										
PM-10	**Progress Review Presentation (alternate to Progress Report)**		3.2.9.2	M																									R
PM-11	**Project Cost Status (if not included in Progress Report)**			M																									R
PM-12	**Project Schedule Update (if not included in Progress Report)**			M																									R
PM-13	Meeting Agenda	110	3.2.9	X																									R
PM-14	Minutes of Meetings	111	3.2.9	X																									R
PM-15	**Action Items Log (AIL)**	112	3.2.8 3.2.9.2	X																									R
PM-16	**Review (MCR, MRR, etc.) Data Packages**	113	4.4 5.7 7.3 7.3.1 7.3.2			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	R
PM-17	**Crown Assets List**	117							IR	U		U											F						A
PM-20	**Background Intellectual Property (BIP) Disclosure**	120	3.2.11	Prop.																									R
PM-21	Foreground Intellectual	120	3.2.11	EoC																									R

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
	Property (FIP) Disclosure																												
PM-23	**Project Final Report**	114	3.2.7.1	EoC																								F	R
PM-24	Meeting Calendar			W or M																									R
PM-25	Joint Project Implementation Plan (JPIP)	CF	3.2.1		IR			F																					
PM-26	Review Presentation	CF	4.1 4.4 6.11 7.9		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Engineering																												
	Requirements Documents and Specifications																												
ENG-01	**System Requirements Document**	400B	3.4.8 5.2.1 6.8						IR	F																			A
ENG-02	**Hardware Source Control Drawings**	704	3.4.8 7.7	X[1]																			F						A
ENG-22	**Software Source Control Document**	704	7.7	X[5]																			F						A
	Engineering Plans																												
ENG-23	**System Design and Development Plan**	451	3.3 3.4.4 3.4.9 5.4	KO[6]	IR			U		F																			A
ENG-31	**System Software Development Plan**	452	3.3.8	CA+[2]		IR				U						F													A
ENG-53A	**Manufacturing, Assembly, Integration and Test Plan**		7.1							IR						F													A

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
	Interface Requirements Documents (IRD)																												
	Interface Control Documents (ICD)																												
ENG-70	**System ICD**	501	5.1 5.3							IR						U		F											A
	Studies, Assessments and Reports																												
ENG-87	**Trade-off Studies (architecture, functional, Design, production, etc.)**	CF							IR	U						F													R
ENG-89	**Product Tree**	525	3.2.4 3.4.9	X					P	IR						U							F						R
ENG-90	**Drawing Tree**	CF		X					P	IR						U							F						R
ENG-92	**Documentation Tree**	CF		X					P	IR						U							F						R
ENG-93	**Long Lead Items List**	529							U	F																			R
ENG-94	**Technical Performance Measures Report**	530	3.4.8 6.4	CA+[1]					P	U						U							F						R
ENG-95	**Technical Notes**	CF	3.2.10.4 3.4.13	X																									R
	Models and Engineering Analyses[1]																												
ENG-96	**Computer-Aided Design models (mechanical)**	600C	3.4.5 3.4.6.2						P	IR						F													R
ENG-97	**Mechanical Analysis**	604	3.4.5						P	IR						F													R
ENG-98	**Structural Model and Analysis**	605	3.4.5 3.4.6.1						P	IR						F													R
ENG-99	**Mass Model and Analysis**	606	3.4.5						P	IR						F													R
ENG-101	**Thermal Model and Analysis**	607	3.4.5 3.4.6.4						P	IR						F													R

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D											Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
ENG-102	**Electrical Power and Distribution Analysis**	611	3.4.5						P	IR						F													R
ENG-107	ElectroMagnetic Compatibility / ElectroMagnetic Interference (EMC/EMI) Model and Analysis	616							P	IR						F													R
ENG-115	**Coupled Loads Analysis**	609	3.4.5						(P)	P						IR							F						R
ENG-116	Fields of View Analysis	625	3.4.6.3						P	IR						F													R
ENG-118	Radiation Model and Analysis	618	3.4.5						P	IR						F													R
	Design Documentation																												
ENG-130	**System Design Document**	701A	3.3 5.1 6.1 6.5 6.7 7.3.2 7.7						P	IR		F				F													R
ENG-140	Payload Software Design Document	706?	5.1 5.2 7.7							IR		U				U							F						R
ENG-141	Payload FPGA Design Document	711	5.2 7.7							IR		U				U							F						R
ENG-148	Payload Software VDD	710	5.2.1 6.2									IR	U			U		U						F					R
ENG-149	Payload FPGA VDD	712	5.2.1 6.2									IR	U			U		U						F					R
ENG-153	**Design, Assembly and Interface Control Drawings (mechanical and electrical),**	704	3.4.7 6.1							IR		U				U							F						R

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
	with Listing of Drawings and Engineering Change Notices (ECNs).																												
	Test Documentation																												
ENG-173	Prototyping and Breadboarding Test Plan	455	3.4.2						IR	F																			A
ENG-174	**System Test Plan**	467	3.4.2 3.4.5.1 5.5 6.8 7.3							IR						F													A
ENG-181	**System Test Requirements Document**	750	7.3.2 6.8												-	IR													A
ENG-188	**Prototyping and Breadboarding Test Procedure**	754											IR			F													A
ENG-189	**System Test Procedure**	754	3.4.2 6.8															IR	F										
ENG-195	Space / Ground Segments Compatibility Test Procedure	755	6.8															IR	F										A
ENG-196	**Pre-launch Site Test Procedure**	754	3.4.2 6.8 7.8															IR	F										A
ENG-198	**Vibration / Shock Test Procedure**	754	3.4.2 6.8															IR	F										A
ENG-199	**Mass Properties Test Procedure**	754	3.4.2 6.8															IR	F										A
ENG-201	**Thermal Vacuum Test Procedure**	754	3.4.2 6.8															IR	F										A
ENG-203	**EMC/EMI Test Procedure**	754	3.4.2 6.8															IR	F										A

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D											Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
ENG-206	Off-gassing Test Procedure	754	3.4.2 6.8															IR	F										A
ENG-208	**Prototyping and Breadboarding Test Report**	759	6.8											IR					IR										A
ENG-209	**System Test Report**	759	6.8																IR										R
ENG-216	**Pre-launch Site Test Report**	759	6.8																IR										R
ENG-218	**Vibration / Shock Test Report**	759	6.8																IR										R
ENG-219	**Mass Properties Test Report**	759	6.8																IR										R
ENG-221	**Thermal Vacuum Test Report**	759	6.8																IR										R
ENG-223	**EMC/EMI Test Report**	759	6.8																IR										R
ENG-226	**Off-gassing Test Report**	759	6.8																IR										R
ENG-227A	**System Software Test Plan**	751								IR																			A
ENG-235	Payload Software Test Procedure	755	6.8															IR											A
ENG-236	Payload FPGA Test Procedure and Report	756 761	6.8															IR	F										A
ENG-242A	**System Software Test Report**	755	6.8																IR										R
	Safety and Mission Assurance (S&MA)																												
	S&MA Plans																												
SMA-02	**Product Assurance (PA) Implementation Plan**	320	3.3.1 3.3.3 3.3.3.1 3.3.4	KO[1]																									A

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
			3.3.6 3.3.7 3.3.13																										
SMA-03	**PA Requirements Compliance Matrix**	320	3.3.1	KO[13]																									A
SMA-04	**Configuration and Data Management (CADM) Plan**	322	3.3.3.3	KO																									A
SMA-06	Contamination Control Plan	324	3.3.10							IR		F																	R
SMA-08	Storage, Transport and Handling Plans	CF	3.3.3.4							IR		F																	A
SMA-09	Manufacturing and Inspection Flow Chart	CF								IR		U																	A
	S&MA Analyses																												
SMA-10A	**Failure Modes, Effects and Criticality Analysis (FMECA) + Single Point Failure (SPF)**	340	3.3.5.1							IR		F																	R
SMA-11	Reliability Prediction Analysis	344								IR		F																	R
SMA-12	Parts De-rating and Stress Analysis for Parts	341	3.3.5.2									IR																	R
SMA-13	Worst Case Analysis (WCA)	342	3.3.5.3									IR																	R
SMA-15	System Maintainability Assessment	CF								IR		U					F												R
SMA-16	Contamination Analysis Report	345	3.3.10							IR		F																	R

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
SMA-17	Safety Assessment Report	347	3.3.13							IR		U					F												R
SMA-18	Radiation Susceptibility Analysis	346	3.3.5.4							IR		F																		R
SMA-19	Software Criticality Analysis and Classification	348	3.3.8							IR		F																		A
	S&MA Lists																													
SMA-20	Critical Items List	360		U						IR		F																		R
SMA-22	Declared Components List (DCL)	361	3.3.6	U						IR		F																		A
SMA-23	Declared Mechanical Parts List (DMPL)	362	3.3.7	U						IR		F																		A
SMA-24	Declared Materials List (DML)	363	3.3.7	U						IR		F																		A
SMA-25	Declared Processes List (DPL)	364	3.3.7	U						IR		F																		A
SMA-26	Qualification Status List	365	3.3.4.3	U						IR		F																		A
	Miscellaneous																													
SMA-27	Packaging and Shipping Procedures	CF	7.8																				IR							R
SMA-29	End Item Data Package (EIDP)	380	3.3.12 7.9																				IR							A
SMA-31	Qualification Acceptance Data Package	382	3.3.4.2 7.9	X								F																		A
SMA-32	Non-Standard Part Approval Requests	386	3.3.6	X																										A

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
SMA-33	Request for Deviation	383	3.3.11.1	X																									A or R[1]
SMA-34	Request for Waiver	383	3.3.11.1	X																									A or R[15]
SMA-36	Class I Non-conformance Reports	385	3.3.3.5	X																									A
SMA-36A	Class II Non-conformance Reports	385		X																									R
SMA-37	Class I/II Failure Reports	387		X																									R
SMA-39	Audit Report	CF	3.3.3.1	X																									R
	Operations																												
	Operations Requirements																												
OPS-01	Operations Requirements Document	800				IR				F																			A
	Operations Concept and Plans																												
OPS-03	System Concept of Operations	825A	4.4 7.2.2				IR								F														A
OPS-04	Mission / Science Operations Plan	826	8.3			IR									F														A
OPS-10	Commissioning Plan	832	8.2													IR	F													A
OPS-13	Training Plan	842														IR	F													R or A[16]
OPS-18	System Calibration Plan	841				P				IR						F														A
	Operations Procedures																												
OPS-20	System Nominal Operation Procedures	900	8.3																				IR						R
OPS-21	System Contingency Operation Procedures	901	8.2 8.3																				IR						R
OPS-22	System Calibration Procedures	902																					IR						R

CDRL No.	Title	DID No.	SOW Reference	Other	Contract Award	A				B		C					D												Acceptance Category
					KOM	MCC	OpRR	SRR	SDR	PDR	PQSR	QSR	TRR	TDR	MOR	CDR	MRR	TRR	TDR	FVVR	GVVR	CTR	AR	ORR	FRR	PSR	FRR	LRR	FR	
	Operations Manuals																												
OPS-23B	Instrument Operations Handbook	CF														IR								F						A
	Operations Reports																												
OPS-30	Commissioning Report	977																										IR		R
	Science Deliverables																												
SCI-01	Science Objectives and Requirements	000	4.2 6.4			IR			F																					A
SCI-02	Canadian Science Plan	CF	4.3 5.6 6.9 7.6 8.4 9.1			IR			U	U			U						U					U						R
SCI-03	Science Verification and Validation Report	CF	7.3.3																F											A
SCI-04	Data Management and Archive Plan	CF	7.4															IR					F							
SCI-05	Science Operations Software User Manual	CF	7.5															IR					F							
SCI-06	Science Presentations and Publications	CF	9.1		As mutually agreed																									

C DATA ITEMS DESCRIPTIONS (DIDS)

Note: The DID list is very preliminary and requires significant tailoring to address the needs and reality of a class C mission. Similar to CDRL's, these can be further tailored at the KOM. The intent of these is to ensure sufficient information exists for a successful mission, and basic government legal requirements.

In general, contractor format will be acceptable, provided the required information is presented.

DID-100 – General Preparation Instructions

DID Issue: Tailored for use in DSXR Phase 0

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.

1.1.3 E-mailed Documents

E-mailed documents must be sent to:
asc.bibliothequegc-cmlibrary.csa@canada.ca
Covering e-mails must contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted.

1.1.4 Direct Transferred Documents

For direct transfer, a notification of the document's availability and location on a Contractor repository must be sent to:
asc.bibliothequegc-cmlibrary.csa@canada.ca
If deliverables contain ITAR content, notifications of their availability on Contractor repositories shall be sent to:
CSA-CM-ITAR@asc-csa.gc.ca
The notification must include the project/program acronym or equivalent identifier and the CDRL identifier under which the deliverable documents are being submitted.

1.1.5 Documents Delivers on DVD or CD-ROM Disk

Hard copy and media deliverables are to be addressed to:
CM Library, 6A-100
Attention: CSA DSXR Phase 0 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 :

e) Company Name

f) Document Title

g) Document Number and Revision Status

h) CSA SOW Number

i) CDRL Number and Title

j) Contract Number

2. DOCUMENT STRUCTURE AND CONTENT

2.1. OVERALL

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

k) Cover/Title Page;

l) Table of Contents;

m) Introduction;

n) Applicable and Reference Documents;

o) Body of Document; and

p) Appendices

2.2. COVER/TITLE PAGE

The title page must contain the following information:

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

r) Rev. indicator / date of Rev.

s) Document Title

t) Project Name

u) Contract No.

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

w) Prepared for: Canadian Space Agency

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

y) Product tree identifier, if applicable

z) © 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:

aa) Project description and background;

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

cc) Purpose of the document;

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

ee) Document conventions; and

ff) 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

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.

Provided by Supplier	Metadata Description	Comments
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	
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

Provided by Supplier	Metadata Description	Comments
Yes	Product Breakdown Structure / Item Hierarchy Identifier	Critical for Item-to-Document Relationship
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

DID-000 – Science Objectives and Requirement Document

DID Issue: IR **Date: 2014-02-14**

PURPOSE:

The purpose of this document is to provide all the science justification, as well as mission and scientific objectives, the identification of the users and the definition of their needs. This document acts as the source for the Mission Requirements Document (MRD) and the Preliminary Mission Development Plan (MDP).

PREPARATION INSTRUCTIONS:

This must be a CSA document with a CSA number. The document must contain the following information, as a minimum:

1) Introduction
    a) Document purpose,
    b) Document scope;
2) Applicable and Reference Documents;
3) Mission Description:
    a) Mission description/overview,
    b) Mission general objectives,
    c) Mission science & application objectives,
    d) Data products,
    e) Mission success criteria;
4) Science Objectives:
    a) Introduction, background, scope,
    b) Mission goals,
    c) Science goals,
    d) Space community priorities,
    e) Traceability between space community priorities and mission goals;
5) Users' Needs:
    a) Measurement needs,
    b) Measurements assessment analysis,
    c) Data needs,
    d) Canadian data needs;

6) Science traceability matrix
    a) Level 1 to 3 requirements with narrative description
7) Instrument data processing architecture
    a) Data tools
    b) Data storage management
    c) Level 0 to Level 2 processing algorithms

Appendix A: Nomenclature

Appendix B: Acronyms

DID-0013 – Technology Readiness and Risk Assessment with Stand Alone Report

DID Issue: IR **Date: 2015-04-28**

PURPOSE:

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

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

The TRRA Report is used to assess project status and technical risks, and to guide definition of risk reduction work in following phases. It is a recommended deliverable at the end of Phases 0, A and B.

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

PREPARATION INSTRUCTIONS:

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

1. INTRODUCTION

This section should include

1) Project Description;
2) Purpose of Document;
3) Scope.

This section must include

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

2. MISSION OBJECTIVES

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

3. MISSION ENVIRONMENT

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

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

4. PRODUCT BREAKDOWN STRUCTURE

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

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

5. KEY PERFORMANCE PARAMETERS (KPPS) FOR EACH CTE

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

6. CRITICAL TECHNOLOGY ELEMENTS (CTES)

1) Description of the CTE;
2) Rational for selecting the CTEs.

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

7. TECHNOLOGY MATURITY AND VIABILITY ASSESSMENTS

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

1) Description;
2) Main requirements (including KPP(s) associated with this CTE);
3) Heritage and compliance;
4) TRL achieved;
5) R&D3;
6) TNV.

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

8. TRRA SUMMARY AND RECOMMENDATIONS

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

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

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

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

9. CONCLUSIONS

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

APPENDIX A – Technology Readiness and Risk Assessment Worksheets

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

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.

4. 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.

5. CONTENTS

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

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

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

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

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

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

DID-008 – Mission Requirements Document (MRD)

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

PURPOSE:

To capture the mission requirements required to proceed with the development of system requirements.

PREPARATION INSTRUCTIONS:

NOTE: the full description of the mission is to be presented in the Mission Concept Document, not in the MRD.

The document must include the following:

1. An introduction including the scope, the purpose, a short description of the mission and a list of assumptions (if any);
2. A list of applicable and reference documents (if any);
3. User requirements, which represent a clear articulation of the data and applications needs as expressed by the user community); these requirements shall be summarized in a table at the end of this section or in an Appendix;
4. Mission requirements that respond to user requirements and break down as follows:
    1) Functional and performance requirements;
    2) Interface requirements:
        a) With higher level system, if applicable;
        b) With users (e.g. for data transmission);
    3) Mission environmental requirements
        a) Storage and handling environment
        b) Ground operations environment
        c) Integration to launch vehicle environment (for flight payload only)
        d) Launch environment (for flight payload only)
        e) On-orbit environment (for flight payload only)
    4) Operational requirements including (as applicable):
        a) Loading of science samples:
            i) Timing of loading,
            ii) Location of loading;
    5) In-flight requirements:
        a) Operational modes,

b) Number of communication opportunities,
c) Upload and download of data requirements,
d) Telemetry availability,
e) Commanding capabilities;

6) Recovery of samples (for flight payload only, if applicable)
   a) Timing of recovery
   b) Location of recovery
7) Telemetry requirements;
8) Commanding requirements;
9) Staffing requirements;

The mission requirements shall be summarized in one or more tables at the end of this section or in an Appendix.

DID-101 – Project Management Plan

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

PURPOSE:

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

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

PREPARATION INSTRUCTIONS:

1) The PMP is used to:
2) Guide the project execution;
3) Document project planning assumptions;
4) Document project planning decisions regarding alternatives chosen;
5) Facilitate communications amongst stakeholders;
6) Define key management reviews as to content, extent and timing; and
7) Provide a baseline for progress measurement and project control.

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

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

1. INTRODUCTION

1) Project Objectives;
2) Scope of the Plan; and
3) Applicable and Reference Documents.

2. PROJECT INTEGRATION MANAGEMENT

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

1) The overall project management strategy;
2) How the plan will be executed; and
3) Overall change control mechanisms.

3. PROJECT SCOPE MANAGEMENT

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

1) Initiation;
2) Scope Planning;
3) Scope Definition;

4) Scope Verification; and
5) Scope Change Control.

4. PROJECT TIME MANAGEMENT

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

1) Activity Definition;
2) Activity Sequencing;
3) Activity Duration Estimating
4) Schedule Development; and
5) Schedule Control.

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

5. PROJECT COST MANAGEMENT

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

1) Resource Planning;
2) Cost Estimating;
3) Cost Budgeting; and
4) Cost Control.

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

6. PROJECT QUALITY MANAGEMENT

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

1) Quality Planning;
2) Quality Assurance; and
3) Quality Control.

7. PROJECT HUMAN RESOURCES MANAGEMENT

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

1) Organisational Planning;
2) Staff Acquisition;
3) Team Development;
4) Project organizational chart; and
5) Key personnel.

8. PROJECT COMMUNICATIONS MANAGEMENT

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

1) Communications Planning;
2) Information Distribution;
3) Performance Reporting; and
4) Administrative Closure.
5) Project Risk Management

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

1) Risk Identification;
2) Risk Quantification;
3) Risk Response Development; and
4) Risk Response Control.

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

9. PROJECT PROCUREMENT MANAGEMENT

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

1) Procurement Planning;
2) Solicitation Planning;
3) Solicitation;
4) Source Selection;
5) Contract Administration; and
6) Contract Closeout.

10. PROJECT STAKEHOLDERS MANAGEMENT

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

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

It must address:

1) Stakeholders identification and analysis;
2) Stakeholder management planning;
3) Stakeholder engagement management; and
4) Stakeholder engagement control.

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:

1) A unique identifier traceable to the WBS;
2) A title;
3) The name of the individual responsible for completion of the work;
4) The scope of the work package;
5) The start date and duration;
6) Required inputs and dependencies;
7) 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;
8) Assumptions;
9) Output and work package acceptance criteria;
10) Issue date;
11) Version number; and
12) List of deliverable with delivery milestone.

DID-105 – Project Schedule

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

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The project schedule must be based on the CWBS, in the form of a Gantt chart. The schedule must be provided in its native tool format (MS project or PS8 are the two accepted formats), and in PDF. The project schedule must be detailed enough to show each CWBS task to be performed, and must provide the following information:

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

The schedule must show dependencies between the Contractor and other organizations. For major subcontracts involving significant new development, subcontractors' master schedules must be provided including the same information as required form the prime contractor.

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

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

The contractor must report schedule performance status in tabular form, with the following information provided for each WP:

1) Schedule variance (current and cumulative), and
2) Schedule Performance Index (SPI).

The monthly progress status may be reported as a part of the Monthly Progress Reports. Baseline versions of these schedules will be maintained against which the project will be reported. These baseline schedules must not be revised or changed without prior approval from the CSA.

DID-106 – Risk Management Plan

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

PURPOSE:

The Risk Management plan (RMP) describes the structured and methodical approach to risk management for the project for the Contractor and for each of the subcontractors.

PREPARATION INSTRUCTIONS:

The Risk Management Plan (RMP) shall contain the following information, as a minimum:

1) Description of RMP purpose;
2) Project Overview: Shall provide a brief overview of the project and its deliverables while focussing on perceived risk areas;
3) 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:
    a) Cost – Risks associated with system acquisition or development cost exceeding the budget,
    b) Schedule – Risks associated with achieving designated milestones within the designated time frame,
    c) 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
    d) Programmatic – Risks associated with programmatic factors such as export control, regulations, changes to the project environment, force majeure, etc.;
4) Risk Identification methodology describing the approach to be followed for identifying and documenting risks that might affect the project. The risk 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. Lessons learned from previous projects should be considered;
5) Risk Analysis methodology describing the approach for assessing the likelihood and consequence of each risk to be identified; this should take the form of the usual likelihood vs. consequence matrix;
6) Risk Response Plan section describing the strategies that will be considered in responding to each risk, the decision making approach in choosing the right strategy, and the documentation of the resulting actions for each risk; this should include contingency plans, appropriate responses for taking advantage of positive risks (opportunities) and risk closure criteria;

7) Risk Monitoring and Control approach describing the procedures and forums (e.g. risk review meetings, committees, boards) to be implemented for monitoring risk status, for following up on response plan actions, for updating the risk assessment and for evaluating the risk management process. A history of changes made to the baseline risk register shall be maintained (could simply involve keeping track of former risk reports);

8) Reporting formats describing the format of the risk register as well as any other risk reports or tools required. Shall also define how the outcome of the risk management processes will be documented, analyzed and communicated internally and externally;

9) Roles and Responsibilities defining the lead, support, and risk management team membership for each type of activity in the risk management plan including the names of the resources assigned to these roles;

10) Budgeting approach describing the process for assigning resources and estimating costs needed to perform risk management activities (which costs to be included in the project cost baseline); management of risk contingency reserve shall also be addressed including the process for releasing funds to implement a mitigation action or to realize a risk; and

11) Timing approach defining when and how often the risk management process will be performed throughout the project. Shall also identify the risk management activities to be included in the project schedule.

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:

1) Summary outlook, including technical performance, work performed, schedule and cost status (at CWBS level 2), organization and key personnel changes and areas of concerns;
2) Financial status including actual and forecasted expenditures, by month, as compared to the original monthly planned expenditure profile;
3) *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);

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

5) 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;

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

7) Major meetings schedule update;

8) 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;

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

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

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

12) Subcontracts events, status and issues;

13) Equipment ordered, received, made and assembled;

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

15) 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;

16) PA 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

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

DID-110 – Meeting Agenda

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

PURPOSE:

The Meeting Agenda specifies the purpose and content of a meeting.

PREPARATION INSTRUCTIONS:

The meeting agendas must contain the following information, as a minimum.

1. DOCUMENT HEADER:

1) Title;
2) Type of meeting;
3) Project title, project number, and contract number;
4) Date, time, and place;
5) Chairperson; and
6) Expected duration.

2. DOCUMENT BODY:

1) Introduction;
2) Opening Remarks: CSA;
3) Opening Remarks: Contractor;
4) Review of previous minutes and all open action items;
5) Project technical issues;
6) Project management issues;
7) Other topics;
8) Review of newly created/closed action items, decisions, agreements and minutes; and
9) Set or confirm dates of future meetings.

DID-111 – Minutes of Meetings

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

PURPOSE:

The minutes of reviews or meetings provide a record of decisions and agreements reached during reviews/meetings.

PREPARATION INSTRUCTIONS:

Minutes of meeting must be prepared for each formal review or meeting in the Contractor's format and must, as a minimum, include the following information:

1) Title page containing the following:
    a) Title, type of meeting and date
    b) Project title, project number, and contract number
    c) Space for signatures of the designated representatives of the Contractor, the CSA and the Public Services and Procurement Canada (PSPC), and
    d) Name and address of the Contractor.
2) Purpose and objective of the meeting;
3) Location;
4) Agenda;
5) Summary of the discussions, decisions and agreements reached;
6) List of attendees by name, position, phone numbers and e-mail addresses as appropriate;
7) Listing of open action items and responsibility for each action to be implemented as a result of the review;
8) Other data and information as mutually agreed; and
9) The minutes must include the following statement:

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

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.

DID-113 – Review Data Package

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

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The Review Data Package shall contain the following:

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

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

1) Test specifications and procedures;
2) Test support requirements and status;
3) Documentation status;
4) Functional and environmental test history of systems and subsystems;
5) Anomalies and their resolution;
6) Deviations and waivers.

DID-114 – Phase Closure / Final Report

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

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

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

DID-117 – Crown Assets List

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

PURPOSE:

The purpose of the Crown Assets List is to record formally the inventory of all Crown property produced and/or acquired under the contract by the Contractor and any of its subcontractors.

PREPARATION INSTRUCTIONS:

This document must list all the material produced under the contract. For each item, the following must be listed:

1) Contractor's Identifier (part number);
2) CSA Inventory Number;
3) Name;
4) Manufacturer's Model No.;
5) Manufacturer's Serial No.
6) Description
7) Controlling specification, such as drawing number, source control drawing, etc.
8) Date item was produced and/or acquired by the Contractor;
9) Current location; and
10) Recommended disposal: delivery to Crown location, delivery to third party, storage at Contractor location, storage at subcontractor location, or other recommendation.

DID-120 – FIP and BIP Disclosure

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

PURPOSE:

To fully disclose all FIP and BIP resulting from a phase 0 contract. This is not to be confused with the work to be conducted as part of mission planning and development (i.e. the identification of the FIP and BIP that will be generated throughout the entire project), which is documented in another DID.

PREPARATION INSTRUCTIONS:

The FIP Disclosure shall 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.

DID-130 – CSA's Performance Indicators

DID Issue: IR

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The Contractor must respond to a series of questions pertaining to the outcomes achieved through the Agreement. The questions will be made available through a link provided by CSA. Approximately one month will be provided for the Contractor to respond to the questions. It is foreseen that approximately 5-10 questions will be solicited. Below is an example of the most salient questions.

1) Please enter the number of people working on this specific project. To the best of your knowledge, include students and employees involved in the project at your organization and at sub-contracting organizations*. Please indicate, to your knowledge, how many are male, female or other.*
2) Categories provided are: Management; Administration; Scientists; Engineers; Technicians; Health Professionals; Post-Doc Fellows; Graduate Students (Masters and Doctoral) Undergraduate Students (Bachelors); College or Cégep Students (below Bachelors); Others.
3) Please use the provided table, to indicate the names of all Canadian or international organizations (private companies, not-for-profits, universities) who are your subcontractors on this project.
4) Please select in the provided drop down list, the maturity level of the application or technology in association with the project PREVIOUS to receiving CSA funding. Note that the technology maturity levels are defined with a (T) and software application levels are defined with an (A).
5) Has the technology or application flown, or will it fly, on a space mission? All types of missions can be considered, e.g. technology demonstration, science mission, and missions in operation, as long as the mission is in space. Space is defined as Low-Earth-Orbit and beyond.
6) Please indicate published works that meet the following criteria:
    a) Made possible (in part or wholly) by CSA funding for the space-related project in reference to this questionnaire; AND
    b) Produced by the (research) team members based in Canada.

DID-320 – PA Implementation Plan

PURPOSE:

The Product Assurance Implementation Plan (PAIP) describes the organization, objectives, and PA activities planned for the project. The PAIP provides the Government with insight into the Contractor's PA organization, tasks, and activities and allows the Government to assess compliance with the governing PA requirements specified in the PAR Document and in this SOW.

PREPARATION INSTRUCTIONS:

The PAIP may be prepared in the Contractor's format and shall, as a minimum, provide the following information, to the extent it is applicable in the Phase(s) covered by this SOW:

1. INTRODUCTION

1.1. PURPOSE AND SCOPE

1.2. GENERAL APPROACH TO PRODUCT ASSURANCE

This section provides an overview of the objectives to be achieved by the plan.

1.3. DOCUMENT CONVENTIONS

2. APPLICABLE AND REFERENCE DOCUMENTS

3. APPLICABLE DOCUMENTS

This section lists applicable documents that will be followed in the implementation of the PAIP.

1.1.6 CSA Documents

1.1.7 In-house PA procedures

1.1.8 General standards and practices (Military, NASA, Industry, Software, etc.)

3.1. REFERENCE DOCUMENTS

This section lists documents that provide additional information or guidelines, but that are not compulsory.

4. PRODUCT ASSURANCE PROGRAM

4.1. GENERAL REQUIREMENTS AND APPROACH TO PRODUCT ASSURANCE

4.2. QA SYSTEM, ISO 9001 OR EQUIVALENT

4.3. RESPONSIBILITY

4.4. PA ORGANIZATION

This section identifies the organizations in the company responsible for applying the provisions of the PAIP: organizational structure, relationships to other organizations within the project and company, including personnel identification and required skill levels.

4.5. AUDITS

This section describes the audits to be performed throughout the life of the project including an audit schedule to be approved by the CSA S&MA representative. This applies to the Contractor and the subcontractors.

4.6. MANDATORY INSPECTIONS

4.7. RIGHT OF ACCESS/OBSERVATION

This section covers government rights to access the premises and the program data including: a list of all reviews Government representatives may attend, a list of all audits the Government may conduct, and any special agreements or conditions of access, including Subcontractor Audits;

4.8. PROJECT REVIEWS

4.9. PA REPORTING

This section describes the plans for monitoring the different phases of the program development, for problem reporting and for ensuring that corrective actions are taken.

1.1.1 CSA Notification

This section specifies the frequency, format, and content of the PA reports submitted to program management to report program progress as well as problems, risks, and proposed solutions.

1.1.1 Requests for Deviations and Waivers

4.10. PRODUCT ASSURANCE AT SUBCONTRACTORS FACILITIES

5. QUALIFICATION PROGRAM

This section presents parts, materials and processes control plans that describe the approach, methods, procedures and organization that will be implemented to assure compliance to the parts/materials/processes program requirements. This shall include a commercial parts control plan in accordance with the requirements of the S&MA Requirements.

5.1. GENERAL

5.2. CLASSIFICATION FOR QUALIFICATION STATUS

5.3. QUALIFICATION PHILOSOPHY

5.4. QUALIFICATION STATUS REVIEWS

5.5. QUALIFICATION PROCESS REQUIREMENTS

5.6. QUALIFICATION STATUS LIST

5.7. QUALIFICATION OF PARTS

1.1.1 Parts Qualification – General

1.1.2 Application-specific Integrated Circuits (ASICs)

1.1.3 GIDEP / ESA Alerts

5.8. QUALIFICATION OF MATERIAL AND PROCESSES

5.9. SOFTWARE QUALIFICATION

5.10. QUALIFICATION TESTING

5.11. ACCEPTANCE TESTING

5.12. STATEMENT OF COMPLIANCE

5.13. UNIT QUALIFICATION

1.1.1 COTS Components / Units

1.1.2 Modified COTS Components / Units

1.1.3 Newly Developed Units

5.14. FLIGHT CERTIFICATION

6. RELIABILITY

This section describes the objectives and tasks to be performed to ensure reliability and maintainability requirements are adequately implemented.

6.1. GENERAL

6.2. RELIABILITY MODELING

6.3. SEVERITY CLASSIFICATION

6.4. RELIABILITY MODELING

6.5. DERATING ANALYSIS

6.6. FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS (FMECA)

6.7. CRITICAL ITEMS

6.8. WORST CASE ANALYSIS

6.9. PARTS STRESS ANALYSIS

6.10. PERFORMANCE TREND ANALYSIS

6.11. RADIATION ANALYSIS

6.12. MULTIPACTION

6.13. CRITICAL ITEMS

6.14. HARDWARE RISK ASSESSMENT LEVELS

1.1.4 Risk Assessment of COTS Hardware

1.1.5 Part List

1.1.1 Risk Assessment for Parts

1.1.2 Contamination Control

1.1.3 Temperature Limits and Cycling

1.1.4 Radiation

7. EEE PARTS PROGRAM

7.1. GENERAL

7.2. EEE PARTS SELECTION

7.3. NON-STANDARD PARTS

7.4. PARTS CONTROL BOARD

1.1.2 AIT

1.1.3 Launch

APPENDIX A PA COMPLIANCE MATRIX

This Appendix presents a matrix testifying to the compliance with the applicable PA Requirements. The compliance matrix shall include as a minimum the following:

a) Indicate the PAR specification paragraph and requirement;

b) Indicate the PAIP corresponding paragraph to address the requirement in the CSA PAR;

c) Indicate Compliance (C) or Non-compliance (NC) and reasons for NC; and

d) List of the contractor PA and process documents that will be used to address a requirement.

APPENDIX B ACRONYMS

DID-322 – CADM Plan

PURPOSE:

The Configuration and Data Management (CADM) Plan establishes the Contractor's general approach, policies, and processes used for identifying the functional and physical characteristics of an item or system; controlling changes to those characteristics; recording and reporting documentation baselines and change processing, approval and implementation status; and verifying that the required functional and physical characteristics are achieved in the deliverable item or system.

The CADM Plan describes how consistency between the product definition, the product's configuration, and the configuration management records is achieved and maintained throughout the applicable phases of the product's life cycle. It also defines the methodology adopted to ensure the integrity of engineering data.

The CADM Plan also define the software configuration management system to be established, documented and maintained to control software work products, and the development and test environment.

PREPARATION INSTRUCTIONS:

The CADM plan shall be a self-standing document. The CADM plan shall identify the context and environment in which configuration management will be implemented for the system to be delivered. It shall define the processes for establishing and updating the system's configuration baseline and the implementation of: configuration identification; configuration control; configuration status accounting; configuration audits; and, data management.

The application of configuration management principles to ensure the integrity of digital representations of product information and other data shall be described.

The CADM Plan shall contain the following information, as a minimum:

1) A description of the organization and resources responsible for Configuration Management including:
    a) authority and responsibility of organizational elements,
    b) programmatic and organizational interfaces – relationship to other organizations within the project and within the company as a whole,
    c) identification of personnel and requisite skill levels, and
    d) sub-contract flow down or how configuration and data management requirements are flowed down to subcontractors and vendors providing sub-systems or components;
2) A detailed description of the Configuration Identification process including:
    a) definition of product tree (or physical item hierarchy) and selection of sub-elements to be managed,
    b) process for establishing traceability,

c) methods for naming, numbering, and marking,

d) process, that uses the product tree as a framework, for establishing baselines and their associated milestones, including:

i) functional baseline,

ii) allocated baseline,

iii) developmental configuration baseline, and

iv) product baseline,

e) method for identifying the configuration of software;

3) A detailed description of the configuration change management process used to control changes and variances (deviations and waivers), and maintain the developmental configuration(s) and associated documentation including:

a) the process by which changes and variances are submitted, recorded, classified, evaluated, approved/disapproved, and implemented,

b) identification, description and specimens of the control forms to be employed, and

c) description of the role and operation of the Configuration Control Board (CCB);

4) A description of the Configuration Status Accounting system to be used including a description of the content, format, and purpose of the status accounting records and reports;

5) A description of plans to conduct Configuration Verifications and Audits to ensure that products conform with requirements including details on how configuration status accounting records and reports will be used in support of these verifications and audits; and

6) A description of Data Management processes and procedures for receipt, inspection, identification, storage, handling, access control, transmittal and delivery of project documents, forms, records and media. Data Management processes shall also define how documents are released for authorized use or for submission to the customer for approval.

The scope of Configuration and Data Management includes all digital data. Digital data is information prepared and maintained by electronic means, and provided by electronic data access, interchange, transfer, or on electronic media.

The plan shall describe the processes that will be used to ensure the integrity of digital data and enhance data management practices such as:

1) File and database management;

2) Unique identification of documents, files and document representations;

3) Retention of essential file and version relationships;

4) Known data status; and

5) Controlled access to digital data.

The application of Configuration and Data Management to digital data is expressed in terms of the following elements:

1) Digital data identification;
2) Data status level management;
3) Maintenance of data dependency and product configuration relationships;
4) Data version control and management of review, comment, annotations, and disposition;
5) Digital data transmittal; and
6) Data access control.

The CADM plan shall also include a section on Software Configuration Management that cover the following, as a minimum:

1) Levels of code and documentation control involved.
2) The work products subject to configuration management such as but not limited to::
    a) Software documentation including plans, requirements, architecture, designs, and user documentation;
    b) Code;
    c) Off-The-Shelf software;
    d) Build procedures, tools, and scripts;
    e) Test cases, scenarios, scripts, data, and results;
    f) Critical records such as change requests, defect reports and action items.
3) Software configuration management tasks:
    a) Maintain a repository for code, documentation and other work products.
    b) Provide training in use of CM tools and procedures.
    c) Establish rules for submitting both new and revised items to the library.
    d) Provide coordination for updating multiple products in one or more locations; differences in site-unique versions should be identified and tracked.
    e) Identify the version of all software items that constitute a specific build or a delivered product.
    f) Identify differences between controlled versions – both source code differences and differences in functionality between versions.
    g) Document the software and hardware used in the development and test environment, including version and known problems; trace software products to the operating system and development tools employed, so that the development environment may be accurately recreated.
    h) Build production software items into a linked set of modules ready for integration and test; rebuild previous development or delivered versions upon request.
    i) Control simultaneous updating of a software item by more than one person.

j) Record and track all actions resulting from defect reports and change requests, for all items under configuration management, from initiation through release of the changed product.

k) Collect and summarize metrics to help assess the state of product development.

l) Monitor and report on the status of software items, defect reports and change requests, and the implementation of approved changes.

m) Archive the software for each delivered product, together with its associated documentation and quality records.

n) Execute periodic back-ups for items under CM and develop disaster recovery procedures.

o) Identify test status of software items under configuration management. Examples of test status include untested (under development), unit test, integration test, acceptance test, defect fixing, and released.

The configuration management system should support incremental software builds and automated testing.

1) Identification of software work products to be placed under configuration management, and the criteria for baselining each item.

2) Establishment and maintenance of baselines for identified software work products.

3) Identification of a change control authority for all items under configuration management.

4) Procedure for recording, reviewing, analyzing, dispositioning, and tracking change requests and software problem/failure reports for configuration items.

Note:

The mechanisms for handling change requests and problem/failure reports should be integrated into the configuration management system.

1) Procedure for documenting and maintaining build procedures and all other required inputs in order to support recreation of the work products needed for a delivery.

2) Performance and documentation of internal configuration audits to be performed by the contractor to confirm the configuration baselines and associated information are accurate. CSA may request additional configuration audits if specified in the Statement of Work.

Note:

Configuration audits assess the integrity of baselines and verify that configuration records correctly identify the status of the configuration items. “Integrity” is the degree to which a system prevents unauthorized access to, or modification of, specified work products. A configuration audit includes

The entire plan shall ensure the establishment and implementation of the Configuration Management and Data Management program.

DID-324 – Contamination Control Plan

PURPOSE:

To describe the procedures that will be implemented to control contamination generated by the system, and to limit the susceptibility of the system to contamination from external sources.

PREPARATION INSTRUCTIONS:

The Contractor shall set forth a plan for controlling any degradation effects resulting from contamination. The plan shall identify all anticipated contaminants expected from initial assembly through the design lifetime and specify the levels to be expected. The plan shall address the proposed methods of minimizing the effects of such contaminants. The plan shall define levels of cleanliness, design requirements and approach, and method/procedures for contamination control to be followed from start of contract through design lifetime. The plan shall also alert the TA to any unusual sensitivities to particular contaminants.

The Contamination Control Plan shall include the requirements in AD-02 and the following information, as a minimum:

1) Environment control:
    a) Identify critical fabrication and assembly activities that will be performed in clean rooms or in clean room benches at the 100,000, 10,000, or 100 class level per FED-STD-209B,
    b) Identify controls over atmospheric contaminants, temperature, and humidity, which will be used during electronic fabrication (including soldering), and testing,
    c) Identify cleaning, inspection, and bagging to be used for parts, flight assemblies, and the assembled Bus Module,
    d) Identify design features of shipping containers that will minimize contamination during shipping and storage,
    e) Show that efforts to control contamination are consistent with controls to prevent electrostatic damage,
    f) Indicate the methods and frequency for monitoring the cleanliness levels to ensure compliance with requirements, and
    g) Identify analyses, inspections and tests that will be performed to verify that contamination has been prevented/abated and that the hardware will meet the performance requirements including the launch environment;

2) System-generated contamination:
    a) Identification and description of each contamination sensitive unit;
    b) Procedures to verify the selection of materials in order to minimize the use of contaminating materials, and
    c) Procedures to verify that materials that need to be subjected to bakeout and off-gassing tests effectively pass such tests;
3) System susceptibility to contamination:
    a) Identification of contamination standards to be met, and
    b) Description of the methods to control the contaminants.

DID-340 – Failure Mode, Effects & Criticality Analysis (FMECA)

PURPOSE:

To identify the failure modes, effect(s) and criticality and to systematically evaluate and document, by item failure mode analysis, the potential impact and severity of failures on the system operation and mission success, system performance, equipment safety, maintainability and maintenance requirements.

PREPARATION INSTRUCTIONS:

The FMECA supports the following development activities: additional design action, safety analysis, hardware/software interface analyses, test planning, mission planning, preparation of mandatory inspection points, fault detection and isolation, maintainability analyses and planning, maintenance planning, and logistics planning.

The Contractor may use the guidelines and worksheets of MIL-STD-1629 or ECSS-Q-30-02, with the following mandatory items considered and addressed, as a minimum:

1. A functional block diagram for the indentured levels of subsystems analyzed, structured from top indentured level down to the lowest level where the failure contributing item resides;
2. Identification of the source of the reliability data utilized, i.e. from the bus contractor's own field data for similar designs and applications, and/or MIL-HBK-217;
3. Identification of all single point failures and methods of mitigating such failures, identified as category I [catastrophic] and II [critical];
4. Identification of ground-rules, assumptions and bus contractor's interpretation of the completed analysis;
5. Identification of design weaknesses which affect system reliability goals;
6. Recommendations for design improvements, removal of cat I and cat II failures and/or reliability improvements;
7. The analysis shall show the inter-related use of its findings and recommendations, to carry out critical/mandatory inspections to mitigate the failure risks;
8. Provide a description of the autonomous system fault protection and how it will ensure the health, safety, and system integrity of the spacecraft. The FMECA shall also describe how the system fault protection will protect against the loss of science data in the presence of anomalous conditions; and
9. Describe the architecture of the fault protection system and the algorithms that comprise it.

For the PDR version, only a high-level FMECA is required. The FMECA shall include a hazard analysis for GSE used in the testing of the flight hardware.

DID-341 – Parts Derating and Stress Analysis

PURPOSE:

To ensure that all parts used in the system operate within their derated stress limits and comply with the required safety factors.

PREPARATION INSTRUCTIONS:

The Parts Derating and Stress Analysis Report may be prepared in the Contractor's format and shall contain the following information, as a minimum:

1. List of EEE parts derated in accordance with MIL-STD-975, PPL-21, EEE-INST-002, JPL-D-8545, MIL-HDBK-1547, SSP-30312,or PSS-01-301;
2. A EEE parts stress analysis to determine actual stresses and to compare them with the derated limits; and
3. Part ratings versus part application worst case stress.

The above analyses shall be performed in accordance with the requirements of the S&MA Requirements Document and this SOW. Deviations for all parts exceeding the stress derating criteria shall be submitted for CSA approval.

DID-342 – Worst Case Analysis

PURPOSE:

To verify that the design meets worst-case requirements.

PREPARATION INSTRUCTIONS:

WCA is the preferred approach to design reliability, but VTMT is a viable alternative for flight projects where trade-offs of risk versus development time and cost are appropriate.

See http://llis.nasa.gov/lesson/0771

The Worst Case Analysis may consist of analyses performed on new design, review of previous design analysis or review of previous test or mission performance.

Since analysis details can be voluminous, the results of the analyses shall be documented in reports that contain the following information to the extent practical.

1) Part Parameter Variability Data;
2) Critical parameters and allowable variation. Provide justification why areas are not considered candidates for Worst Case Analysis;
3) Major contributors;
4) Circuits analyzed, with schematics of circuits;
5) How analyzed;
6) Variations considered;
7) Solutions;
8) Analysis of results:
    a) Did it pass?
    b) If not, by how much? What actions are possible? What actions are planned?
    c) Life expectancy of unit?

Sufficient back-up shall be retained for auditing and future reassessments.

DID-344 – Reliability Prediction Analysis

PURPOSE:

The Reliability Prediction Analysis identifies potential reliability problem areas and supports trade-off activities designed to satisfy maintainability requirements.

PREPARATION INSTRUCTIONS:

The Reliability Prediction Analysis Report may be prepared in the Contractor's format and shall include all information necessary for a basic understanding and review of the analysis. If the design of certain subsystems is not sufficiently mature to support the requirements of this DID, a reliability allocation shall be made for each of these subsystems. As a minimum, the report shall contain the following information:

1. Identification of the configuration being analyzed;
2. Appropriate design information (e.g. functional block diagrams, parts lists, assembly drawings, etc., as far as they are necessary for understanding);
3. Identification of applicable functional and design descriptions and of the associated failure mode analysis;
4. Identification of operational and mission phases;
5. Definition of success and failure, any assumption or method applied;
6. Calculation approach, assumptions and simplifications used;
7. Reliability block diagrams and computations (to the extent necessary for basic review);
8. Sources of the reliability data (origin of used failure rates and parts quality level);
9. Reliability data Mean-Time Between Failure (MTBF) and Mean Time To Failure (MTTF) figures, for all deliverable hardware;
10. Analysis to demonstrate that the MTBF and MTTF of the system are concomitant with the expected use of the system, and satisfy the maintainability requirement;
11. Summary of results; and

Evaluation of results and design recommendations if applicable.

DID-345 – Contamination Analysis Report

PURPOSE:

To demonstrate that any contamination generated by the system is properly controlled, and that the system performance is not degraded by the overall environment.

PREPARATION INSTRUCTIONS:

This report shall provide a comprehensive guide to cleanliness and contamination control, including requirements for implementation, documentation, analysis, and specifications during design, manufacturing, integration and testing, transportation and handling, launch and early flight.

In support of the contamination and cross-contamination control system activities, the Contamination Analysis Report shall include the following information, as a minimum:

1) System-generated contamination:
    a) Identify all sources of contamination generated by the system, including fluids and gases, and report on:
        i) Material types, specific outgassing/offgassing rates (if necessary, make reference to other documents reporting the required information),
        ii) Contamination generated by Configuration Item operation, and
    b) Define the appropriate countermeasures used to control the contamination sources identified in 1)a);
2) System susceptibility to contamination:
    a) Identify equipment sensitive to external contamination during the development and the operational phase, and the required level of control of contaminants for this contamination-sensitive hardware,
    b) Define the appropriate countermeasures used to meet the specified performance for any equipment identified in 2)a), and

Assess the expected degradation for contamination-sensitive hardware subjected to the expected level of contamination, as input to the maintainability assessment and to maintenance planning.

DID-346 – Radiation Susceptibility Analysis

PURPOSE:

To demonstrate that the system electronics will operate satisfactorily in the specified radiation environment.

PREPARATION INSTRUCTIONS:

This report shall document all analyses and activities performed to establish the sensitivity of parts to radiation in terms of total dose effects and cosmic ray effects, and to demonstrate that the chosen design(s) and parts will operate satisfactorily throughout the mission(s) in the ionizing radiation environment applicable to the mission.

The report may be prepared in the Contractor's format and shall contain the following information, as a minimum:

1. Radiation Environment: reference and inputs used to conduct the radiation analyses including assumptions on solar flares and model uncertainties;
2. Radiation Estimates: total absorbed doses and Linear Energy Transfer (LET) spectra shall be predicted down to part levels. Methods and models used for these predictions shall be described, including assumptions and the coordinate system used;
3. Critical Parts and Materials: radiation sensitive materials and parts shall be listed. This listing shall be based on information obtained from manufacturers or field data. A radiation sensitivity table shall be generated indicating sensitive materials and parts, their radiation hardness (best estimates, manufacturer's data, test data, predictions from similarity, etc.), the expected types of effect: mechanical (etching, hardening, etc.), chemical (by-product formation, etc.) and electrical (latch-up, dielectric breakdown, power consumption, leakage, loss of gain, etc.);
4. Detailed Analyses: based on the total dose and LET spectra, calculations shall be performed for parts that exhibit marginal radiation hardness. Single Event Upset (SEU) rates and latch-up sensitivities shall be analyzed;
5. Qualification Issues: qualification status (for radiation) shall be discussed during PDR and CDR; and
6. Conclusions: design margins shall be discussed and recommendations shall be made.

DID-347 – Safety Assessment Report

PURPOSE:

To present the status of the safety program with respect to hazard identification, control, verification and compliance with program requirements.

PREPARATION INSTRUCTIONS:

The Safety Assessment Report (SAR) shall identify all safety features of the hardware and software, and system design, as well as procedural, hardware and software related hazards present in the system. It shall include the results of the Preliminary Hazard Analysis (PHA) as well as any other safety analyses performed on the equipment, system, interface with launch vehicle and the ground processing at the launch site. The PHA and other hazard analyses shall identify equipment design, integration and test, and launch site processing safety hazards and proposed hazard controls early in the design phase. The SAR shall include a hazards list with hazard controls that meet the Launch Vehicle (LV) and launch site safety requirements. The SAR shall be updated throughout the development effort.

The safety assessment and analysis shall identify and classify by hazard level all failures, malfunctions, operator errors or premature operations that could result in mishaps.

All hazards shall be identified as follows:

1) Description of hazard :

   Description of hazardous conditions that could result in mishap including damage at launch/flight capability or mission operating staff.

2) Hazard Classification:

   a) Category I - Hazards that could result in:

      i) Loss of life;

      ii) Loss of major systems such as launch vehicle, spacecraft, launch facility or a support facility.

   b) Category II - Hazards that could result in:

      i) Injury to people;

      ii) Damage to the eOSTEO payload, other payloads, the Foton spacecraft, or the launch vehicle.

   c) Category III - Hazards where the worst case effect is less than Category I and II.

3) Hazard Causes:

   Description of malfunction, failures, operator error, environmental factors, or other external events which could result in a hazard.

4) Hazard Effect:

Description of intermediate and worst case effects of the failures, and their consequences. For example, the failure of a protective diode in a battery cell leads to overheating of the battery, which could cause an explosion resulting in personnel or equipment damage.

5) Hazard Controls:

Description of design features to prevent hazards from occurring or controls to mitigate hazards.

Each identified hazard shall be presented in a dedicated hazard sheet appended to the SAR that include as a minimum the following information:

a) Report number;
b) Applicable phase;
c) Subsystem;
d) Hazard classification;
e) Date;
f) Hazard Title;
g) Hazard Consequence;
h) Hazard Probability;
i) Applicable Safety Requirement;
j) Description of Hazard;
k) Hazard Causes;
l) Hazard Controls;
m) Verification Method (test, analysis, inspection or similarity to previously qualified hardware); and,
n) Status of Verification.

DID-348 – Software Criticality Analysis and Classification

PURPOSE:

To classify software by the impact of failures on system safety.

PREPARATION INSTRUCTIONS:

The Software Criticality Analysis Report shall contain the result achieved by carrying out the software criticality analysis. Following is the outline of this report.

1. Introduction;
2. Documents:

   Listing applicable and reference documents;
3. Context:

   A description of the context of the software dependability and safety analysis:
   a) System Overview
      - Provides a short system overview to introduce the context of the software item
   b) Software Items and Critical Functions
      - Provides a list of all software critical functions (or the upper level critical functions list, as applicable), identified in the upper level dependability and safety report, and
      - Provides complete traceability between critical functions and software items;
4. Criticality Analysis:

   Dependability and safety analysis of the software items:
   a) Approach:
      - Describes the approach used to conduct the analysis, and
   b) Results:
      - Summary of results grouped by software item;
5. Recommendations:

   Description of recommendations resulting from the software dependability and safety analysis; and
6. Appendix A:

   Detailed results of the analysis performed.

DID-360 – Critical Items List

PURPOSE:

The Critical Items List (CIL) contains a listing of items that can critically impact the reliability of contract end items. The list includes summaries of and references to specific documents defining compensating controls and features. The list is used to evaluate the adequacy and implementation of critical item controls.

PREPARATION INSTRUCTIONS:

Critical Items shall be selected by the criteria specified in the S&MA Requirements.

The CIL may be prepared in the Contractor's format, shall address the elements described below, and shall contain the following data, as a minimum.

1. CONTENT

1) Identification of each critical item with cross-reference information such that it is possible to trace directly to the related FMECA entry and to drawings, schematics, and hardware;
2) Identification of the page of the FMECA describing the related failure modes;
3) The reason or criteria causing the item to be classified as critical;
4) A summary in specific terms for each critical item of the compensating features, controls and other practices incorporated or planned to minimize the likelihood or effect of the critical items failing during the life of the system. Specific documentation containing compensating features shall be identified. These controls can be specific design features, procurement controls, reliability tests and controls, manufacturing and handling controls, etc. Examples of compensating controls shall include but not be limited to the following:
    a) Mandatory inspection of key product characteristics,
    b) Detail design review of critical failure modes,
    c) Control of soldering, welding, brazing, plating and flatness,
    d) Nitrogen purge, proof test, leak test, X-ray of brazed or welded joints,
    e) Special handling provision requirements: gloves, special care, specially trained personnel,
    f) Torque measurement control,
    g) Functional tests and verification of performance,
    h) Structural design margin and derating of loads,
    i) Special lubricant control,
    j) Moisture and temperature control,
    k) Special clean room environment and contamination controls,

l) Connector x-ray after mating,

m) Connector pin/socket retention tests,

n) Mate-demate logs for connector savers,

o) Special tracking of Failure Reports, Non-conformance Review Board actions and related discrepancy data,

p) Purchase Order review for Contractor inspection and PA Requirements,

q) X-Ray or non-destructive testing,

r) Extended actuation or life tests,

s) Special environmental tests,

t) Process baseline control, and

u) Mechanisms Life Cycle Test;

5) Identification of the activity that discovered the critical items, such as a FMECA, test planning, stress analysis, reliability prediction or risk assessment and reference to the related applicable documents;

6) The rationale for not eliminating the critical item or related failure mode(s):

a) Single point failure mode (SPFM) which shall include the added data specified in paragraph 3,

b) Critical items shall be listed by category as follows:

i) Special environmental tests,

ii) Single Point Failure (as a result of FMECA),

iii) Parts out of accepted derating conditions,

iv) Items with safety hazards,

v) Parts or items using critical technologies (new part, new technology, radiation sensitive part, etc.),

vi) Life Limited Items - items having a nominal lifetime shorter than the mission duration, and

vii) Critical materials with limited life or out-of-specification outgassing rates.

2. SUPPORTING DATA:

The following information shall be included if it has not been previously submitted (such as in the Reliability Plan) or if repetition is needed for clarity. If the supporting data is not included, a cross-reference to where it appears shall be included in this section.

1) A list of criteria used to identify critical items;

2) A summary of the contractor's formal policy and procedures for critical item control and notification to affected personnel of the essential and critical nature of such items;

3) A description of the traceability system applicable to the critical items list to facilitate follow-up verification that all planned critical item compensating features, controls and practices have been implemented;

a) A description of the methods and plans for updating the critical items list to provide timely management visibility; and

b) An identification of critical items which are on calendar age limited life and limited operating life item lists when applicable.

3. SINGLE POINT FAILURE MODES (SPFM)

SPFM items shall be complied as a separate section of the critical items list. In addition to the data in paragraphs above the following shall be included:

1) Each uncorrected SPFM shall be characterized as to mission impact, probability of occurrence, and the practicality of correction; and

2) For each uncorrected SPFM, the list shall include contractor recommended options for elimination or mitigation of the failure modes for procuring officer consideration.

4. UPDATES

Information not available for initial lists, due to incomplete design or planning details, shall be so noted and provided when available.

DID-361 – Declared Components List (DCL)

PURPOSE:

To establish a list of all EEE parts used in the system design.

PREPARATION INSTRUCTIONS:

The DCL shall contain all EEE parts that will be used in the system manufacturing and shall reflect the current design at the time of issue.

The DCL shall include the following information for each part, as a minimum:

1. Part description;
2. Generic part designation and number (commercial reference);
3. Part type (commercial reference);
4. Use and location (equipment name to the subassembly level and part quantity per equipment);
5. Manufacturer (name, Commercial and Government Entity (CAGE) code, country of manufacture);
6. General information indicating part qualification status;
7. Heritage greater than 2 years (list flight programs in which the part was used);
8. Standard or Non-standard Part;
9. Approval Status (NSPAR #, except for standard parts, when the NSPAR number should be replaced by the MIL QPL/ESA QPL references);
10. Procurement part number, as specified in the procurement specification or purchase order;
11. Package style;
12. Procurement specification reference;
13. Quality level;
14. Identification of parts subject to radiation lot testing and radiation data references (total dose and single event levels, if available);
15. Using assembly/subcontractor information; and
16. Comments – to indicate problems, long lead items, additional testing imposed, application unique notes, etc.

Updates to the parts list shall identify changes from the previous submission.

DID-362 – Declared Mechanical Parts List (DMPL)

PURPOSE:

To establish a list of all mechanical parts used in the system design.

PREPARATION INSTRUCTIONS:

The DMPL shall contain all mechanical parts that will be used in the system manufacturing and shall reflect the current design at the time of issue.

The DMPL shall be broken down into categories to facilitate locating each item in the document.

The DMPL shall include the following information, as a minimum:

1. Item number (as the reference of the part in the DMPL);
2. Part designation (commercial designation);
3. Type of part;
4. Manufacturer (name, Commercial and Government Entity (CAGE) code, country of manufacture);
5. Manufacturer's procurement specification or standard;
6. Summary of functions and characteristics;
7. Use and location;
8. Environmental code;
9. Criticality and hazards;
10. Test data (corrosion, SCC, flammability, outgassing properties);
11. Approval status (with reference to the approval authority, test report and similar previous applications); and
12. Heritage greater than 2 years (list flight programs in which the part was used).

Coding or abbreviations used in the DMPL shall be defined in the document.

Updates to the DMPL shall identify changes from the previous submission.

DID-363 – Declared Materials List (DML)

PURPOSE:

To establish a list of materials to be used in the system design.

PREPARATION INSTRUCTIONS:

The DML shall contain a list of the materials that will be used for the manufacturing of the system and shall reflect the current design at the time of issue.

The DML shall be broken down into categories to facilitate locating each item in the document.

The DML shall include the following information, as a minimum:

1. Item number (as the reference of the material in the DML);
2. Material type (commercial identification);
3. Chemical nature and type of product;
4. Procurement Information (manufacturer/supplier, procurement specification or standard);
5. Summary of processing parameters (e.g. finish, temper condition, mix ratio, curing);
6. Use and location;
7. Environmental code;
8. Size code;
9. Test data (corrosion, SCC, flammability, outgassing properties);
10. Approval status (with reference to the approval authority, MUA reference, test report and similar previous applications);
11. Identification of limited life material; and
12. Heritage greater than 2 years (list flight programs in which the material was used).

Coding or abbreviations used in the DML shall be defined in the document.

Updates to the DML shall identify changes from the previous submission.

DID-364 – Declared Processes List (DPL)

PURPOSE:

To establish a list of all processes used in the system manufacturing.

PREPARATION INSTRUCTIONS:

The DPL shall list all the processes that will be used in the system manufacturing, and shall reflect the current design at the time of issue.

The DPL shall be broken down into categories to facilitate locating each item in the document.

The DPL shall include the following information, as a minimum:

1. Item number (as the reference of the part in the Declared Processes List);
2. Process identification;
3. Process specification;
4. Process description (with associated materials designation where possible);
5. Use and location;
6. Process supplier;
7. Associated DML item numbers;
8. Criticality
9. Approval status (with reference to the approval authority, test report and similar previous applications); and
10. Heritage greater than 2 years (list flight programs in which the process was used).

Coding or abbreviations used in the DPL shall be defined in the document.

Updates to the DPL shall identify changes from the previous submission.

DID-365 – Qualification Status List

PURPOSE:

The Qualification Status List (QSL) provides a qualification status of all hardware/software used in the system, and rolls up all lower units into a consolidated status list; the qualification categories of specific items are summarized.

PREPARATION INSTRUCTIONS:

The qualification status of each component of the prime item shall be listed in table form. In the table, columns shall be provided to show:

1) Item/Part Designation (Ref. or Log Number)
2) Description (including subsystem/unit name and specification/part number, revision level)
3) Manufacturer / Supplier (or subcontractor), name, category
4) Qualification Status: one of the following categories shall be used:
    a) Identical to a flight, proven/qualified equipment operating in orbit at the time of reporting,
    b) Adapted from a flight, proven/qualified equipment, operating in orbit at the time of reporting,
    c) To be qualified during the present program,
    d) Already qualified as part of the present program, and
    e) Heritage: see next item;
5) Heritage: (list of other missions of same or longer mission life, and same or worse environment)

Heritage based on: a) flight history, or b) similarity with change identification. Detailed information will be provided or referenced in order to provide comparison (environments and durations) between the current mission and those presented as heritage. Each element of qualification test should be addressed specifically, such as mission duration, SEE, temperature extremes, shock, vibration, etc.

6) Method of qualification: Test description, test levels and models used:
    a) Acceptance, protoflight, qualification, life tests
    b) Level of testing: part, unit, system, etc.,
    c) Nature of the tests (vibration, thermal, etc.,
    d) Model used: BBM, EM, EQM, QM or PFM;
        i) BBM: Breadboard Model
        ii) EM:Engineering Model
        iii) EQM: Engineering Qualification Model

iv) QM: Qualification Model

v) PFM: Protoflight Model

7) Estimated qualification date.

Each item that is not already qualified shall be included in the Qualification Program. For each item in the Qualification Program, the Qualification method shall be identified.

DID-380 – End Item Data Packages (EIDP)

PURPOSE:

To provide the historical record and documentation of an end item.

PREPARATION INSTRUCTIONS:

NOTE: This DID may be tailored depending on the item being delivered, e.g. spacecraft, bus, payload, subsystem, unit or GSE.

The End Item Data Package (EIDP) shall provide, in a single document, the information necessary to accept the end item. The EIDP shall contain all the documentation that provides visibility over the configuration, manufacture, assembly and test operations performed on the equipment delivered.

Each EIDP shall be initiated and maintained during all stages of assembly, inspection and test for each unit and will contain the traveler sheets.

The interface control documentation/drawings provided in the EIDP shall reflect the latest design status.

The original EIDP shall be submitted prior to the pre-shipment data review. Updates to EIDPs shall be provided if items are returned for modification/corrective action.

The EIDPs shall contain the following information, as a minimum:

1) **Title Page**. The cover page of the deliverable data package will identify the item being delivered as follows:
    a) Item part name, number and serial number,
    b) Model number (if applicable),
    c) Contract number (if applicable), and
    d) Contractor/supplier name (if applicable);
2) **Index** (table of contents);
3) **Certificate of Conformance** (C of C) with Requirements Verification Compliance Matrix; the C of C shall state the item is verified and provide the following:
    a) Identification of applicable specification or requirements document(s) (document number and revision level),
    b) Identification of applicable ICD(s) (document number and revision level),
    c) Unit or item description, part number (vendor part number or Contractor part designation if applicable) and serial number, and
    d) Approval and signature by the Contractor/supplier PA and Technical Lead;
4) **RFD/RFW listing**. TA-approved waivers and deviations to the contract authorizing hardware delivery with existing variations, as applicable to the physical/functional parameters of the item being delivered (i.e. form, fit, function);

5) **Non-conformance and NCR reports**: All Class I non-conformance reports or NCR reports and problem reports shall be included; list of Class II non-conformances by NCR number including description and the final disposition;

6) **Component/Equipment Historical Logs**: A log shall be maintained to continuously document the history of the item or component. Each log shall be chronologically maintained and will include dates, operating times or cycles, mate/de-mate cycles of life limited connectors, adjustments, modifications, operations or tests performed and all failures or anomalies (with cross-referencing to problem reports), special inspections or any other significant activity such as storage. Entries shall be complete, self-explanatory, and traceable to the originator. Logs shall be included into the next higher assembly's data package upon installation of the item into the next higher level of assembly;

7) **Unplanned/Deferred Work**: Unaccomplished fabrication, test, inspection, or installation activities remaining to be completed at time of acceptance and delivery due to shortages, lack of schedule time, etc., including open discrepancy reports and other open work, applicable to equipment being delivered;

8) **Preplanned/Assigned Work**: Description of work from manufacturing and/or test authorized for accomplishment after delivery which is deferred for safety reasons, is required to restore the item from alterations/differences necessary for shipping, or deferred to allow end item delivery although component delivery slipped;

9) **Shipping Documents**: This form will be required for all shipments. The shipping document shall include:

    a) Deliverable item name, part number serial number(s) and lot number,

    b) Quantity shipped and date of shipment,

    c) Shortages,

    d) The shipping document will list the EIDP as being part of the shipment,

    e) Special shipping/handling instructions, and

    f) Consignee and address;

10) Packing, Handling, Transportation and Storage Procedures;

11) **Identification of the As-built Configuration**. An indentured parts list of the hardware being delivered shall define the difference between the assigned as-designed configuration and the as-built configuration and supporting rationale for differences;

12) **As-built Configuration Data List (ABCL)**: compilation of items describing exactly the configuration of a fabricated serialized assembly to provide traceability for parts and materials used to build the end item; this must include:

    a) Part number and revision letter of each item,

    b) Part description (title) of each item,

    c) Electronic part reference designation,

    d) Manufacturer, and

    e) Procurement specification or Source Control Drawing (SCD) number and SCD revision letter;

NOTE: this document and the following may be combined and provided as a separate document; see DID for Configuration Item Data List / As Built Configuration Data List (CIDL/ABCL);

13) **Configuration Items Data List (CIDL)**: contains a listing of all documents, including specifications, drawings, ICDs, software description documents, etc., including revision level, that are part of the deliverable end item;
14) **Drawings**: One copy of the assembly drawings, interface drawings, schematic and parts drawing of the deliverable end item;
15) Test Procedures;
16) Test Reports;
17) **Non-standard Calibration**: Record of measurement equipment, instrumentation, components, or systems having non-standard calibration curves shall be provided at time of delivery;
18) **Repair Limitations**: When repair limitations are imposed by the design (i.e., limits the number of times a specific hardware type can be repaired), then a status of these limited repair items which have had prior repair activity but have not reached the specific limit shall be identified at the delivery;
19) End Item Weight;
20) Certificate of cleanliness (flight hardware); and
21) **Pre-closure photos** of items and major assemblies, including photos of boards.

DID-382 – Qualification Acceptance Data Package (QADP)

PURPOSE:

To provide the historical record and documentation of an item used to qualify the design.

PREPARATION INSTRUCTIONS:

The Qualification Acceptance Data Package shall provide, in a single document, the information necessary to accept the qualification of an Item. The QADP shall contain all the documentation that provides visibility over the configuration, manufacture, assembly and test operations performed on the equipment qualified.

Each QADP shall be initiated and maintained during all stages of assembly, inspection and qualification test for each unit and will contain the traveler sheets.

The interface control documentation/drawings provided in the QADP shall reflect the latest design status.

The original QADP shall be submitted prior to the qualification data review. The QADPs shall contain the following information, as a minimum:

1) **Title Page**. The cover page of the deliverable data package will identify the item qualified.
    a) Item part name, number and serial number,
    b) Model number (if applicable),
    c) Contract number (if applicable), and
    d) Contractor/supplier name (if applicable);
2) **Index** (table of contents);
3) **Certificate of Conformance (C of C)** with Requirements Verification Compliance Matrix;
4) The C of C shall state the item is qualified and meets all the applicable requirements and the ICD document (number and revision level) applicable. The requirements documents against which the unit was qualified shall be listed in the C of C. The Contractor/supplier PA Lead and Technical Lead shall sign the C of C.
5) **RFD/RFW listing**. TA-approved waivers and deviations to the contract authorizing hardware acceptance with existing variations, as applicable to the physical/functional parameters of the item qualified (i.e. form, fit, function);
6) **Non-conformance and NCR Board reports**: All Class I non-conformance reports or NCR Board reports and problem reports shall be included; list of Class II non-conformances by NCR number including description and the final disposition;

7) **Component/Equipment Historical Logs**: A log shall be maintained to continuously document the history of the item or component. Each log shall be chronologically maintained and will include dates, operating times or cycles, mate/de-mate cycles of life limited connectors, adjustments, modifications, operations or tests performed and all failures or anomalies (with cross-referencing to problem reports), special inspections or any other significant activity such as storage. Entries shall be complete, self-explanatory, and traceable to the originator. Logs shall be included into the next higher assembly's data package upon installation of the item into the next higher level of assembly;

8) **Unplanned/Deferred Work**: Unaccomplished fabrication, test, inspection, or installation activities remaining to be completed at time of acceptance and delivery due to shortages, lack of schedule time, etc., including open discrepancy reports and other open work, applicable to equipment being delivered;

9) **Preplanned/Assigned Work**: Description of work from manufacturing and/or test authorized for accomplishment after delivery which is deferred for safety reasons, is required to restore the item from alterations/differences necessary for shipping, or deferred to allow end item delivery although component delivery slipped;

10) **Shipping Documents**: This form will be required for all shipments. The shipping document shall include:

    a) Deliverable item name, part number serial number(s) and lot number,

    b) Quantity shipped and date of shipment,

    c) Shortages,

    d) The shipping document will list the EIDP as being part of the shipment,

    e) Special shipping/handling instructions, and

    f) Consignee and address;

11) Packing, Handling, Transportation and Storage Procedures;

12) **Identification of the As-built Configuration**. An indentured parts list of the hardware being delivered shall define the difference between the assigned as-designed configuration and the as-built configuration and supporting rationale for differences;

13) **As-built Configuration Data List (ABCL)**: compilation of items describing exactly the configuration of a fabricated serialized assembly to provide traceability for parts and materials used to build the end item; this must include:

    a) Part number and revision letter of each item,

    b) Part description (title) of each item,

    c) Electronic part reference designation,

    d) Manufacturer, and

    e) Procurement specification or Source Control Drawing (SCD) number and SCD revision letter;

NOTE: this document and the following may be combined and provided as a separate document; see DID for Configuration Item Data List / As Built Configuration Data List (CIDL/ABCL);

14) **Configuration Items Data List (CIDL)**: contains a listing of all documents, including specifications, drawings, ICDs, software description documents, etc., including revision level, that are part of the deliverable end item;
15) **Drawings**: One copy of the assembly drawings, interface drawings, schematic and parts drawing of the deliverable end item;
16) Test Procedures;
17) Test Reports;
18) **Non-standard Calibration**: Record of measurement equipment, instrumentation, components, or systems having non-standard calibration curves shall be provided at time of delivery;
19) **Repair Limitations**: When repair limitations are imposed by the design (i.e., limits the number of times a specific hardware type can be repaired), then a status of these limited repair items which have had prior repair activity but have not reached the specific limit shall be identified at the delivery;
20) End Item Weight;
21) Certificate of cleanliness (flight hardware); and
22) **Pre-closure photos** of items and major assemblies, including photos of boards.

DID-383 – Request for Deviation / Waiver

PURPOSE:

A Request for Deviation/Waiver shall be submitted for non-compliances to the program requirements and/or for equipment performance Class I non-compliances.

PREPARATION INSTRUCTIONS:

A Request for Deviation (RFD) or Request for Waiver (RFW) shall contain the following information, as a minimum:

ID	Data	Description	Deviation	Waiver
RFD/RFW Identification				
1)	Organization	Identification of the organization originating the RFD/RFW	X	X
2)	Number	Unique identification and register number	X	X
3)	Revision	Revision status of the RFD/RFW	X	X
4)	Date	Issue date of the RFD/RFW	X	X
5)	Classification	Classification (i.e. major or minor)	X	X
6)	Project	Project under which the nonconforming item is supplied	X	X
7)	Business agreement/ contract identifier	Business agreement / contract identification under which the nonconforming item is supplied (if applicable)	X	X
8)	Order	Order number under which the nonconforming item is supplied (if applicable)	X	X
9)	Originator site	Location of the request for deviation originator (if applicable)	X	X
Identification of Affected Item and Affected Documents				
10)	Item designation	Identification of the nonconforming item per name, manufacturer, part number and serial number (for a waiver), according to its configuration item data list	X	X
11)	Affected item(s)	Identification of the CI(s) (number and name) affected by the deviation of waiver	X	X
12)	Effectivity	Model or serial number (or batch / lot number) of the deviating or non-conforming item	X	X

ID	Data	Description	Deviation	Waiver
13)	Affected document(s)	Identification of the document(s) (specification, design drawing, etc.) to which the item does not conform (document number and revision/issue, paragraph or requirement ID)	X	X
14)	Short description	Title or short description of the RFD/RFW (consistent with the title of the related non-conformance report)	X	X
15)	Detailed description	Description of the deviation from the relevant requirement or design feature. / Description of the non-conformity, supported by sketches and attachments as appropriate. Include information on the origin of the deviation/waiver (design difficulties, non-conformance observed, procurement difficulties, ambiguous specifications, schedule constraints, etc.)	X	X
16)	Non-conformance Report	Identification number of the Non-conformance Report related to the request for waiver		X
17)	NCRB	Identification of the minutes of meeting of the NCRB which decided to raise the RFW		X
Technical and Programmatic Impact Assessment and Decision				
18)	Impact Assessment	Impact on cost, schedule, functionality, performance, reliability and safety	X	X
19)	Consequences of non-approval	Project impact if the deviation/waiver is not approved (cost and schedule)	X	X
20)	Rationale for acceptance	Reason why the proposed deviation/non-conformity can be accepted (supporting analyses, drawings, etc.)	X	X
21)	Adverse effects	Item characteristics affected by the deviation or non-conformity	X	X
22)	Limitation of use	Regarding the intended use		X
23)	Approval	Decision (Approval or Disapproval), names, date and signatures of the relevant authorities (Project Manager, Systems Manager, S&MA Manager)	X	X

DID-385 – Non-Conformance Reports

PURPOSE:

This DID contains the content preparation instruction for Non-Conformance Reports (NCRs) generated under the work described in this SOW.

PREPARATION INSTRUCTIONS:

The NCRs shall contain the following information, as a minimum:

1. Originator;
2. Date;
3. Part Number of discrepant item;
4. Description;
5. Operation or test phase during which the discrepancy was observed;
6. Effectivity (SN or Lot number);
7. Description of Non-conformance;
8. Disposition;
9. NRC Board meeting minutes with attendees list;
10. Attachments required to support the disposition;
11. Root cause and corrective action;
12. Verification performed to closeout non-conformance;
13. Closeout summary report or statement;
14. NCR Board approval.

DID-386 – Non-Standard Part Approval Requests

PURPOSE:

This DID contains the content preparation instruction for Non-Standard EEE Parts Approval Requests (NSPARs) generated under the work described in this SOW.

PREPARATION INSTRUCTIONS:

The NSPARs shall contain the following information, as a minimum:

1. NSPAR number;
2. Contract number;
3. Project name;
4. Assembly(ies) affected;
5. Part identification (name, Part Number (PN), manufacturer, CAGE code);
6. Procurement, screening and qualification specification and revision;
7. Radiation Susceptibility, TID, SET, SEU levels;
8. Manufacturer data sheets;
9. Rationale for use of a non-standard part and basis for approval;
10. Contractor Approval.

DID-387 – Problem or Failure Report

PURPOSE:

To provide a timely notice of anomalies, problems or failures with the Contractor's software or hardware. Also, to provide the data necessary to assess the adequacy of the analysis and corrective action, so as to prevent recurrence of anomalies, problem or failures and to assess the residual risk following the corrective action.

PREPARATION INSTRUCTIONS:

The report may be prepared in the Contractor's format and shall, as a minimum, provide the required information.

Each anomaly, problem or failure report shall include the following:

1) Complete identification of the hardware and software;
2) Date the anomaly, problem or failure occurred;
3) Estimated operating hours and cycles at the time of occurrence;
4) Location of the hardware at occurrence;
5) Hardware environmental conditions when it occurred;
6) Test and/or operation being performed;
7) A description of the incident and the potential impact on the assembly, subsystem, and system functional performance;
8) An analysis, including impact on hardware and software;
9) Cause of the incident;
10) A description of the corrective action taken;
11) A description of the method used to verify that the corrective action was effective;
12) A safety rating of either "S" for a potential personnel or hardware safety concern or "N" for no safety concern, supported with adequate rationale;
13) A risk assessment based on an evaluation of the failure effect rating (see below) and the failure cause and corrective action rating (see below).

Failure effects ratings are:

- Rating 1 Negligible effect on mission performance and system safety,
- Rating 2 Significant effect on mission performance or system safety,
- Rating 3 Major or catastrophic effect on mission performance or system safety.

Cause and corrective action ratings are:

- Rating 1 Known cause and certainty in corrective action,
- Rating 2 Unknown cause and certainty in corrective action,
- Rating 3 Known cause and uncertainty in corrective action,
- Rating 4 Unknown cause and uncertainty in corrective action.

Reports having a failure rating effect rating of 2 or 3 coupled with a failure cause and corrective action rating of 3 or 4 must include a rationale for accepting the residual risk;

14) Appropriate closeout signature.

DID-XXX – Software Product Assurance Development Plan

PURPOSE:

The Software Product Assurance Development Plan (SDP) describes the organization, objectives, and Software PA activities planned for the project.

PREPARATION INSTRUCTIONS:

The SDP may be prepared in the Contractor's format and shall, as a minimum, provide the following information, as applicable per software category as defined in the Product Assurance Requirement (PAR):

1. Organization and Responsibilities

This section describe the organizational structure of the Software PA Program. Identified position and individuals have defined tasks and responsibilities explicitly described.

2. SPA Phase-Independent Activities

This section cover activities that are applicable throughout the life of the Project.

- Evaluation of Software Methodologies, Standards and Procedures

2.1. Evaluation of Tools
This section cover software tools used in the development, support, verification and validation of software.

2.2. Evaluations of Software Configuration (SC) Management (SCM)

2.3. Evaluation of Software Libraries

2.4. Evaluation of Risk Management

2.5. Evaluation of Metrics
This section shall cover as a minimum the following metrics:

a) Size;

b) Complexity;

c) Fault density;

d) Test coverage; and,

e) Number of failures.

2.6. Evaluation of Technical Performance Measures (TPM)
This section shall cover as a minimum the following TPM:

a) Memory margin (ROM and RAM); and,

b) Processor Loading margin.

2.7. Evaluation of Vendor/Supplier

2.8. Evaluation of Commercially Available, Non-Development, Reusable Software

2.9. Software Non-conformance, Disposition and Corrective Action System

2.10. Software Non-conformance Review Boards

2.11. Evaluation of Software Storage and Handling

2.12. Quality Evaluation Records

2.13. Software Delivery

2.14. Progress reporting

2.15. Non-deliverable Software

3. Software PA Engineering Phase Dependent Activities

3.1. Evaluation of Development Planning

3.2. Evaluation of the Requirements Analyses Phase

3.3. Evaluation of the Preliminary Design Phase

3.4. Evaluation of the Detailed Design Phase

3.5. Evaluation of the Implementation Phase

3.6. Evaluation of Computer software Component and Software-Hardware Integration Testing Phase

3.7. Evaluation Acceptance

This section shall cover the validation and acceptance activities.

DID-400A – Scientific Instrument System Requirements Document

DID Issue: Tailored **Date: 2021-07-23**

PURPOSE:

To define the functional, performance, environmental and other requirements for the system to provide the basis on which the Specifications Documents will be developed.

PREPARATION INSTRUCTIONS:

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

   "must" indicates a mandatory requirement
   "should" indicates a goal or preferred alternative. Such goals or alternatives must be treated as requirements on a best efforts basis, and verified as for other requirements. The actual performance achieved must be included in the appropriate verification report, whether or not the goal performance is achieved;,
   "will" indicates statement of intention or fact
   "may" indicates an option.

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

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

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

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

   b) There must be one requirement per paragraph;

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

   d) They must not define design solutions;

   e) They must define their source and/or rationale

   f) They must be verifiable;

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

   h) Performance requirements must be quantified.

5) The Requirements Document must comprise a number of sections, each defining a specific set of requirements. The document must address the listed requirements listed in DID-400A – Figure 1 below, as applicable to the project.

6) More specific requirements that are not clearly identified in DID-400A – Figure 1:

   a) Resource allocation requirements;

   b) System environmental requirements associated with:

i) Storage, packaging and handling environment;

ii) External stowage requirements, if any;

iii) Ground operations environment;

iv) Integration to launch vehicle environment;

v) Launch environment;

vi) Space environment;

vii) Lunar environment.

viii) Planetary protection

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

d) Power requirements including:

i) Power consumption;

ii) Power transients;

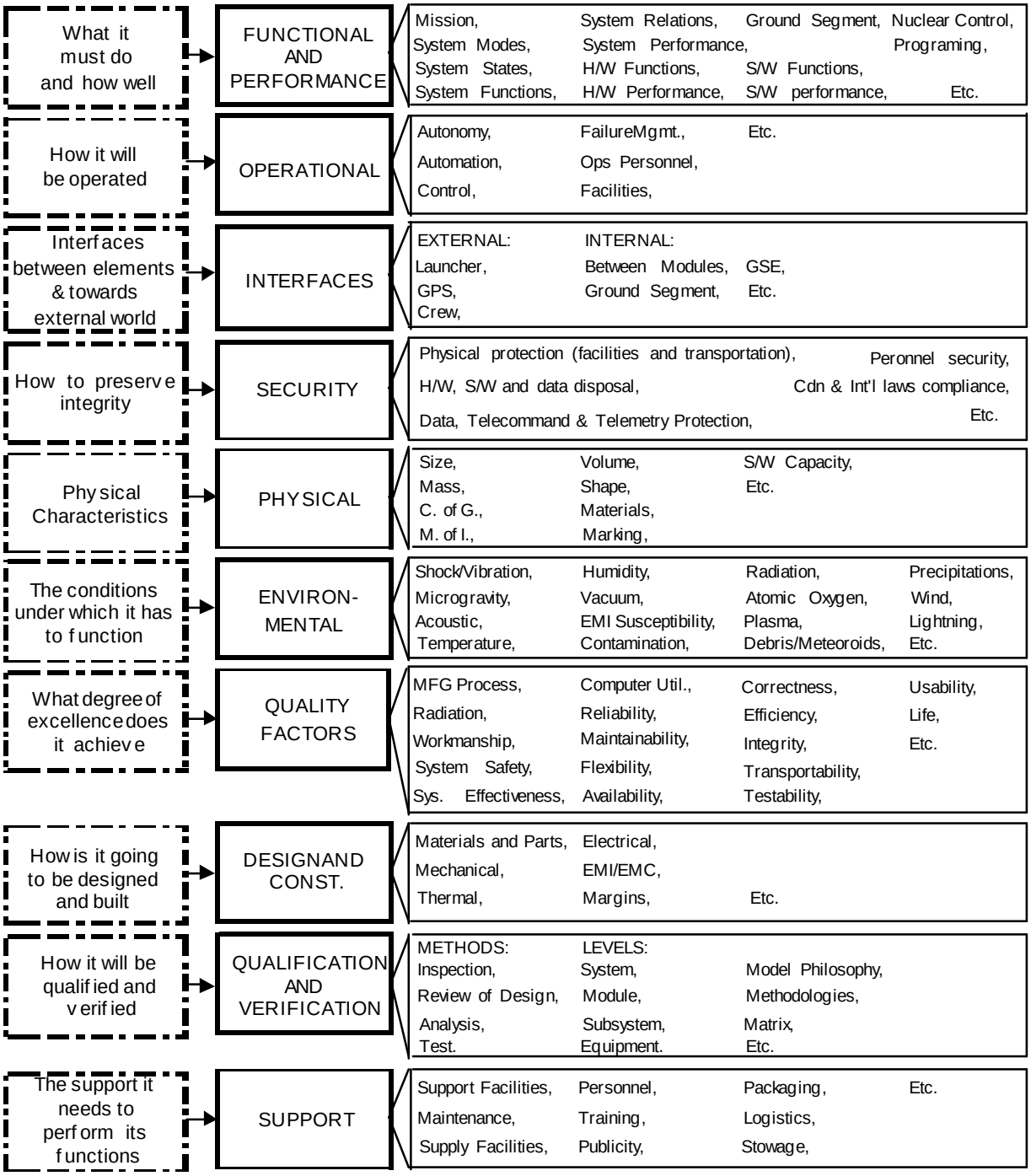
iii) Voltage requirements.

e) Telemetry and Telecommand requirements including rates and storage;

f) Radio Frequency;

g) Software requirements;

h) Other applicable requirements that are considered omitted by the Contractor and/or the CSA.



DID-400A – Figure 1

DID-450 – Systems Engineering Management Plan (SEMP)

DID Issue: IR **Date: 2014-01-24**

PURPOSE:

To define and describe the approach to and details of System Engineering activities to be performed by the Contractor and its lower-tier contractors.

PREPARATION INSTRUCTIONS:

The SEMP shall cover all engineering activities to be performed within the applicable contractual time and responsibility boundaries. The System Engineering Management Plan (SEMP) shall describe how a fully integrated engineering effort will be managed and conducted through design, analysis, development, integration, and testing of the system. It shall highlight key engineering methods and tools to be applied, and describe interfaces to external activities. It shall also reference and make use of the lower-tier Engineering Management Plans, and provide a coherent and consistent planning document for the entire Contractor Engineering program.

The SEMP shall include the following data, tailored to the specific needs of each project. See the CSA Systems Engineering Management Plan (SEMP) Template, CSA-SE-PL-0001, Rev. A for more details. Where one of the items listed below is the subject of a separate document, the SEMP shall merely include a pointer to that document.

1. INTRODUCTION

- **1.1. PURPOSE**
- **1.2. SCOPE**
- **1.3. RELATIONSHIP TO OTHER STANDARDS AND PLANS**

2. DOCUMENTS

- **2.1. APPLICABLE DOCUMENTS**
- **2.2. REFERENCE DOCUMENTS**

3. PROJECT OVERVIEW

- **3.1. MISSION DESCRIPTION**
- **3.2. PROJECT OBJECTIVES AND CONSTRAINTS**
- **3.3. SYSTEM DESCRIPTION**
- **3.4. PROJECT PHASES AND REVIEWS**

4. APPROACHES AND TECHNIQUES

- **4.1. SYSTEMS ENGINEERING PROCESS**
- **4.2. SE MANAGEMENT AND CONTROL**
  - *4.2.1. SE Management*
  - *4.2.2. Technical Organisation*
  - *4.2.3. Responsibility Allocation*
  - *4.2.4. Systems Engineering Working Group (SEWG)*
  - *4.2.5. Technical Reviews and Audits*
  - *4.2.6. Design and Development Plan*
  - *4.2.7. Technology Readiness Levels*

DID-451 – Design and Development Plan

DID Issue: IR **Date: 2014-01-27**

PURPOSE:

To define and detail all technical/engineering activities to be performed during the project's lifetime.

PREPARATION INSTRUCTIONS:

The Design & Development Plan (D&D 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 Design & Development activities. It is applicable to all Contractor deliverable hardware or for the system as a whole if applicable.

If requested separately in the CDRL, the following plans shall be considered as sub-plans to the D&D. In such cases, the D&D Plan shall merely include a pointer to those documents.

1) Qualification Program Plan;
2) Audible Noise/Human Vibration Control Plan;
3) Electromagnetic Compatibility (EMC) Control Plan;
4) Fracture Control Plan;
5) Microgravity Control Plan;
6) Contamination Control Plan;
7) Assembly, Integration, Testing and Verification Plan; and
8) Software Development Plan.

2. CONTENTS

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

1) A description of the Contractor's organisation, methods, and control to implement the development work;
2) A description of the development activities to be performed, detailing benefits, constraints, and objectives;
3) A detailed time-correlated sequence of development milestones from contract-start date through to completion of design certification;
4) A description of support equipment, software, facilities, and tooling necessary for the development activities;
5) A description of development and breadboard tests planned at equipment level;

6) Long Lead items shall be identified and the schedule for procuring these items shall be presented;
7) Qualification Program in terms of Model Philosophy, Model Definition, Test Programs, Analysis and Verification Program, to be further detailed in the Assembly, Integration and Test (AIT) Plans; and
8) Margin philosophy to be applied in the course of the development flow and its associated review milestones.

3. TABLE OF CONTENTS

This document shall be prepared in accordance with the following Table of Content, as a minimum:

1) Introduction;
2) Overall Approach;
3) Technical Organisation;
4) Approaches, Techniques and Tasks;
5) Model Philosophy;
6) Manufacturing;
7) Assembly, Integration, Testing and Verification;
8) Critical Technologies;
9) Commonality and Standardisation;
10) Long Lead Items, Critical Items;
11) EEE Parts Procurement
12) Spares Philosophy;
13) Ground Support Equipment; and
14) External Facilities.

DID-452 – Software Development Plans

DID Issue: IR **Date: 2014-01-27**

PURPOSE:

To describe the management and technical approaches that govern the software development process. It describes what products and materials are received and delivered, how requirements are determined, and important aspects of the provider's relationship with the customer.

PREPARATION INSTRUCTIONS:

The Software Development Plan shall cover all deliverable software. It applies to whole system software or to the software used in any constituent subsystem.

The Software Development Plan shall address the following, as applicable:

1) A description of the software development process and technical approach, including code generation strategies that stem from the UML software design model;
2) Standards for software products;
3) Reusable software products;
4) Software development planning;
5) Software test planning;
6) Test facilities & simulation requirements;
7) Software qualification process including code reviews;
8) Traceability (from requirements to design);
9) Fault Tree Analysis;
10) Documentation tree;
11) Resource estimation and control
12) Performance parameter estimation and control;
13) Development of build plans and schedules; and
14) Interfaces to Project Management, Hardware Engineering, Product Assurance, and Configuration Management.

DID-455 – Breadboard Development and Test Plan

DID Issue: IR **Date: 2014-01-27**

PURPOSE:

To present a set of pre-prototype activities to reduce risk and validate the requirements at all levels of the system to the extent practical prior to full system assembly.

PREPARATION INSTRUCTIONS:

The document must present a list of planned breadboards and pre-prototypes, with test concept and goals, location, supporting resources needed, plan, schedule and suggested milestones.

DID-467 – Test Plan

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

PURPOSE:

To describe the formal qualification end-to-end test plans for the system, to identify and describe the individual tests that shall be performed during validation, and to identify the test resources required.

PREPARATION INSTRUCTIONS:

5. SCOPE

This DID establishes the content, format, and submittal requirements for all test activities. The Contractor must describe the nature and extent of the specific tests proposed for each unit, in accordance with SOW requirements, and in accordance with the System Verification Plan.

6. CONTENTS

The Test Plan may be prepared in the Contractor's format and must contain the following information, as a minimum:

6.1. GENERAL

Identification number, title, and brief overview of the system to which the Test Plan applies;
A description of the relationship of this plan to other project management and engineering plans;
Identification and description of general test requirements applicable to all system tests or group of system tests; and
A schedule of tests.

6.2. TEST-SPECIFIC

Description of each test to be conducted on the system including:

c) Test objective,

d) Qualification method as specified in the System Requirements Document (SRD) and/or ICD,

e) Reference to the corresponding SRD and/or ICD requirements,

f) Identification and type of data to be recorded,

g) Location of testing,

h) List of procedures documents required for tests,

i) Personnel required for each test, and

j) All assumptions and constraints associated with each test;

Identification and description of all hardware and software items required to perform validation testing, including identification of the proprietary nature and Government rights associated with each item;
A description of plans to install, setup, and maintain items in the system test environment; and

A description of the data recording, reduction, and analysis activities to be carried out during and after system tests.DID-468 – Launch Campaign Plan

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

PURPOSE:

To define the work planned for integration of the spacecraft into the launch vehicle for launch.

PREPARATION INSTRUCTIONS:

The plan shall describe, as a minimum

1) Requirements and activities for transport of the spacecraft and support equipment to the launch site;
2) Requirements and activities for checkout of the system on arrival and throughout the integration process;
3) Identification of processes and procedures to be used during the integration;
4) Identification of processes and procedures to be used during the launch;
5) Identification of special equipment, project GSE and facilities, and definition of the utilization flows for the integration and test activities;
6) Test program description, including test sequence, objectives of each test, preparations required, and list of procedures;
7) LV integration plans;
8) Payload activities at the launch pad;
9) A graphical schedule of the activities;
10) Organization and responsibilities of the Integration and Launch team;
11) Facility cleanliness and contamination control provisions; and
12) Security and safety provisions to safeguard the personnel and flight hardware.

DID-469 – Electrostatic, Electromagnetic & Magnetic Cleanliness Control Plan

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

PURPOSE:

To document the plan for controlling Electrostatic, Magnetic and Electromagnetic Cleanliness (EMEC) throughout the design and development of hardware to final integration, launch and operations.

PREPARATION INSTRUCTIONS:

The Contractor shall set forth a plan for controlling design and development procedures to avoid any potential mission degradation due to EMEN (Electrostatic, Magnetic and Electromagnetic Noise). The plan shall identify all anticipated sources of EMEN, including expected levels. The methodology described in the plan shall span the full system life cycle, from design, through manufacturing, assembly, integration and testing, to operations. The plan shall address the proposed methods of minimizing the effects of EMEN. The plan shall define levels of EMEN as part of the design requirements and approach, and methods/procedures for Electrostatic, Magnetic and Electromagnetic Cleanliness (EMEC). The plan shall also alert the CSA to any unusual sensitivity to particular EMEN.

The plan shall incorporate all measures and actions necessary to achieve EMEC as defined in the Radiation Analysis and shall include flow down requirements to sub-contractors and all third party participants from conceptual stage to final integration. The plan shall show how verification of requirements is performed at various major milestones particularly in first article testing.

The Electrostatic, Magnetic and Electromagnetic Cleanliness Control Plan (EMECCP) shall include, as a minimum, the following EMEN Control information:

1) Identify critical noise sources for each scientific instrument and formulate mitigation activities that will be performed to meet instrument requirements.
2) Identify controls over materials which may produce EMEN particularly insulators, coatings and treatments which are prone to ESD noise.
3) Identify contamination sources that may contribute to EMEN and instrument malfunction, including cleaning, inspection, and bagging procedures for flight parts, flight assemblies, and the assembled instruments and Bus Module.
4) Identify design features of shipping containers that will avoid damage to insulation coatings and general spacecraft parts/assemblies during shipping and storage.
5) Show that efforts to control and avoid EMEN are consistent with concerns laid out by the science instrument teams.
6) Indicate the methods and frequency of evaluation for ensuring that EMEC philosophy is exercised and maintained diligently throughout the different stages of design, development and manufacture of instruments and the spacecraft bus.
7) Identification of tests and inspections that will be performed to verify that EMEC has been rigorously applied to ensure that the hardware will meet the performance requirements.

DID-501 – Interface Control Document (ICD)

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

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

Examples of External ICDs are:

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

Examples of Internal ICDs are:

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

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

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

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

1. Purpose and Scope
2. Applicable and Reference Documents
3. Identification (name, number) and brief overview of the system and role within the system, of the interfaces to which the ICD applies
4. Interface diagrams showing by name and identifier all interfaces among the HWCIs and CSCIs to which this ICD applies
5. Identification (name, identifier) and purpose of each of the interfaces
6. Physical / Mechanical Interfaces
   - 6.1. Coordinate System
   - 6.2. Dimensions and tolerances
   - 6.3. Units of measurement
   - 6.4. Envelope, Volume and Mass Properties
   - 6.5. Attachment methods
   - 6.6. Alignment features

7. Structural/Mechanical Interfaces
   - 7.1. Applied Loads and Disturbances (including random vibrations, frequency spectrum)
   - 7.2. Acoustics
   - 7.3. Depressurization/Repressurization
   - 7.4. Ground Handling Environment
8. Thermal/Fluids Interfaces
   - 8.1. General Requirements (touch temperature, condensation prevention, etc.)
   - 8.2. Thermal Environment
   - 8.3. Payload/Subsystems Cooling
   - 8.4. Vacuum Exhaust Interfaces
9. Electrical Power Interfaces
   - 9.1. Electrical Power Requirements, Sources and Allocation
   - 9.2. Power Supply characteristics and limits
   - 9.3. Overload protection and limits
   - 9.4. Power control
   - 9.5. Electrical connectors (types, pinouts, locations, mating and demating)
   - 9.6. Cable schematics
10. Electromagnetic Compatibility (EMC)
    - 10.1. EMC Classifications
    - 10.2. Host system produced interference environment
    - 10.3. Payload produced interference environment
    - 10.4. Bonding and grounding
    - 10.5. Power and signal circuits isolation
11. Command and Data Handling (C&DH)
    - 11.1. Communications Technology (RS-422, Ethernet, Analog, Discrete, video, laptop, etc.)
    - 11.2. Signal Characteristics
    - 11.3. Response / Telemetry Format
    - 11.4. Request/Command Format
    - 11.5. Processing Requirements
    - 11.6. Connector/Pin Interface
    - 11.7. Data Acquisition, Storage and Management
    - 11.8. Synchronization
    - 11.9. Application Programming Interfaces
12. Environmental Interfaces
    Any environmental factors not addressed elsewhere in the ICD (e.g. radiation, atmosphere, illumination, etc.)
13. Materials and Processes Interfaces
14. Human Factors Interfaces
15. Propulsion Interfaces
16. Pyrotechnic Interfaces
17. Fire Prevention
18. Ground Operations
    - 18.1. Facilities
    - 18.2. Payload Handling

18.3. Ground Support Equipment (GSE)
18.4. Communications Requirements
18.5. Power Requirements
18.6. Special Equipment
18.7. Storage

DID-525 – Product Tree

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

PURPOSE:

To establish the hierarchical structure of the products that defines a system.

PREPARATION INSTRUCTIONS:

1. TYPE OF OUTPUT INFORMATION

The Product Tree (PT) shall describe the hierarchical breakdown of the System into lower-levels as necessary to fully define the System. It shall be structured as a "natural" breakdown of the system. It shall be strictly product oriented, that is a systematic subdivision of the product into discrete and related elements of the product to be provided. It shall provide a complete graphical overview of the entire System by its defined product items and their relationships. The PT is a structure on its own, but forms the basis for other structures.

2. LEVEL OF DETAIL

The subdivision shall go down to the items of every program contract/subcontract (hardware and software shall be identifiable).

a) A hierarchical address code shall be used;

b) The PT shall identify the items' specification or the controlling requirements document for the item;

c) The PT shall identify the requirements and control documents controlling the interfaces to that item; and

d) The PT shall identify the responsible supplier.

The subdivision shall be limited to items where management control is required for the following aspects:

a) Configuration control;

b) Cost;

c) Engineering;

d) Product assurance; and

e) Operations and logistics.

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 (LLI) List must identify, as a minimum:

1. All LLIs;
2. The time frame, relative to the project schedule, when these items need to be ordered or fabricated; and
3. The estimated cost of all identified items.

DID-530 – Technical Performance Measures Report (Budget)

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

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The TPMs must include the following parameters, as appropriate:

1) Physical resources
    a) Mass: this section must indicate the current allocated Spacecraft mass, the current estimated mass, and the current mass margin; mass estimates should be broken down to the unit level.
    b) Power (steady-state and transient peaks): this section must provide estimates of power consumption (maximum, minimum) and available load power (maximum, minimum) against the Requirements Document or Specification.
    c) Volume: this section must indicate the current allocated Instrument volume, the current estimated volume, and the current volume margin; volume estimates should be broken down to the unit level.
2) Computer resources
    a) Processor usage: for each microprocessor used in the Instrument, this section must allocate a processing capacity budget and estimate the average and peak loading on the processor, as well as calculate the processing margin.
    b) Memory usage: for each microprocessor used in the Instrument, this section must allocate a Random Access Memory (RAM) and Electronically Erasable Programmable Read-Only Memory (EEPROM) usage budget and estimate the current memory margin.
3) **Communication bandwidth:** for each onboard data equipment, this section must allocate a communication bandwidth budget between subsystems (down to the unit level).
4) **Radio-frequency link margin:** this section must allocate a communication bandwidth budget between the Instrument and the Ground Segment.
5) **Command and Telemetry:** this section must allocate a Command and Telemetry budget and estimate the current rate and volume of commands and telemetry in each subsystem.
6) Synchronization and timing;
7) **Thermal margins (including model uncertainty):** this section must present the equipment temperature limits (down to the unit level), and the current estimated operational temperature range for the equipment based on an analysis of the mission states.

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

9) EMC/EMI: this section must allocate the Spacecraft Electromagnetic Compatibility / Electromagnetic Interference (EMC/EMI) budget conducted susceptibility, radiated emissions, and radiated susceptibility for the components (down to the unit level). must

10) **Reliability (probability of success):** this section must present an estimate of reliability and a calculation of the reliability margin against the Requirements Document or Specification.

11) **Availability:** this section must present an estimate of the availability of Science data. This must take into account any time (mode and state) the Instrument is unavailable to perform science measurements. Calibration is one example.

12) **Payload-specific performance criteria and parameters.** This must include an error budget, which must present the error budget for the overall instrument performance and the allocations to the various sources of measurement errors.

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

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

The report must show:

a) the historic trend of requirements and estimates,

b) all the margins being carried on the estimates, and

c) the source of the estimates (e.g. allocation, estimation, analysis, measurement).

DID-600C – Computer-Aided Design (CAD) Models

DID Issue: Tailored **Date: 2021-07-23**

PURPOSE:

To provide a 2D or 3D virtual model of a product to support the performance of various analyses (mechanical, electrical, thermal) and virtual testing.

PREPARATION INSTRUCTIONS:

All CAD models developed must be delivered.

Models must be delivered in the following formats:

1) Mechanical design: STEP AP203 (.stp), and PDF (with 3-D viewing);
2) Additive manufacturing design: Sterolithography (SLA) and native files;
3) Electrical design: .dsn, .sch, Pspice, and Gerber formats or applicable native format with a pdf export;
4) Thermal Design: TMG universal file format, or I-Deas Archive file format;
5) Software design: UML 2.0 or XML;
6) Model-based Systems Engineering Model (if required): Artisan Studio.

In cases where a different tool is used from the one CSA uses, the model and outputs must be supplied in native format in addition to the required format. For generic modeling and analysis that don't use a specialty tool, CSA will accept Matlab, Excel and MathCad format data. Where a highly specialized tool is used (e.g. bearing analysis, EMC analysis) delivery format must be negotiated with the CSA.

Translation from the Contractor's tool to the required format is only acceptable where the results can be repeated in CSA's tool. Translation that corrupts the model, loses data, or produces data that is interpreted differently, is not acceptable.

Assumptions that are used must be stated, along with resulting limits on model accuracy.

DID-604 – Mechanical Models and Analyses

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

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

DID-605 – Structural Model and Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To demonstrate that the design is compatible with the system requirements, when subjected to the worst-case mechanical, thermo-mechanical, and man-induced loads including launch and landing loads, establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

Analyses and models shall be provided in the following areas, as applicable:

1) Design loads and dynamic analysis
2) Coupled loads analysis
3) Strength and stress analysis

4) Thermo-structural analysis
5) Modal analysis
6) Microgravity Analysis

Comprehensive Finite Element Modeling (FEM) shall be used to perform the foregoing analyses. Analysis shall cover at least the following sources of loads: launch, deployment and mechanisms.

Models shall be subjected to standard quality checks (e.g. total mass = mass analysis, static reaction loads equals mass, no extra rigid-body modes, rigid-body stiffness is zero to within tolerance, temperature-induced loads are zero when temperature is zero, reaction loads are zero when unconstrained model undergoes temperature change.)

The FEMs shall be delivered in NASTRAN format (.bdf or .dat).

The structural analysis shall cover fracture mechanics analysis. Fracture models shall be delivered in NASGRO format.

DID-606 – Mass Model and Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To establish the mass properties of the system, which would result from the proposed design, support the Launch Vehicle Selection analysis, establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

The Mass Model and Analysis shall contain the decomposition and allocation process of mass to subsystems, with rationales. As the design progresses, the mass analysis shall provide the detailed estimates used to support the Mass TPM report. Mass analysis shall consider the whole life of the system, if the design is such that mass properties change.

Mass analysis shall cover zeroth, first and second moments of mass (i.e. mass, centre of mass and moments of inertia including cross-products.)

Mass analysis shall be complete, showing all calculations and assumptions used for every item estimated.

The mass model shall be delivered in one of the generic formats: Excel, Matlab, or MathCad.

The Mass Model and Analysis is required for the Space Segment only, not for the Ground Segment.

DID-607 – Thermal Model and Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To support the feasibility of the design at system, subsystem, unit, module and assembly levels, by predicting operating temperatures and the amount of heat transferred to the external environment, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

The Thermal Model and Analysis shall predict the touch temperature of accessible parts of the system, the operating temperature of the electronic or other heat-sensitive components, allowable flight temperature margins, and internal and external heat exchange breakdown. The analysis shall cover the worst case of the operating environment (i.e. on-orbit) using beginning and end of life properties. Furthermore, sensitivity analyses shall be performed on critical and marginal components.

A comprehensive analysis of heat balance shall be completed for cryogenic sub-systems, to clearly demonstrate appropriate margin in heat lift versus heat dissipation, considering all uncertainties related to material properties, heat dissipation, contact resistances and cooler performance (active or passive). A clear strategy shall be communicated whereby reserve power is maintained to address anomalous behaviour in any non-redundant cooling equipment.

Two levels of thermal balance are required as a minimum:

a) Spacecraft thermal balance:

   The spacecraft thermal balance shall define worst-case and nominal budgets for heat exchange of key dissipation sources, sinks and fluxes both internally and externally.

b) Cryogenic region thermal balance:

   The cryogenic region thermal balance shall describe in detail, dissipation, radiation and other parasitic sources versus the available heat lift. Heat lift margin shall be expressed versus worst-case predicted conditions. The cryogenic region includes all equipment with a temperature less than 180K.

Thermal analysis and budgeting shall include allowance for contamination build-up for cryogenically operated equipment and radiative surface. Sources of thermal and thermo-optical properties, including contact conductances shall be provided.

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

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

Comprehensive Finite Element Modelling (FEM) shall be used to perform this analysis. The Thermal Models shall be delivered in TMG universal file format, or I-Deas Archive file format.

DID-611 – Electrical Power and Distribution Model and Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To document the decisions for decomposition and allocation of power to subsystems, with rationales, support the power generation and distribution system requirements and design, provide the detailed estimates used to support the Power section of the TPM report, define requirements for subsystems and design choices for components, establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

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

1) Electrical architecture: power, data, and redundancy;
2) Electronics: circuitry, protection, and component switching;
3) Power budgets and distribution;
4) Worst case analysis.

The analysis shall evaluate the system electrical and electronic design to show that it meets performance requirements. Worst-case analysis shall be performed to show that parameter and input variations will not compromise system performance.

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

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

Power is primarily a concern for the Space Segment, requiring detailed analysis. Less detailed power estimates are also required for the Ground Segment to support CSA facilities planning.

DID-616 – EMC/EMI Model and Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To demonstrate that the system will be immune to the Electromagnetic Environment (EME) in which it will operate and will not cause undue Electromagnetic Interference (EMI) to the environment, to establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

The analysis shall cover the following aspects as a minimum:

1) Radio Frequency (RF) compatibility, including radiated and conducted emissions, and RF link disturbances,
2) Radiated and conducted susceptibility,
3) Calculation of conducted and radiated EMI safety margins,
4) Analysis to support the EMC/EMI verification, in particular of interfaces, including simulations,
5) Charge accumulation and leakage from the space environment, and other EME related to the space environment.

The analysis shall consider wiring harness EME.

DID-609 – Coupled Loads Analysis (CLA)

DID Issue: IR **Date: 2014-02-28**

PURPOSE:

To predict responses caused by major dynamic and quasistatic loading events such as liftoff, gust, buffet, and engine startup and shutdown. CLA helps to minimize risk and maximize the probability of mission success.

PREPARATION INSTRUCTIONS:

The dynamic Coupled Loads Analysis (CLA), based on the payload dynamic model released by the Spacecraft Prime Contractor, shall provide:

1) The modal analysis of the LV and the payload,
2) The dynamic responses of the payload for the most severe load cases induced by the LV,
3) At nodes selected by the spacecraft prime contractor, the min / max tables and the time history of forces, accelerations, and relative deflections as well as LV/payload interface acceleration and force time histories,
4) The inputs for analyzing the launch service provider's request for notching during the payload qualification tests.

DID-625 – Fields of View Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

To determine the requirements on location and size of the instruments fields of view.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

In addition to the requirements on location and size of the instruments fields of view, the Fields of View Analysis (FOV) shall also determine interface requirements on the spacecraft and instruments to provide and not impinge on these fields of view. The analysis shall at later stages verify compliance of the elements to the FOV requirements to support the performance analyses for the instruments.

DID-618 – Radiation Analysis

DID Issue: IR **Date: 2014-01-29**

PURPOSE:

These analyses are required to demonstrate that the chosen design will meet and operate satisfactorily in the specified radiation environment, establish feasibility of the design to meet the requirements in the design phase, and in some cases provide verification of compliance to requirements where this cannot be demonstrated directly by test or inspection.

PREPARATION INSTRUCTIONS:

GENERIC FORMAT AND CONTENT FOR ALL ANALYSES

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

Analysis documents shall contain all analysis work that is performed in support of the design. The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

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

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

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

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

SPECIFIC CONTENTS

This report shall document all analyses and activities performed to establish the sensitivity of parts to radiation in terms of total dose effects and cosmic ray effects, and to demonstrate that the chosen design(s) and parts will operate satisfactorily throughout the mission(s) in the ionizing radiation environment applicable to the mission.

The report may be prepared in the Contractor's format and shall contain the following information:

1) Radiation Environment: reference and inputs used to conduct the radiation including assumptions on solar flares and model uncertainties.
2) Radiation Estimates: total absorbed doses and Linear Energy Transfer (LET) spectra shall be predicted down to part levels. Methods and models used for these predictions shall be described, including assumptions and the coordinate system used.
3) Critical Parts and Materials: radiation sensitive materials and parts shall be listed. This listing shall be based on information obtained from manufacturers or field data. A radiation sensitivity table shall be generated indicating sensitive materials and parts, their radiation hardness (best estimates, manufacturer's data, test data, predictions from similarity, etc.), the expected types of effect: mechanical (etching, hardening, etc.), chemical (by-product formation, etc.) and electrical (latch-up, dielectric breakdown, power consumption, leakage, loss of gain, etc.).
4) Detailed Analyses: based on the total dose and LET spectra calculations shall be performed for parts that exhibit marginal radiation hardness. Single Event Upset (SEU) rates and latch-up sensitivities shall be analyzed.
5) Qualification Issues: qualification status (for radiation) shall be discussed early in the project, ideally during the SRR.
6) Conclusions: design margins shall be discussed and recommendations shall be made.

DID-701A – Design Document

DID Issue: IR- Tailored **Date: 2021-07-23**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

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

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

The Design Document shall contain as a minimum:

1. Introduction

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

2. Architecture, design and interfaces

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

3. Drawings and schematics

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

4. System Analysis and Trade-offs

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

5. Analyses

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

6. Quality factors: Reliability of the instrument and availability of science data. Considering the environment, calibration and other factors that could affect the interruption of science operations and science data availability.
7. Budgets:

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

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

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

    This section shall describe the maintenance approach and the proposed spares, especially for maintainable items such as flight software and ground systems.
11. Matrix: To demonstrate design compliance to requirements by providing clear link between design and requirements. Indication of design compliance, non-compliance and partial compliance.

DID-704 – Design, Assembly and Interface Control Drawings

DID Issue: IR **Date: 2014-01-31**

PURPOSE:

To provide the design data required to manufacture, assemble, verify, test, operate and maintain the hardware and software products of the contract.

PREPARATION INSTRUCTIONS:

1. FORMAT

Drawings may be prepared in the Contractor's format.

All drawings shall be provided in electronic format, in both the native CAD format and .igs format. Paper copies shall be provided only upon request from CSA.

2. MAINTENANCE

These documents shall be updated to reflect approved changes resulting from design reviews and updated as required every 90 days.

Changes and/or updating of drawings and lists shall be accomplished in accordance with the contractor's engineering system and the provisions of the cited applicable documents.

3. CONTENTS

This is a package of data that completely defines the as-delivered system or subsystem. This includes all drawings, parts lists, material and process specifications, manufacturing and assembly processes and procedures, layouts, etc. Computer-aided design models are included in this package, but must meet the requirement of the DID titled "CAD Models".

A complete set of drawings to include integrated systems schematics representing the final "as-designed" or "as-built" configuration is required. Integrated system schematics shall include interfaces between systems, components and software. Integrated functional schematics shall include the functions to be performed by systems and elements and shall show the inter-relationships between these functions. Post-delivery and on-orbit modifications shall be documented in a manner that facilitates individual incorporation and verification of design changes and distinctions between the as-built and modified configurations.

DID-706 – Software Design Model

DID Issue: IR **Date: 2014-02-05**

PURPOSE:

To present a Software architectural design that shows how all the requirements will be addressed by the software design.

PREPARATION INSTRUCTIONS:

The Software Design Model must be provided in UML version 2.

The model shall represent the software requirements and decompose them into elemental requirements, which will then be implemented by software objects defined within the model. The software shall be generated from the model, with human-created software only where necessary because of limitations in the UML environment.

The model shall be used to perform analyses of the software to ensure high quality.

The UML model should be delivered in Artisan Studio compatible format. If developed in Artisan Studio, the contractor can realize a simplified flow of requirements and design information from the system level Model Based Software Engineering (MBSE) model.

DID-710 – Software Version Description Document (VDD)

DID Issue: IR **Date: 2014-02-25**

PURPOSE:

To identify the contents of a software CSCI release and to record the details of all aspects of the system, support software and hardware required to regenerate this CSCI.

PREPARATION INSTRUCTIONS:

This document shall follow the J-STD-016 DID for a software Version Description Document. This document shall identify the software modules that make up the system or segment software. Changes from the previous version (if any) shall be documented along with any known deficiencies that affect the operation of the current version.

The VDD shall contain the following information, as a minimum:

1) Introduction:
    a) Identification;
    b) System Overview.
2) Applicable and Reference Documents.
3) Version Description:
    a) Inventory of Materials Released:
        i) Materials;
        ii) Hardware Tools;
        iii) Development Platform Hardware Requirements;
        iv) Software Tools;
        v) CSCI Source File Listing;
        vi) Documentation; this section must list all relevant documents revisions associated with this build version (requirements, ICDs,…).
    b) Inventory of Software Content.
    c) Changes Incorporated. This section must list all new functionalities that were added, and/or all problems that were corrected in this version. A list of all modified and created files with the rationale must be included.
    d) Build Procedures and Development Environment Setup Information. The procedure must provide step-by-step actions with screen shots as appropriate to document the complete build process.
    e) Installation Instructions.
    f) Validation Test Scripts, Data and Results.
4) Known Errors and Possible Problems.
5) Notes

DID-711 – FPGA Design Document

DID Issue: IR **Date: 2014-03-26**

PURPOSE:

To document the design of the Field-Programmable Gate Array (FPGA) and the supporting analyses and trade-offs.

PREPARATION INSTRUCTIONS:

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

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

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

The Design Document shall contain as applicable:

1. INTRODUCTION

This section shall present a short system overview, and the FPGA's role in the system.

2. ARCHITECTURE, DESIGN AND INTERFACES

This section shall give a detailed description of the architecture and design of the FPGA, including internal and external interfaces.

3. DRAWINGS AND SCHEMATICS

This section shall include architectural diagrams for the FPGA; it shall describe and reference important design drawings such as functional block diagrams, activity flow diagrams, ICDs.

4. ANALYSIS AND TRADE-OFFS

This section shall present the evaluation of the design approaches, including the accomplishment of trade-off studies supporting design decisions. Trade-off studies shall include criteria definition, criteria results and decisions.

5. ANALYSES

This section shall summarize the analyses performed, main results and problems encountered.

6. TESTS

This section shall summarize tests performed and main results and problem areas.

7. OPERATIONS

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

DID-712 – FPGA Version Description Document (VDD)

DID Issue: IR **Date: 2014-02-25**

PURPOSE:

To identify the contents of an FPGA release and to record the details of all aspects of the system, support software and hardware required to regenerate this FPGA.

PREPARATION INSTRUCTIONS:

This document shall follow the J-STD-016 DID for a software Version Description Document. This document shall identify the software modules that make up the system or segment software. Changes from the previous version (if any) shall be documented along with any known deficiencies that affect the operation of the current version.

The VDD shall contain the following information, as a minimum:

1) Introduction:
    a) Identification;
    b) System Overview.
2) Applicable and Reference Documents.
3) Version Description:
    a) Inventory of Materials Released:
        i) Materials;
        ii) Hardware Tools;
        iii) Development Platform Hardware Requirements;
        iv) Software Tools;
        v) CSCI Source File Listing;
        vi) Documentation; this section must list all relevant documents revisions associated with this build version (requirements, ICDs,…).
    b) Inventory of Software Content.
    c) Changes Incorporated. This section must list all new functionalities that were added, and/or all problems that were corrected in this version. A list of all modified and created files with the rationale must be included.
    d) Build Procedures and Development Environment Setup Information. The procedure must provide step-by-step actions with screen shots as appropriate to document the complete build process.
    e) Installation Instructions.
    f) Validation Test Scripts, Data and Results.
4) Known Errors and Possible Problems.
5) Notes

DID-750 – Test Requirements Document

DID Issue: IR **Date: 2014-02-25**

PURPOSE:

To define the testing to be performed in order to accurately measure, verify and document the functionality, performance and environmental characteristics of a system, subsystem or unit.

PREPARATION INSTRUCTIONS:

The purpose of this document is to specify the minimum test requirements from the customer's perspective. This document will serve the contractor as a starting point for elaborating a more complete Test Requirement Document.

The Test Requirements Document shall contain the following information, as a minimum:

1. Introduction:
    a) Background;
    b) Goals and objectives,
    c) Scope;
    d) Requirements numbering convention;
    e) Assumptions;
    f) Constraints.
2. Applicable and Reference Documents;
3. General test requirements:
    a) Tests required;
    b) Test Design:
        i) Test Case,
        ii) Test Procedures,
        iii) Test Data Sheet;
4. Test Activities, Test Management and Conduct:
    a) Test Readiness Review;
    b) Test Management:
        i) Test Interruptions,
        ii) Re-test,
        iii) Regression Testing;
    c) Test measurement accuracy;
    d) Non-Compliance and Problem Reports;

e) Test Data Review.

5. Requirements for documenting test activities and test results:
    a) Test Records;
    b) Test Reports;
    c) Configuration Control.
6. Specific tests in addition to verification.

DID-751 – Software Test Plan

DID Issue: IR **Date: 2014-03-28**

PURPOSE:

To describe the purpose and goals of the software testing, and to identify the strategies to be used to implement and execute testing, and the resources needed.

PREPARATION INSTRUCTIONS:

The document shall include the following:

1. SCOPE

The Software Test Plan (SWTP) identifies the software test environment resources required for testing and provides schedules for testing activities. In addition the SWTP identifies the individual tests that must be performed during testing. The testing must include Human-Computer Interface Testing.

2. CONTENT

The SWTP may be prepared in the Contractor's format and must, as a minimum, contain the following information:

1. identification number, title, and brief overview of the system and Computer Software Configuration Items (CSCIs) to which the SWTP applies;
2. a description of the relationship of this plan to other project management plans;
3. identification and description of all hardware and software items required to perform testing including identification of the proprietary nature and Government rights associated with each item;
4. a description of plans to install, setup, and maintain items in the software test environment;
5. identification and description of general test requirements applicable to all tests or group of tests (e.g. measurement of execution time);
6. a description of the types or classes of tests (e.g. stress tests, timing tests, erroneous input tests, maximum capacity tests) and levels at which testing will be performed (e.g. CSCI, CSCI to CSCI, CSCI to HWCI, system);
7. a description of the data recording, reduction, and analysis activities to be carried out both during and after tests;
8. a schedule of tests; and
9. identification and description of each test to be conducted on the CSCI(s) including:
    a) test objective,
    b) test level,
    c) type or class,
    d) test method,
    e) cross reference to the CSCI design requirements,
    f) cross reference to the CSCI interface requirements,
    g) type of data to be recorded, and
    h) assumptions and constraints.

DID-754 – Test Procedure

DID Issue: IR **Date: 2013-12-20**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

This DID is applicable to systems, hardware and software.

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

1. **SCOPE**

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

2. **TEST REQUIREMENTS**

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

3. **TEST ARTICLE**

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

4. **TEST FACILITIES**

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

5. **PARTICIPANTS REQUIRED**

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

6. **TEST SET-UP AND CONDITIONS**

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

7. **INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE**

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

8. **PROCEDURE**

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

9. **DATA ANALYSIS**

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

10. ACCEPTANCE/REJECTION CRITERIA TABLE

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

DID-755 – Software Test Procedure

DID Issue: IR **Date: 2014-03-26**

PURPOSE:

To define the procedure to be followed for each test to be performed on the software.

PREPARATION INSTRUCTIONS:

This DID is applicable to all software.

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

1. SCOPE

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

2. TEST ITEM AND FEATURE(S) TO BE TESTED.

This section shall identify the test items and describe the features and combination of features that are going to be the object of the test.

3. PARTICIPANTS REQUIRED

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

4. TEST DESIGN SPECIFICATION

1. Approach refinement: This section shall refine the approach described in the test plan. It must include the specific testing techniques to be used and the method of analyzing the test results.
2. Automated or Manual Testing: This section shall state whether the testing will be done manually or automatically. If it is done automatically, the automatic testing software shall be identified and briefly described.
3. Test case/procedure identification. This section shall include a brief description of each test case associated with its particular design and procedure.

5. TEST CASE SPECIFICATION

This section shall include the following information:

1. Test case and feature specification identifier: Test case number, feature ID, and name.
2. Input specifications: This section shall specify each input required to execute the test case. Note: explain how each input will be identified either by name, value, file etc.
3. Output expectations: This section shall specify the outcome of the feature's input execution (time response, valid or invalid etc.)

6. TEST HARDWARE AND SOFTWARE

This section shall include the following information:

1. Hardware: This section shall specify hardware configurations, size, memory space etc.
2. Software: This shall specify the software required to execute each test case. It shall include operating system, compiler, test environment and test tools if applicable.

7. TEST LOG

This section shall include the following information:

1. Test Log identifier: Number assigned to a feature to identify it.
2. Execution description: This section shall specify the execution process used for the item tested.
3. Activity and event entry: This section shall provide a brief description of the events and activities that occurred during the test.
4. Procedure results: For each execution, a record of visually observable results (for example, error messages generated, abort, and requests for operator action), and a statement of whether the test was successful or unsuccessful.

8. TEST SUMMARY REPORT

This section shall include the following information:

1. Test summary report identifier.
2. Summary of results. This section shall contain a summary of all the testing. It shall include any incidents and their resolution.
3. Evaluation. This section shall provide an overall evaluation of each test feature item including its limitations.

DID-756 – FPGA Test Procedure

DID Issue: IR **Date: 2014-03-26**

PURPOSE:

To define the procedure to be followed for tests to be performed on a Field-Programmable Gate Array (FPGA).

PREPARATION INSTRUCTIONS:

This DID is applicable to all FPGAs.

The FPGA Test Procedure shall document all tests to be performed to verify that the FPGA meets the requirements specified in the FPGA Requirements Specification.

The Test Procedure shall contain, the following information, as a minimum:

1. Introduction
    1.1. Purpose
    1.2. Scope
    1.3. Overview
2. Applicable and Reference Documents
3. Test Requirements
4. Test Article
5. Summary of Test Results
6. Test Facilities (equipment, instrumentation, software)
7. Participants Required
8. Test Procedure
    8.1. Memory Decoding
    8.2. Rx Control MUX UART Test
    8.3. EEPROM and Boot Prom Tests
    8.4. Interrupt Test
    8.5. DAC and ADC Tests
    8.6. DSP Test
    8.7. Watch Dog Test
    8.8. IO test
    8.9. FPGA Performance Test
9. Test Data Analysis
10. Acceptance/Rejection Criteria Table
11. Appendix A: Acronyms

DID-759 – Test Report

DID Issue: IR **Date: 2013-12-20**

PURPOSE:

To document the results of all tests done on Space Segment and Ground equipment, at unit level and higher.

PREPARATION INSTRUCTIONS:

This DID is applicable to systems, hardware and software.

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

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

1. **APPLICABLE DOCUMENTS**

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

2. **TEST ARTICLE OR SYSTEM UNDER TEST**

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

3. **PURPOSE**

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

4. **SUMMARY OF TEST RESULTS**

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

5. **TEST FACILITIES**

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

6. **TEST SET-UP AND CONDITIONS**

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

7. **INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE**

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

8. **DETAILED TEST RESULTS**

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

9. TEST DATA ANALYSIS

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

10. NON-CONFORMANCES

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

11. CONCLUSIONS AND RECOMMENDATIONS

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

12. PROCEDURE SIGN-OFF SHEET

A statement that the test article has been tested in accordance with the approved procedure shall be signed and dated by the Test Conductor, the Quality Representative and the Customer Representative (where applicable).

DID-760 – Software Test Report

DID Issue: IR **Date: 2014-03-28**

PURPOSE:

To document the results of tests done on the software.

PREPARATION INSTRUCTIONS:

This DID is applicable to all software.

The test report shall document all tests performed to verify that the software will meet all the requirements specified in the applicable Software Specification.

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

1. Overview.
2. Software identification, including name and version number.
3. Dates and duration [start and end dates, duration (the number of calendar days that the test phase spanned) and test effort (the sum of all the work days of all the test team over the test duration)].
4. Resources
   - 4.1. People (test lead, test analyst, development lead, developer, etc.);
   - 4.2. Environment (test rigs, test PCs, test server, production server);
   - 4.3. References (references such as Requirements Specification, Functional Specification, Test Specification, etc.)
5. Testing
   - 5.1. Methodology:
     This should reflect the approach described in the Test Procedure. If it became necessary to use different techniques and methods as testing progressed, then document these changes in this section. Otherwise simply refer to the original document.
   - 5.2. Tools (names and version)
   - 5.3. Tests performed:
     Describe the tests that were performed: area, component, screen, load, performance, etc. This should be as documented in the Test Procedure. If different, then mention those differences in this section.
   - 5.4. Tests not performed:
     This section must identify items or areas that were not tested. The reason for not testing must be provided.
6. Issues
   - 6.1. Issues raised: number of bugs and change requests raised.
   - 6.2. Issues closed: number of bugs and change requests closed.
   - 6.3. Issues deferred to future releases: number of bugs and change requests deferred.
   - 6.4. Issues outstanding: number of bugs and change requests outstanding.

For each outstanding issue, provide the following information:

a) ID: the unique ID number of the issue

b) Severity (e.g. low, medium or high)

c) Type: bug or change request

d) Summary: one line summary of the issue

e) Workaround: state/identify any workaround that mitigates the issue; these workarounds should be included in release notes or equivalent documentation.

f) Plan: state what the plan is to finally resolve this issue for the final version of the flight software.

7. Recommendations.

DID-761– FPGA Test Report

DID Issue: IR **Date: 2014-03-26**

PURPOSE:

To document the results of tests done on Field-Programmable Gate Array (FPGA).

PREPARATION INSTRUCTIONS:

This DID is applicable to all FPGAs.

The FPGA Test Report shall document all tests performed to verify that the FPGA meets the requirements specified in the FPGA Requirements Specification.

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

1. Introduction
    1.1. Purpose
    1.2. Scope
    1.3. Overview
2. Applicable and Reference Documents
3. Test Article
4. Summary of Test Results
5. Test Facilities (equipment, instrumentation, software)
6. Test Description and Results
    6.1. Memory Decoding
    6.2. Rx Control MUX UART Test
    6.3. EEPROM and Boot Prom Tests
    6.4. Interrupt Test
    6.5. DAC and ADC Tests
    6.6. DSP Test
    6.7. Watch Dog Test
    6.8. IO test
    6.9. FPGA Performance Test
7. Test Data Analysis
8. Non-conformances
9. Conclusions and Recommendations
10. Appendix A: Acronyms

DID-800 – Operations Requirements Document

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

PURPOSE:

To define the operations requirements for the entire mission.

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 mission as a whole and shall not contain specific requirements on sub-items. All requirements shall be verifiable at the mission level.
3. Requirements documents shall cite applicable standards and parent requirements, and shall make clear the priority sequence of the applicable documents.
4. All operations requirements, including operational interface requirements, shall be defined and shall be verifiable, preferably by test.
5. The operations requirements shall respond to the mission requirements and the Concept of Operations (ConOps).
6. The operations requirements shall be complete and sufficiently accurate to proceed with the preliminary design.
7. Traceability from operations requirements to mission requirements shall be established and maintained throughout the system life cycle.
8. Operational requirements shall be derived from the following:
   a) Mission requirements (driver);
   b) ConOps (driver);
   c) Feedback from Requirements Analysis;
   d) Feedback from Validation activities; and
   e) Existing constraints and assumptions.
9. In the development process, new constraints and assumptions shall be identified, if any.
10. 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; and
    f) They shall specify the conditions under which they apply.

DID-825A – System Concept of Operations

DID Issue: IR - Tailored **Date: 2021-07-23**

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

The System Concept of Operations must contain the following information:

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

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.

DID-832 – Commissioning Plan

DID Issue: IR **Date: 2014-02-06**

PURPOSE:

To define the commissioning activities to be conducted for the system, leading to declaration of the system as ready for commencement of Routine Phase operations.

PREPARATION INSTRUCTIONS:

The Commissioning Plan shall contain the following information, as a minimum:

1) Operational organization structure, composition, roles, shift schedules, and management approach;
2) Rules for priority and decision-making during critical events and situations;
3) Communications and reporting protocols;
4) Description of key events and system configuration changes;
5) Sequence of operational activities and identification of corresponding procedures;
6) System status targets and criteria for completion of Commissioning;
7) Timed sequence of events;
8) Required resources and initial conditions;
9) Outline of the testing to be performed and the procedures to be used;
10) Anomaly detection, resolution and correction procedures; and
11) Contingency scenarios and possible recovery actions.

DID-835 – Routine Operations Plan

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

PURPOSE:

To define the activities to be conducted during routine operations.

PREPARATION INSTRUCTIONS:

The Routine Operations Plan shall contain the following information, as a minimum:

1) Operational organization structure, composition, roles, shift schedules, and management approach;
2) Rules for priority and decision-making during critical events and situations;
3) Communication and reporting protocols;
4) Description of key events and system configuration changes;
5) Sequence of operational activities and identification of corresponding procedures;
6) Overall schedule;
7) Required resources and initial conditions, particularly ground reception facilities and the Operations Center;
8) Anomaly detection, resolution and correction procedures; and
9) Contingency scenarios and possible recovery actions, including those addressing IT security Concerns;
10) System change management procedures, addressing IT security concerns;
11) System configuration management procedures, addressing IT security concerns; and
12) System elements retirement procedures, addressing IT security concerns.

DID-841 – Calibration Plan

DID Issue: IR **Date: 2014-02-07**

PURPOSE:

To describe the calibration plans for the system or instrument, and to identify the calibration resources required.

PREPARATION INSTRUCTIONS:

This plan shall be prepared so as to enable the fulfillment of the calibration requirements set out in the Requirements Documents.

This plan shall describe the processes and procedures to be used for calibration of the system (payloads, bus, ground systems) during the routine operational phase, the requirements for their execution, their place in the operational schedule, and all other information needed to plan for keeping the system functioning accurately.

The Calibration Plan shall contain the following information, as a minimum:

1) Calibration Requirements;
2) Calibration Methodology;
3) Calibration Procedures;
4) Calibration Tests;
5) Hardware and software requirements; and
6) Conclusion.

DID-842 – Training Plan

DID Issue: IR **Date: 2014-02-07**

PURPOSE:

To define plans for training the Mission Routine Operations Team.

PREPARATION INSTRUCTIONS:

This document shall provide a detailed description of the training of the mission operations staff. It shall describe the material, the in-class training and the hands-on training required to bring operational staff to an adequate level of readiness for the routine operation of the spacecraft.

The Training Plan shall contain the following information, as a minimum:

1) A listing of, or an applicable reference to, all personnel involved in operations, including but not limited to: mission directors/managers, order desk, product generation/calibration, archives, planners, flight dynamics analysts, controllers, spacecraft/payload engineers, simulation engineers, training personnel, security personnel, backup facility personnel and administrative staff, along with a summary of their roles and responsibilities.
2) An analysis of the required skills for each role, including interfaces with other parties, tools that need to be used and assumptions about prior knowledge and experience.
3) A listing of the applicable training activities for each role.
4) Training methods and content:
    a) Subsystem training: For each Ground Segment software/hardware tool, a listing of all associated training activities, including but not limited to: objectives, training module description, target audience, trainee prerequisites, training materials developed/purchased, vendor, projected duration and evaluation methods.
    b) Integrated system training: A listing of additional classroom and hands-on training activities/methods developed for an integrated training flow, including but not limited to: objectives, training module description, target personnel, skills, knowledge and attitudes developed through the activity, training materials developed/purchased, projected duration, trainee prerequisites/pre-course reading, tools required (e.g., simulator) and other dependencies, and evaluation methods.
    c) Training activities must include the following topic areas at a minimum:
        i) Ground Segment design, capabilities, constraints and maintenance;
        ii) Spacecraft and payload design, capabilities, constraints and troubleshooting;
        iii) System security provisions, including command/data security and IT security;
        iv) Usage of the Backup Control Facility, if applicable;
        v) Nominal, maintenance and contingency (off-nominal) operational flows, processes and procedures;
        vi) In the case of a constellation, differences between the various spacecraft and/or their operations.

5) A listing of additional one-time-only informal training opportunities available through system design, development, integration and test phases, including the skills and knowledge that developed through those activities, suggested personnel participation and prerequisites to enable personnel to participate fully in those training opportunities.

6) An overall schedule of all training activities.

7) For each role, a structured training program composed of a well-defined flow of classroom and hands-on training activities to achieve the required operational readiness level. The flow should include metrics for certification for particular tasks, as applicable.

DID-900 – Nominal Operations Procedures

DID Issue: IR **Date: 2014-02-11**

PURPOSE:

To document procedures to be followed for all Nominal Operations.

PREPARATION INSTRUCTIONS:

The procedures shall provide unambiguous, step-by-step instructions for the operations to be described. The initial conditions shall be defined, and the supporting equipment, software, scripts, personnel, etc. shall be identified.

All automated procedures shall be identified in a list.

Each procedure shall include an automated script, to be installed in the Operational Database (ODB) in electronic Spacecraft Testing and Operations Language (STOL) format (if applicable).

Each procedure shall include branches and conditions for handling of anomalous situations that arise during its execution; the scope of such possible anomalous results will be negotiated and agreed early in the development program, and adequate resources allocated to allow for expansion of the scope of possible anomalies up until completion of the suppliers responsibility under the contract.

The Nominal Operation Procedures shall contain the following information:

1) Operational procedures for the Space and Ground Segments;
2) Procedures for daily management of routine processes, from operation schedule preparation and approval through post-pass or post-operation analysis and logging;
3) Outline of process for routing and management of operational products, including identification of command chain, operational policies, and decision-making guidelines;
4) Outline of the process for preparation and approval of operational schedules, execution in the real-time system, execution monitoring, and post-pass or post-operation analysis and event logging.

DID-901 – Contingency Operations Procedures

DID Issue: IR **Date: 2014-02-11**

PURPOSE:

To document procedures to be followed for all Contingency Operations.

PREPARATION INSTRUCTIONS:

The procedures shall provide unambiguous, step-by-step instructions for the operations to be described. The initial conditions shall be defined, and the supporting equipment, software, scripts, personnel, etc. shall be identified.

All automated procedures shall be identified in a list.

Each procedure shall include an automated script, to be installed in the Operational Database (ODB) in electronic Spacecraft Testing and Operations Language (STOL) format.

Each procedure shall include branches and conditions for handling of anomalous situations that arise during its execution; the scope of such possible anomalous results will be negotiated and agreed early in the development program, and adequate resources allocated to allow for expansion of the scope of possible anomalies up until completion of the suppliers responsibility under the contract.

The Contingency Operation Procedures shall provide diagnosis and recovery procedures for an agreed set of anomalous conditions. This document shall contain the following information:

1) Contingency Operational procedures for the Space and Ground Segments;
2) Procedures for daily management of routine processes, from operation schedule preparation and approval through post-pass or post-operation analysis and logging;
3) Outline of process for routing and management of operational products, including identification of command chain, operational policies, and decision-making guidelines;
4) Outline of the process for preparation and approval of operational schedules, execution in the real-time system, execution monitoring, and post-pass or post-operation analysis and event logging.

DID-902 – Calibration Procedures

DID Issue: IR **Date: 2014-02-11**

PURPOSE:

To document the procedures to be followed for the calibration of the system or instrument.

PREPARATION INSTRUCTIONS:

This document shall describe the procedures to be used for calibration of the system (instruments, bus, ground systems) during the routine operational phase and as part of recovery from anomalies.

The Calibration Procedures shall contain the following information:

1. SCOPE

This section shall include a brief description of the calibration procedure and its objectives.

2. REQUIREMENTS

This section shall define the measurements and evaluations to be performed by the calibration procedure.

3. ARTICLE TO BE CALIBRATED

This section shall define in detail the configuration of the article to be calibrated.

4. CALIBRATION FACILITIES

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

5. PARTICIPANTS REQUIRED

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

6. TEST SET-UP AND CONDITIONS

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

7. INSTRUMENTATION, CALIBRATION EQUIPMENT AND SOFTWARE

This section shall provide a listing of the instrumentation, calibration equipment and software that is to be used during the test.

8. PROCEDURE

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

9. DATA ANALYSIS

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

10. ACCEPTANCE/REJECTION CRITERIA TABLE

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

DID-977 – Commissioning Report

DID Issue: IR **Date: 2014-02-13**

PURPOSE:

To document the results of the commissioning activities conducted for the system, leading to declaration of the system as ready for commencement of Routine Phase operations.

PREPARATION INSTRUCTIONS:

This document shall describe the entire on-orbit commissioning process carried out for the system.

The Commissioning Report shall contain the following information:

1) System setup;
2) Objectives;
3) Summary of the results;
4) Commissioning team;
5) Hardware configuration;
6) Software configuration;
7) System parameters and initial conditions;
8) Timed sequence of events or actions performed;
9) Description of key events and system configuration changes;
10) Anomalies detected, and their resolution, correction and recovery actions;
11) Commissioning output;
12) Commissioning results and analysis; and
13) Conclusions.

D ACRONYMS AND ABBREVIATIONS

AD	Applicable Document
AIL	Action Item Log
AR	Acceptance Review
BIP	Background Intellectual Property
CAD	Computer Assisted Design
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CF	Contractor's Format
CLPS	Commercial Lunar Payload Services
COTS	Commercial Orbital Transportation Services
CRB	Configuration Control Review Board
CSA	Canadian Space Agency
CTE	Critical Technology Element
CTR	Compatibility Test Review
CWBS	Contractor Work Breakdown Structure
DCL	Declared Components List
DID	Data Item Description
DFL	David Florida Laboratory
DML	Declared Materials List
DMPL	Declared Mechanical Parts List
DPL	Declared Parts List
DR	
ECM	Engineering Coordination Memo
EEE	Electrical, Electronic, and Electro-mechanical
EIDP	End Item Data Package
EM	Engineering Model
ESA	European Space Agency
ExDOC	Exploration Development Operations Center (Centre?)
FEM	Finite Element Model

FIP	Foreground Intellectual Property
FMECA	Failure Mode, Effects, and Criticality Analysis
FPGA	Field Programmable Gate Array
FRR	Flight Readiness Review
FSE	Flight Support Equipment
FTP	File Transfer Protocol
GER	Global Exploration Roadmap
GFE	Government Furnished Equipment
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
IP	Intellectual Property
IPs	International Partners
IR	Infra-red
IR	Interim Review
ITQ	Invitation To Qualify
JPIP	Joint Project Implementation Plan
KIP	Key Inspection Point
KOM	Kick-Off Meeting
LEAP	Lunar Accelerated Exploration Program
LEO	Low Earth Orbit
LEOP	Launch and Early Operation Phase
LOS	LSI Operations Simulator
LRM	Lunar Rover Mission
LSI	LEAP Science Instrument(s)
LSM	Lunar Surface Mobility
LRR	Lauch Readiness Review
MCC	Mission Concept Checkpoint
MCD	Mission Concept Document
MCR	Mission Concept Review
MM	Mission Manager
MOR	Mission Operations Review

MRD	Mission Requirements Document
MRR	Mission Requirements Review/Manufacturing Readiness Review
MS	Microsoft
NASA	National Aeronautics and Space Administration
NDA	Non-Disclosure Agreement
NCRB	Non-Conformance Review Board
NSPAR	Non-Standard Part Approval Request
ODD	Operations Description Document
ORD	Operations Requirements Document
ORR	Operations Readiness Review
PA	Project Authority
PAIP	Product Assurance Implementation Plan
PAR	Product Assurance Requirements
PDR	Preliminary Design Review
PFM	Proto-Flight Model
PDF	Portable Document Format
PM	Project Manager
PMP	Project Management Plan
PMBoK	Project Management Book of Knowledge
PRISM	Payloads and Research Investigations on the Surface of the Moon
PSPC	Public Services and Procurement Canada
QA	Quality Assurance
QSR	Qualification Status Review
RD	Reference Document
RDW	Request for Deviation or Waiver
RFD	Request for Deviation
RID	Review Item Disposition
SA	Scientific Authority
SDD	System Design Document
SEMP	System Engineering Management Plan
SI	Système International (d'unités)
SLA	Stereolithographic
SMD	Science Mission Directorate

SOW	Statement of Work
SRR	Systems Requirement Review
STEP	Standard for The Exchange of Product model data
TA	Technical Authority
TBD	To be determined
TBR	To Be Reviewed
TDR	Test Data Review
TIM	Technical Interchange Meeting
TN	Technical Note
TPM	Technical Performance Measure
TRRA	Technology Readiness and Risk Assessment
TRL	Technology Readiness Level
TVAC	Thermal Vacuum
VDD	Version Description Document

LEAP SCIENCE INSTRUMENT (LSI)

INVITATION TO QUALIFY (ITQ)

MISSION COST EVALUATION FRAMEWORK

Attachment 1 to Part 4 - Financial Response Preparation Instructions

1.0 MISSION COST REQUIREMENTS

1.1 Purpose of this Document

1.1.1 This Attachment 1 to Part 4 - Financial Response Preparation Instructions (herein referred to as Attachment 1 to Part 4) provides a high-level overview of how Canada will assess on a Met or Not Met basis the Respondent's Mission Cost estimate for Phases A through F of the LEAP Science Instrument (LSI) project. In this context, the term Mission Cost estimate includes all costs to the mission excluding payloads launch cost. This includes, but is not limited to, concept definition, requirements analysis, design, build, test, and delivery of the LSI to the NASA payload provider for integration within the NASA PRISM payload as well as the support to operations and decommissioning in accordance with the maximum funding (16,9 M$) available for the LSI project. All Cost Elements should be identified following the Cost Breakdown Structures (CBS) detailed in Attachment A - Cost Breakdown Structure Template. As such, the Mission Cost estimate includes all estimated costs for these Cost Elements, including the Respondent's mark-ups and profits, and will take into consideration risks and uncertainty associated with these costs.

1.1.2 The maximum funding for this LSI project has been set in accordance with the foreign participation limit of 1/3 of NASA's cost cap as specified in the upcoming NASA's ROSES-2021 F.10 PRISM call for proposals released in September 2021. Given this maximum funding at this juncture, Respondents are required to provide sufficient information to demonstrate the robustness of their estimates.

1.1.3 This Attachment 1 to Part 4 includes the definitions, overarching concepts, cost requirements and methodology of the Mission Cost evaluation. Additional details pertaining to the requirements and evaluation of the Mission Cost evaluation are available in Section 3 of this Attachment 1 to Part 4.

1.2 Definitions

The following definitions apply to Attachment 1 to Part 4 and the associated appendices and attachments.

1.2.1 Mission Cost: The total comprehensive cost in Canadian dollars, Applicable Taxes excluded, Free on Board (FOB) destination, Canadian customs duties and excise taxes included, to execute the proposed LSI mission excluding the launch cost. All the relevant costs are included in the Cost Breakdown Structure Template (Attachment A).

1.2.2 Cost Breakdown Structure (CBS): Cost Elements arranged in a hierarchy and detailed in Attachment A.

1.2.3 Cost Element: Item for which a cost is determined within the CBS.

1.2.4 Basis of Estimate (BoE): Documentation to support cost estimates and mitigate risk. View 1.4.1 for more information.

1.2.5 Indicative Estimate: Estimate which provides a rough cost projection used for budget planning purposes in the early stages of concept development of a project. It is usually based: on an operational Statement of Work (SOW), a market assessment of products and technological availability that would meet the requirement and other considerations such as implementation, life cycle costs and operational savings.

1.2.6 Ground Rules & Assumptions (GR&A): Core assumptions or drivers determined to ensure a common understanding.

1.3 Overarching concepts

1.3.1 The Mission Cost evaluation has the main goal of enabling the assessment of the completeness, reasonability and consistency of the estimated costs associated with each Respondent's Response in the Canadian context, in order to select "Qualified Respondents" that will receive a Letter of support from the CSA for the NASA PRISM call. Respondents should consider the following overarching concepts of the Mission Cost evaluation when completing their Mission Cost estimate:

1) The cost evaluation process has been designed to accommodate differences in Respondent contexts due to the fact that Responses from different Respondents may (1) include different combinations of resulting instruments, (2) use different cost estimation techniques, and (3) incorporate different risk considerations. However, all Responses will be evaluated in accordance with the same criteria.

2) The Mission Cost estimates, and cost-related information received from each Respondent will be evaluated by Canada as part of the Mission Cost evaluation process. Therefore, Mission Cost estimates should be adequality substantiated following guidance found in Attachment A. In addition, Mission Cost estimates should accurately reflect what has been proposed in other parts of the Respondent's Response. Estimates without adequate substantiation or lacking alignment with other components of the Respondent's Response will be declared non-responsive during the Met or Not Met evaluation process for the Mission Cost.

1.4 Costing Requirements

1.4.1 Cost Estimate Breakdown

The scope of work includes Phases A through F for a typical space mission relevant to PRISM. The Respondent must submit the total firm, all-inclusive Mission Cost estimate, customs duties included and applicable taxes extra, for the work to be performed for all phases of the project as specified in the SOW.

The Respondent must provide their cost estimate for all phases within Attachment A-2. A Basis of Estimate (BoE) for the science instrument for Phases A, B and C is required whist only an Indicative Estimate is required for Phases D, E and F. Both the BoE and the Indicative Estimate need to be documented within Attachment A-2. The BoE must be built using Parametric estimating, Delphi, Analogous costs or Bottoms-up methods.

The cost estimates must be provided using the Excel spreadsheet (Attachment A-1) and can be obtained from CSA's FTP site as per the SOW and segregated by Phase and by CBS item at Level 1 for Labour and Non-Labour costs. Level 2 Cost Breakdown Elements have also been provided to clarify the costs that compose Level 1. Respondents are invited to breakdown their cost at a Level 2; however this is not mandatory for a successful submission by the Respondent.

This estimate will not be contractually binding for the Respondent to compete for subsequent phases of the project, if any. However, significant changes in estimates between phases will of course, disadvantage the project and Canada's participation in the LEAP program.

1.4.2 Maximum Funding

As outlined in this Invitation to Qualify (ITQ), as part of the PRISM call, NASA limits international contribution to 1/3 of the mission cost for both the South Polar mission and the Gruithuisen Domes delivery location.

As such, if a U.S. team proposal, with a Canadian Qualified Respondent, is selected as part of the PRISM call selection process for only one delivery location, the CSA plans to support one Canadian science instrument up to the full allowed 1/3 international contribution of the total investigation cost for either of the above-mentioned locations. This cost requirement includes a 20% cost reserve, as per the PRISM call, that will be held by the CSA and included in the overall budget.

Responses with values in excess of this maximum funding will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

1.4.3 Descoping Option

For the Descoping Option, the Respondent must present at least one option in the Attachment A-3 including all impacts to the cost. The Respondent is invited to present more than one option however, this is not mandatory for a successful submission by the Respondent.

Should two U.S. team proposals, with a Canadian Qualified Respondent, be selected as part of the PRISM call selection process for each delivery location, the CSA plans to support both Canadian science instruments up to the full allowed 1/3 international contribution, subject to the total funding required being available prior to contract award as specified in Table 1 below.

At this time, in the case that two Canadian responses are successful during the PRISM call, the anticipated maximum funding available for both missions is $16.9M Canadian Dollars (CAD), applicable taxes extra. The South Polar mission will have a maximum anticipated funding of $5.6M CAD, applicable taxes extra. The Gruithuisen Domes mission will have a maximum anticipated funding of $11.3M CAD, applicable taxes extra.

As a result of the anticipated maximum funding available for both missions, the total investigation costs will also be required to include an option to descope the work for the South Polar delivery location of up to $2.8M CAD, applicable taxes extra, and for the Gruithuisen Domes delivery location of up to $5.5M CAD, Applicable Taxes extra, as specified in Table 1 below. The total descoped cost for the proposed instrument must meet the minimum requirements for achieving the stated mission objectives and requirements.

Table 1 – Mission Cost Breakdown

Delivery Location	**NASA's Cost Cap (USD), Inclusive of 20% Cost Reserve**	**NASA's Foreign Participation Cost Cap (Baseline Canadian Payload Cost) (CAD)** **Applicable Taxes Extra, Inclusive of 20% Cost Reserve**	**Required Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve**
South Polar	$20M	$8.4M[1]	Up to $2.8M
Gruithuisen Domes	$40M	$16.8M[1]	Up to $5.5M
Total	$60M	$25.2M[1]	Up to $8.3M

(1) The baseline Canadian payload costs (CAD) represent 1/3 of NASA's cost cap (USD), inclusive of 20% cost reserve converted into CAD dollars; applicable taxes extra.

Appendix C provides hypothetical examples of selected Canadian proposals with the outcome for each based on the maximum funding available of $16.9M for this requirement. These examples are not considered an exhaustive list of scenarios of selected Canadian proposals that could meet the funding requirement. The CAD values shown in the third column of Table 1 are based on an exchange rate of 0.80 CAN$/US$ and will remain unchanged regardless of any changes to the CAN$/US$ exchange rate in the future.

1.4.4 Ground Rules & Assumptions

The Respondent will need to follow the following Ground Rules & Assumptions to ensure standardization across all the Respondent's Response and their cost evaluation.

1.4.4.1 Inflation and Exchange Rates

All estimated costs entered in the Cost Breakdown Structure Template (Attachment A):

a) Include inflation regarding the different Phases.

b) Take into consideration that the CAD values shown in the third column of Table 1 of Section 1.2 of the ITQ are based on an exchange rate of 0.80 CAN$/US$ and will remain unchanged regardless of any changes to the CAN$/US$ exchange rate in the future.

1.4.4.2 Tax Exclusion and Profits

All estimated costs entered in the Cost Breakdown Structure Template (Attachment A):

a) Are in Canadian dollars, Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included.

b) Should include mark-ups and profits.

1.4.4.3 Material Assumptions

a) All and any other material assumptions must be documented in the Respondent's ITQ submission.

1.4.4.4 *SACC* Manual Clauses

a) *SACC* Manual clause A0220T (2014-06-26), Evaluation of Price - Bid

b) *SACC* Manual clause C3011T (2013-11-06), Exchange Rate Fluctuation

1.4.5 Other Contracts

The Respondent must certify that there is no redundant costs for work already covered under another contract with Canada by including a signed copy of Attachment 2 to Part 4 - Anticipated Requirements for Bid Solicitation as specified in 4.3 Section II: Financial Response, (b), (ii) of this ITQ. If the proposed scientific instruments are currently being developed or were developed under a separate contract with Canada, the difference between the work carried out in such contract and the proposed incremental work should be clearly explained.

2.0 MISSION COST EVALUATION

2.1 Mission Cost Evaluation Process Overview

The Respondent must demonstrate in their Response the adequacy and robustness of the cost estimate. The Costing Requirements in Section 1 of this Attachment 1 to Part 4 will constitute the basis for the Mission Cost Evaluation Process. A Met or Not Met basis will be used to enable standardization across all Respondents and to ensure consistency throughout the evaluation process.

The Mission Cost Evaluation Criteria are detailed in Attachment 1 to Part 5 – Mandatory Evaluation Criteria of the ITQ and include the costing requirement reference in Section 1 as well as the proof required for each evaluation criterion. These evaluation criteria will yield an overall Met or Not Met for the Mission Cost Estimate and will render a Met or Not Met decision based on each criteria of the Mission Cost M11 to M14 in Attachment 1 to Part 5 - Mandatory Evaluation Criteria of the ITQ.

3.0 SUPPORTING DOCUMENTATION

Additional information about the cost evaluation process is provided to Respondents in the following documents:

a. Appendix A: Cost Breakdown Structure.

(i) Attachment A: Cost Breakdown Structure Template; This document is to provide the structural cost requirements of the LEAP Science Instrument Mission Cost estimates supporting the Respondents Response and it contains the following attachments:

a) Attachment A-0: Instruction; A list of instructions, guidance and suggestions on how to leverage the template document and structure the cost information related to the Mission Cost.

b) Attachment A-1: LSI CBS Table; A template the Respondents can use to summarize their cost breakdown associated with their Mission Cost Estimate. A list of the Level 1 Cost Elements and Level 2 Cost Elements associated with the LEAP Science Instrument for which Respondents are requested to submit costing information as part of their Mission Cost Estimate.

c) Attachment A-2: LSI Mission Cost Estimate; A template for the submission of the cost for all phases (A, B, C, D, E and F) as well as for the BoE information and justifications for the estimates for Phase A, B and C.

d) Attachment A-3: LSI Descope Options; A template capturing all financial impacts of a descoped mission including justifications.

b. Appendix B: Hypothetical Examples of Selected Canadian Proposals

APPENDIX A - COST BREAKDOWN STRUCTURE
See Excel Document: Attachment A – Cost Breakdown Structure Template

APPENDIX B – HYPOTHETICAL EXAMPLES OF SELECTED CANADIAN PROPOSALS

a. Scenario 1

Hypothetical examples of selected Canadian proposals

Scenario	Proposed Baseline Canadian Payload Cost, (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Proposed Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Total Descope Cost (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve
1) A U.S. team proposal with a Canadian Qualified Respondent is selected as part of the PRISM call selection process for only the Gruithuisen Domes delivery location	$14.8M	$4.8M	$10M

In the above scenario 1), CSA would support the proposed investigation cost of $14.8M without the proposed descope option since it is up to the full allowed 1/3 international contribution of the total investigation and below the maximum budget of $16.9M.

b. Scenario 2

Scenario	Proposed Baseline Canadian Payload Cost, (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Proposed Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Total Descope Cost (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve
2)A U.S. team proposal with Canadian Qualified Respondents is selected as part of the PRISM call selection process for each delivery location	$7M for the South Pole delivery location and $14.8M for the Gruithuisen Domes delivery location	$1.4M for the South Pole location and $4.8M for the Gruithuisen Domes delivery location	$5.6M for South Pole delivery location and $10M for the Gruithuisen delivery location

In the above scenario 2), CSA would support the proposed descoped investigation cost of $5.6M for the South Pole delivery location and the proposed descoped investigation cost of $10M for the Gruithuisen Domes delivery location since the maximum funding available for both missions of $16.9M is not exceeded and the investigation costs for each delivery location are below the maximum descope costs for each delivery location i.e. up to $5.6M for the South Pole delivery location and up to $11.3M for the Gruithuisen Domes delivery location.

c. Scenario 3

Scenario	Proposed Baseline Canadian Payload Cost, (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Proposed Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Total Descope Cost (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve
3) A U.S. team proposal with Canadian Qualified Respondents be selected as part of the PRISM call selection process for each delivery location	$7M for the South Pole delivery location and $14.8M for the Gruithuisen Domes delivery location	$1.4M for the South Pole location and $2.8M for the Gruithuisen Domes delivery location	$5.6M for South Pole delivery location and $12M for the Gruithuisen delivery location

In the above scenario 3), CSA would support the proposed investigation cost of $5.6M for the South Pole delivery location only as the proposed investigation cost of $12M for the Gruithuisen Domes delivery location exceeds the maximum descope cost of $11.3M for this delivery location.

d. Scenario 4

Scenario	Proposed Baseline Canadian Payload Cost, (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Proposed Descope option(s) (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve	Total Descope Cost (CAD), Applicable Taxes Extra, Inclusive of 20% Cost Reserve
4) A U.S. team proposal with Canadian Qualified Respondents be selected as part of the PRISM call selection process for each delivery location	$7M for the South Pole delivery location and $14.8M for the Gruithuisen Domes delivery location	$1.4M for the South Pole location. Option 1 of $2.8M and option 2 of $4.8M for the Gruithuisen Domes delivery location	$5.6M for South Pole delivery location. $12M for option 1 and $10M for option 2 for the Gruithuisen delivery location

In the above scenario 4), CSA would support the proposed investigation cost of $5.6M for the South Pole delivery location and $10M for the Gruithuisen Domes delivery location based on the proposed option 2 as it does not exceed the maximum descope cost of $11.3M for this delivery location. Option 1 would not be considered since it would exceed the maximum descope cost of $11.3M for this delivery location.