

ATTACHMENT 1 to PART 3

ELECTRONIC PAYMENT INSTRUMENTS

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

- VISA Acquisition Card;
- MasterCard Acquisition Card;
- Direct Deposit (Domestic and International);
- Electronic Data Interchange (EDI);
- Wire Transfer (International Only)

ATTACHMENT 1 TO PART 4

Point Rated Evaluation Criteria

1 Technical / Management Point Rated Criteria

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

- 1) Technical; and
- 2) Management.

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

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

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

75% of 20 points = 15 points (score)

Table 1 identifies:

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

Table 1: List of Evaluation Criteria and Associated Ratings

Evaluation Criteria and Ratings	
	Ratings
Technical Criteria	
1. Understanding the Requirements and Technical Principles	20
2. Feasibility of Achieving the Goals and Technical Objectives	20
3. Scope of the Study	25
<i>Maximum Score</i>	65
Management Criteria	
4. Team Capability	15
5. Project Management Plan	20
<i>Maximum Score</i>	35
<i>Maximum Overall Score</i>	100
<i>Minimum Overall Score Requirement</i>	70

2 CROSS-REFERENCES TO EVALUATION CRITERIA IN THE BID (OPTIONAL)

The Bidder may complete the following table by indicating where in its Bid the information is found demonstrating how the proposal meets the evaluation criteria, in order to assist in the assessment of the Bid.

Table 2: Cross-References to Evaluation Criteria in the Bid

Company:	
Project Title:	
Evaluation Criteria	Location where the information is found in the Bidder's bid
1	
2	
3	
4	
5	

3 EVALUATION CRITERIA AND BENCHMARK STATEMENTS

TECHNICAL CRITERIA

1. UNDERSTANDING THE REQUIREMENTS AND TECHNICAL PRINCIPLES

This criterion assesses the degree to which the Bid identifies and substantiates in detail the underlying requirement and the scientific and technical principles of the potential mission contributions and also to what extent it thoroughly demonstrates an understanding of these requirements and principles and how they relate to the mission objectives as stated in the Statement of Work.

O)

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

A)

- The proposal includes an overview of the main requirements of some of the potential mission contributions which are only partially in line with the objectives outlined in the Statement of Work OR
- The proposal demonstrates lack of knowledge of the scientific and technical principles of some of the potential mission contributions and how they relate to the overall goal of the mission; OR
- The bid does not identify how the mission objectives will be in achieved with the potential mission contributions; OR
- The proposal does not include an adequate review of the existing literature or previous relevant studies.

B)

- The proposal includes only an overview of the main requirements of some of the potential mission contributions; AND
- The proposal demonstrates a general understanding of the scientific and technical principles of some the potential mission contributions and how they relate to the goal of the mission; AND
- The proposal includes a presentation of some of the potential mission contributions and their operations requirements that will be addressed by the proposed activities; AND
- The proposal includes a cursory review of and references to existing literature or previous studies relevant to the proposed mission contributions.

C)

- The proposal identifies and demonstrates understanding of the main requirements of all the potential mission contributions; AND
- The proposal demonstrates knowledge of the scientific and technical principles of the potential mission contributions and how they relate to the goal of the mission; AND
- The proposal includes a presentation of the potential mission contributions and their operations requirements that will be addressed by the proposed activities; AND
- The proposal includes references to and a discussion of other work or previous activities relevant to the the potential mission contributions.

D)

- The proposal includes an exhaustive identification of the requirements of the potential mission contributions; AND
- The proposal demonstrates a comprehensive knowledge of the scientific and technical principles of the potential mission contributions and how they relate to the goal of the mission; AND

- The bid includes a presentation of the potential mission contributions and operations requirements that will be addressed by the proposed activities, and their relationship to the mission objectives; AND
- The proposal includes references to and a thorough discussion of the existing literature relevant to the the potential mission contributions is provided.

2. FEASIBILITY OF ACHIEVING GOALS AND TECHNICAL OBJECTIVES

The criterion assesses the description and overall feasibility of the proposed approach and the degree to which it is capable of delivering the goals and technical objectives of the study. This includes the effectiveness of the strategy selected to address the technical requirements. This criterion evaluates the technical risks associated with the thoroughness and completeness of the study. It assesses if the proposed effort is well documented and substantiated.

0)

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

A)

- The proposal does not present an adequate case that the study can deliver the technical objectives; OR
- Main elements of a preliminary technology development road map, in order to meet the scientific and technical objectives of the study, are lacking.

B)

- The proposal presents an adequate case that the study can deliver the technical objectives; AND
- Main elements of a preliminary technology development road map, in order to meet the scientific and technical objectives of the study, are briefly outlined.

C)

- The proposal presents a well-referenced case that the study can deliver the technical objectives; AND
- The proposal presents creative, feasible and valid technologies and methods that can obtain the desired technical results with sufficient details; AND
- Main elements of a preliminary technology development road map are presented in order to meet the scientific and technical objectives of the study.

D)

- The proposal presents a well-referenced and convincing case that the study can undoubtedly achieve the technical objectives. AND
- The proposal identifies well proven technology with one or more components having flight heritage and is substantiated with ample details; AND
- A preliminary technology development roadmap is presented in order to meet the scientific and technical objectives of the study.

3. SCOPE OF THE STUDY

The criterion assesses the description and overall scope of the proposed study.

0)

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

- A)
- The bid addresses the scope of what is requested in the SOW, but gaps exist in more than one area, OR
 - It provides a description of the approach for the study strategy, that is not consistent with the scope.
- B)
- The bid addresses the scope of what is requested in the SOW, but gaps exist in one area, AND
 - It provides a description of the approach for the study strategy.
- C)
- The bid addresses the full scope of what is requested in the SOW, AND
 - It provides a description and substantiation of a relevant approach for the study strategy.
- D)
- The bid addresses the full scope of what is requested in the SOW. AND
 - It provides a detailed description and substantiation of a relevant approach for the study strategy, AND
 - The bid provides overview of the mission contribution option(s) and a description of the operation concepts.

MANAGEMENT CRITERIA

4. TEAM CAPABILITY

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

- 0)
- The proposal does not address this criterion.
- A)
- The proposed team lacks expertise and may not be capable of fulfilling the statement of work (SOW); OR
 - The roles and responsibilities of the proposed team members are not defined.
- B)
- Some of the key personnel identified in the proposed team have been involved in at least one project similar in complexity and scope to what is requested in the SOW; AND
 - The proposed team is lacking some expertise but demonstrates that it is capable of fulfilling the statement of work (SOW); AND
 - The team may have deficiencies in the completeness of the skills of its members; AND
 - Some team members have experience in the design and development of space flight hardware in a similar environment as described in the relevant SOW or space software.
- C)
- Each key personnel identified in the proposed team has been involved in at least two projects similar in complexity and scope to what is requested in the SOW; AND
 - The expertise of the proposed team demonstrates that it is highly capable of fulfilling the statement of work (SOW) based on acquired experience in similar technology; AND
 - The completeness of the team is very well demonstrated through the complementarities of skills of its members and by the roles / tasks that they are assigned during the study; AND

- The roles and responsibilities for most of the team members, including sub-contractors (if any), are defined; AND
- Most of the required key personnel are identified and there are qualified back-up personnel identified for most of them; AND
- The key personnel have experience in the design and development of space flight software or space flight hardware in a similar environment as described in the relevant SOW.

D)

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

5. PROJECT MANAGEMENT PLAN

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

0)

- The proposal does not address this criterion.

A)

- The proposal presents a poor work-plan; OR
- The proposed methodology is not effective in achieving the objectives of the work; OR
- There is no correlation between the work-plan and the management method; OR
- Risks are not identified.

B)

- The proposal presents a basic work-plan; AND
- The proposed methodology is able to partially achieve the objectives of the work; AND
- There is poor correlation between the work-plan and the management method; AND
- Risks are identified and mitigation strategies are insufficient.

C)

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

D)

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

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001
File No. - N° du dossier
MTB-7-40038

Buyer ID - Id de l'acheteur
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ANNEX "A"

STATEMENT OF WORK

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

ANNEX B

BASIS OF PAYMENT

SCHEDULE OF MILESTONES

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

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

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



CSA-LiteBIRD-SOW-0001

Canadian Space Agency

Annex "A"

Mission Contribution Study for the LiteBIRD CMB Polarization Mission

Statement of Work (SOW)

Initial Release

30 June, 2017

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1 INTRODUCTION

1.1 PROGRAM BACKGROUND

The exploration of space is a highly visible endeavour, a powerful driver for scientific and technical innovation, a magnet for world-class talent, and an inspiration for young Canadians to pursue careers in science and technology. It enables scientific questions to be addressed in a unique environment such as investigations to better understand our universe through space astronomy. The Canadian Space Agency's (CSA) Space Exploration (SE) Strategic Planning helps to shape and determine the nature of Canada's contribution to potential future planetary and space astronomy missions.

Space Exploration Strategic Planning supports pre-Phase 0 activities that include:

- (i) Consultations and prioritizations (mission and technology roadmapping);
- (ii) Studies for science definitions and maturation; and
- (iii) Studies for mission concepts or contributions to international missions.

Through (iii), Space Exploration Strategic Planning supports activities to identify the science and technology developments as most likely opportunities in future space exploration missions of interest to Canada, and contribution studies are part of the requirement development activity to increase the level of readiness.

Responding to Canadian space exploration stakeholder priorities, CSA invests in the first stages of mission identification, including anticipated scientific, technological and operational needs and evaluate opportunities in potential missions.

SE Preparatory Activities target missions that are mature contenders at conceptual phases of strong interest to the Canadian space sector and scientific community. Results prepare Canada to offer well-informed and confident options.

1.2 PRIORITIZATION

Studies are selected and defined based on analyses of international and national space exploration priorities, through consultations committees, foreign space agency plans and strategies, agency-to-agency dialogue, and national workshops (e.g. Canadian Space Exploration Workshop (CSEW) (RD-03, RD-04)).

The current requirement will expand on the CSA Space Exploration priorities in **Space Astronomy**. Space-based observatories enable scientific measurements and imaging not possible from the ground, serving to increase our understanding of the origins and the nature and physics of the universe, its composition, matter and energy, age, structure and evolution.

For space astronomy, stakeholder priorities are reflected in the astronomical community (Canadian Astronomical Society (CASCA)) decadal plans (Long Range Plan (LRP) 2010, LRP Mid-term review 2016) (RD-09, RD-10 respectively).

This Statement of Work (SOW) requires a Mission Contribution Study proposal in the area defined in the following sections in support of the preparatory activities of CSA's Space Exploration Strategic Planning.

2 DOCUMENTS

2.1 REFERENCE DOCUMENTS

The documents identified in Table 2-1 provide additional information or guidelines that may clarify the contents or are pertinent to the history of this document.

TABLE 2-1: REFERENCE DOCUMENTS (RD)

RD No.	Document No. / Source	Document Title	Rev.	Date
RD-01	http://www.asc-csa.gc.ca/pdf/eng/publications/space-policy/canadas-space-policy-framework.pdf	Government of Canada Space Policy Framework		February 2014
RD-02	https://www.ic.gc.ca/eic/site/062.nsf/eng/home	Canada's Innovation Agenda		2017
RD-03	ftp://ftp.asc-csa.gc.ca/users/Exp/pub/Publications/CSEW6/	Canadian Scientific Priorities for the Global Exploration Roadmap, CSEW6 report	Initial	30 May 2009
RD-04	ftp://ftp.asc-csa.gc.ca/users/Exp/pub/Publications/CSEW2016/	CSEW 2016 abstracts, presentations		November 2016
RD-05	http://litebird.jp/eng/	LiteBIRD science website		
RD-06	CSA-SPEX-GDL-0001 ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Science-Definition-Studies/2017/	CSA Science Readiness Level Guidelines	Draft 2.0	June 2017
RD-07	CSA-ST-GDL-0001 ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRRA/	CSA Technology Readiness Levels and Assessment Guidelines	C	March 2017
RD-08	CSA-ST-RPT-003 ftp://ftp.asc-csa.gc.ca/users/TRP/pub/TRM/	Technology Roadmap Worksheet	A	Sept 2012
RD-09	http://www.casca.ca/lrp2010/index.php	CASCA Long Range Plan 2010 "Unveiling the Cosmos"	Final	2010
RD-10	http://casca.ca/?page_id=2944	CASCA LRP MTR 2016 "Unveiling the Cosmos: Canadian Astronomy 2016-2020" - Report of the Mid-Term Review 2015 Panel		2016

RD No.	Document No. / Source	Document Title	Rev.	Date
RD-11	Cosmic Microwave Background Space Science Discipline Working Group ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Concept-Studies/2017/LiteBIRD_Contribution_Study/	Cosmic Microwave Background Space Science Discipline Working Group, Final Report	Final	March 2009
RD-12	Bender et al, Proc. SPIE 9153, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII, 23 July 2014. http://spie.org/Publications/Proceedings/Paper/10.1117/12.2054949	Digital frequency domain multiplexing readout electronics for the next generation of millimeter telescopes		July 2014
RD-13	CSA STDP-4 Contract #9F063-100359/007/MTB ftp://ftp.asc-csa.gc.ca/users/TRP/pub/Exploration-Core-Concept-Studies/2017/LiteBIRD_Contribution_Study/	Executive Report - Frequency Multiplexed Readout for Transition Edge Sensor Bolometers	1	February 2014

3 OBJECTIVE OF THE MISSION CONTRIBUTION STUDY

Contribution Studies are part of the requirement development activities. Requirement development is part of the Space Exploration Strategic Planning of the CSA. Requirement development supports CSA's exploration planning activities and defines the science and technology developments most likely to be required in future space exploration missions of interest to Canada, and assesses potential contributions that Canada could make to such missions.

3.1 SCOPE

This document defines the requirements and deliverables of the contribution study for the targeted mission identified below to inform the decision process when selecting Canadian-led missions or contributions to international space exploration missions by providing in general:

- 1) Preliminary Science and Technology Assessment
- 2) Conceptual Assessment
- 3) Programmatic Assessment

3.2 TARGET MISSION

This SOW is for one Mission Contribution Study in Space Astronomy targeting a Cosmic Microwave Background (CMB) Polarization Mission, namely the proposed Japan Aerospace Exploration Agency (JAXA) LiteBIRD (Lite 'light' satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection) mission (RD-05).

Modern astronomy offers answers to fundamental questions about our universe and our place in it. Astronomy is the study of the physics of the universe and encompasses a wide range of subjects from the birth of the universe, its composition and evolution to the formation of planets, stars and galaxies.

One of the fundamental questions is: Where did it all come from? The universe expanded rapidly from an extraordinarily hot and dense state 13.7 billion years ago. This fundamental model of cosmology is called the Big Bang. It predicts accurately many observed phenomena: the expansion of the universe, the abundance of light elements like hydrogen and helium and the CMB. The CMB has been precisely mapped by space missions like Cosmic Background Explorer (COBE), Wilkinson Microwave Anisotropy Probe (WMAP) and Planck. In essence cosmology seeks to understand the nature of space, time, and matter, and the origins of the fundamental forces.

Yet many fundamental questions remain to be answered in cosmology. The Big Bang model predicts a super rapid expansion called inflation of the universe in its very early stage. It is predicted that evidence of the inflation could be observed from a weak polarization in the CMB signal. This polarization would have been imparted by primordial gravitational waves and their strength can confirm and exclude different models of inflation. Some early attempts have been made to measure the polarization with balloon-borne projects and radio telescope in Antarctica, but not convincingly. Several CMB polarization space missions are proposed by international groups, and the (JAXA) LiteBIRD is one such proposed mission, that could be the first to discover this signal.

Canadians have played key roles in nearly every important CMB result to appear in the past 25 years. Clearly Canada's biggest impact has been in terms of expertise and know-how that has contributed to advances in theory, data analysis, experiment design and technology. Essentially

every CMB polarization experiment either on the ground or on stratospheric balloons is using Canadian-built technology - namely readout electronics for the hyper sensitive detectors. Significant expertise has come from participation in balloon-borne projects (Balloon-borne Large-Aperture Submillimeter Telescope (BLAST), E and B Experiment (EBEX) and SPIDER) designed to measure the polarization of the CMB. Such projects provide good science and tests of new technologies for space-based missions. Canadian expertise was demonstrated through the ESA Planck mission data reduction that generated the most accurate measurements of the CMB ever made.

Precise measurements of the CMB polarization will allow cosmologists to address a number of fundamental questions by detecting and analyzing the signature of Inflationary Gravitational Waves which provide an image of the universe when it was a tiny fraction of a second old. LiteBIRD is a next-generation satellite mission proposed by JAXA aimed at investigations of the CMB polarization. Since on large angular scales the B-mode polarization of the CMB carries the imprint of primordial gravitational waves, its precise measurement would provide a powerful probe of the epoch of inflation. In order to achieve the mission goals and target sensitivity, the instrument will utilize a cryogenically cooled sub-Kelvin focal plane based on kilo-pixel-format superconducting detector array of Transition Edge Sensor (TES) bolometers with an optical system operating at a temperature of 4K. Superconducting TES bolometers have been demonstrated to achieve photon-noise-dominated performance and can be fabricated in large arrays.

There is considerable Canadian expertise related to the readout electronics needed for the TES bolometers. This readout electronics is based on Digital Frequency Multiplexing and is considered as a potential instrument contribution to LiteBIRD (RD-12, RD-13)

The Contractor will provide an assessment of this potential contribution to the LiteBIRD mission. This assessment is expected to provide information on contribution options by elaborating on architecture, design, and interfaces to the detector arrays with an analysis of the LiteBIRD payload requirements and flow down to electronics specification.

Key performance requirements of the instrument may be demonstrated by laboratory testing, which may include demonstration of feasibility of achieving science objectives, for example by optimizing electronic readout configuration and signal processing.

4 GENERIC TASK DESCRIPTION

The work to be performed by the Contractor under this contribution study is divided into three major WPs. Each WP has one or more associated tasks. Figure 4-1 describes the WBS.

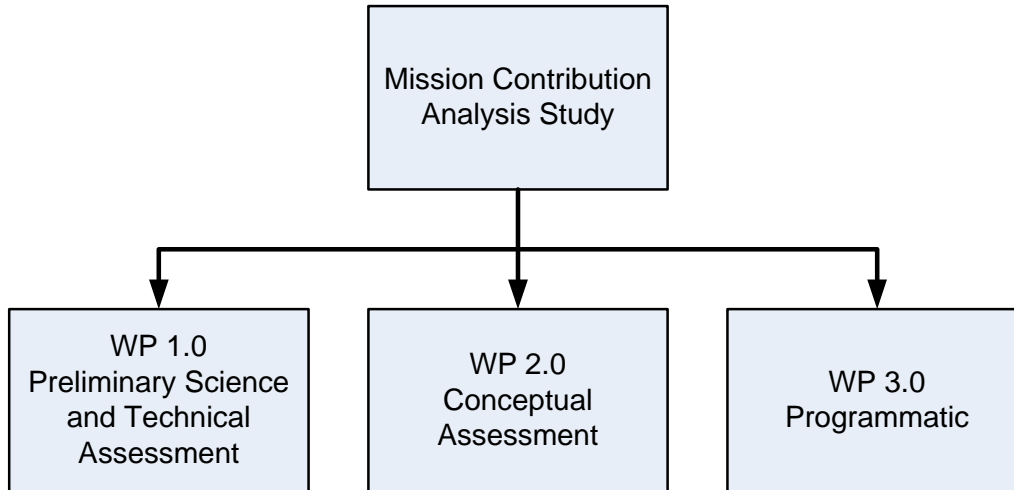


FIGURE 4-1: WORK BREAKDOWN STRUCTURE (TOP LEVEL)

The CSA requires insight into the science implication and benefit to the Canadian academic and scientific community. Furthermore, the studies must identify the industrial capabilities and define a technology development roadmap, with cost and schedule.

4.1 PRELIMINARY SCIENCE AND TECHNICAL ASSESSMENT

4.1.1 *Science Objectives Relationship to the Mission Objectives*

The Contractor must identify Science Readiness Level (see RD-06).

The Contractor must identify science capacity within Canada: who in Canada is placed to make use of data gathered from either the mission, or the instrument or the sub-system?

The Contractor must describe science merit and objectives: the expectation here is to identify how a specific contribution can promote Canadian science investigations.

4.1.2 Canadian Industrial Capabilities

The Contractor must identify a pool of key personnel critical for the realization of the concept. The Contractor must perform an assessment of current capabilities with respect to anticipated system performance and modifications and level-of-effort required to adapt or develop technology.

4.2 CONCEPTUAL ASSESSMENT

The Contractor must identify and assess instrument measurement goals and associated data products. This is expected to feed into technical requirements: current capability vs. anticipated capability as well as preliminary implications for related tools (tests, calibration, data handling).

The Contractor must perform a Technology Readiness and Risk Assessment (TRRA) in accordance with the requirements of the CSA Technology Readiness and Risk Assessment Guidelines (RD-07) and Technology Readiness Levels, to formally document the technology status.

The Contractor must also provide a Technology Development Plan, also known as Technology Roadmap (TRM) including the required technology developments to meet mission needs, and a plan and timeline to reach Technology Readiness Level (TRL) 6 and 8. The TRM must be provided in the format of (RD-08).

4.3 DEVELOPMENT, MANUFACTURING AND QUALIFICATION APPROACH.

The Contractor must provide an overview of the development approach, specifying subsystem providers, key subcontractors, and the general strategy best suited for this approach. The Contractor must also list the major tasks required in the development and manufacturing cycles. The Contractor should provide the Verification and Validation (V&V) and qualification approach and assumptions made.

4.4 PROGRAMMATIC ASSESSMENT

4.4.1 Estimated cost

The Contractor must provide cost estimates as per Table 4-1 below, for all phases leading to the development, qualification, implementation, launch, operation and disposal of the hardware / software / instruments resulting from the concept.

TABLE 4-1: COST

		Prior to Mission	Phase A	Phase B	Phase C	Phase D	Phase E	Phase F
Labour	Management							
	Technology Development							
	Design							
	Documentation							
	Reviews							
	Manufacturing							
	Assembly							
	Testing							
	Product Assurance							
	Operations							
	Total Labour							
Non-Labour	HW/SW Procurement							
	Tools, equipment & facilities							
	T&L							
	Overhead							
	Total Non-Labour							
Risk	Risk Contingency							
Taxes								
Total per phase								
Total all Phases								

4.4.2 Estimate of Canadian Content

The Contractor must provide an estimate of the anticipated percentage of Canadian content relative to the overall cost presented in Table 4-1 what options could be undertaken to maximize the Canadian content, and their corresponding impacts and benefits.

4.4.3 Schedule

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

4.4.4 Preliminary Mission Risk Assessment

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

4.4.5 Intellectual Property Management

The Contractor must identify the Background Information (BIP), the IP that will be generated, and the owners of these BIP and IP and how it will be managed and coordinated among the various collaborators and entities involved in a potential mission.

4.4.6 Business Potential

The Contractor must provide information on the minimum business, in the field, required to maintain the necessary expertise in the long run. The Contractor should provide a preliminary business plan or opportunities to support further Canadian positioning beyond the scope of the proposed CSA program. This should include an analysis of who the competitors are (national and international) for the proposed subsystem and/or technology and/or concept and/or for the overall mission. It must identify who are the stakeholders and how Canada and/or the bidder are positioned. This could also include potential spin-offs (space and non-space).

4.5 MISSION CONTRIBUTION ANALYSIS STUDY PROJECT SCHEDULE

The project schedule prepared by the Contractor must provide a graphical representation of predicted tasks, milestones, dependencies, resource requirements, task duration, and deadlines. The project's master schedule must inter-relate all tasks on a common time scale and be in the form of a Gantt chart. The project schedule must be detailed enough to show each WBS task to be performed, the name of the person responsible for completing the task, the start and end date of each task, the deliverables and the expected duration of the task. The Contractor must also provide all WPs.

4.6 PROJECT DURATION

The Contract will be from the date of issue for a period of approximately seven (7) months after Contract Award (CA).

4.7 CONTRACT MEETINGS AND DELIVERABLES

This section reviews and describes the contract meetings and deliverables.

4.7.1 Final Report

The contractor must prepare a final report containing the results of the study corresponding to CDRL 6.

4.7.2 Contract Milestones and Meetings

The Contractor must organize the meetings listed in Table 4-2.

TABLE 4-2: MILESTONE AND MEETING SCHEDULE

Milestone	Meeting	Nominal Date relative to Contract Award (CA)	Required CDRL	Location ¹
M1	Kick-off Meeting	CA + 2 weeks	1, 2, 3	By telecom
M2	Progress Review	CA + 2 months	1, 3	By telecom
M3	Mid-term Review Meeting	CA + nominally 5 months	1, 3, 4, 6, 8, 9,	By telecom
M4	Final Review Meeting	End of Contract – 2 weeks	1, 3, 6, 8, 9, 10, 11, 12, 13	CSA HQ ² or by telecom

Notes: 1.Reminder: travel costs are the responsibility of the Contractor.

2. Choice of the meeting location (CSA HQ or Telecom) will be according to the Contractor's proposal.

All key participants under the contract, including at least one representative from each subcontractor, must attend all the meetings.

The Progress Review telecom is meant for discussion on the success of the approach and review of schedule and future activities and any other issues. The Mid-Term Review (MTR) Meeting is meant for discussion on the progress towards the Mission Contribution Final Report. A presentation at the MTR is expected. It is necessary to have an agenda and minutes produced from the MTR, capturing any actions for either party.

The specific intent of the Final Review Meeting will be to discuss in detail the results obtained and the proposed follow-on activities. This meeting is intended to provide an opportunity for the Contractor, the Project Authority (PA), the Technical Authority (TA), and other invited attendees to review and discuss the project. Canada reserves the right to invite additional knowledgeable people [Public Servants or others under Non-Disclosure Agreement (NDA), if necessary] to this meeting.

Key Contractor personnel involved in the work under review must attend the meetings. The exact date and time of the meetings will be mutually agreed to by the PA, the TA, and the Contractor.

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

4.7.3 Documentation, Reporting and Other Deliverables

The Contractor must submit the documentation as defined and at the date stipulated in the Contract Data Requirements List (CDRL), Table 4-3, to the PA. All diagrams must be clearly drawn and labeled.

In addition to any paper copy of all project documentation and reports, the Contractor must also provide the PA with an electronic copy in a format acceptable to the CSA. Both the PDF and original version, e.g. Microsoft Word or PowerPoint, must be provided to CSA. Original version of any figures or tables that are part of these documents must also be provided to CSA, e.g. Visio file of a figure created in Microsoft Visio. Instructions on how to name electronic documents are provided in Appendix A.1.

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

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RESTRICTION ON USE, PUBLICATION OR DISCLOSURE OF PROPRIETARY INFORMATION

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

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

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

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

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

In addition to the disclosure obligation under clause K3410C, any Foreground Information must be fully disclosed and documented by the Contractor in the technical reports delivered by the Contractor to the Project Authority under this Contract.

TABLE 4-3: CONTRACT DATA REQUIREMENTS LIST (CDRL)

CDRL	Deliverable	Due Date	Version	DID
1.	Meeting Agendas	Meeting - 1 week	Final	0001
2.	Kick-off Meeting Presentation	Meeting - 1 week	Final	0002
3.	Meeting Minutes	Meeting + 1 week	Final	0003
4.	Mid-term Review Meeting Presentation	Meeting - 1 week	Final	0004
5.	(Monthly Progress Reports – not required)			
6.	Final Report	Draft version at milestone M3 - 2 weeks Final version at end of contract -2 weeks	Draft Final	0006
7.	(Executive Report - not applicable)			
8.	Technology Readiness and Risk Assessment Worksheets and Rollup and Critical Technology Element Identification Criteria	Draft copy at milestone M3 End of contract – 2 weeks	Draft Final	0008
9.	Technology Roadmap Worksheet	Draft at each milestone End of contract – 2 weeks	Draft Final	0009
10.	Final Review Meeting Presentation	Meeting - 1 week	Final	0010
11.	Contractor Performance Evaluation	End of contract - 2 weeks	Final	0011
12.	Foreground Intellectual Property (FIP) Disclosure	End of contract - 2 weeks	Final	0012
13.	Final Data Package	End of contract	Final	0013

5 LIST OF ACRONYMS

BIP	Background Intellectual Property
BLAST	Balloon-borne Large-Aperture Submillimeter Telescope
CA	Contract Award
CASCA	Canadian Astronomical Society
CDRL	Contract Data Requirements List
CMB	Cosmic Microwave Background
COBE	Cosmic Background Explorer
CSA	Canadian Space Agency
CSEW	Canadian Space Exploration Workshop
DDR	Detailed Design Review
DID	Data Item Description
EBEX	E and B Experiment
ESA	European Space Agency
FIP	Foreground Intellectual Property
HQ	Headquarters
IP	Intellectual Property
ITAR	International Traffic in Arms Regulations
JAXA	Japan Aerospace Exploration Agency
LiteBIRD	Lite 'light' satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection
LRP	Long Range Plan
MTR	Mid-term Review
NASA	National Aeronautics and Space Administration
NDA	Non-Disclosure Agreement
PA	Project Authority
PDF	Portable Document Format
PDR	Preliminary Design Review
PR	Progress Report
PT	Presentation
RD	Reference Document
RFP	Request for Proposal
SA	Scientific Authority
SE	Space Exploration
SOW	Statement of Work

SW	Software
TA	Technical Authority
TES	Transition Edge Sensor
T&L	Travel and Living
TRL	Technology Readiness Level
TRM	Technology Roadmap
TRRA	Technology Readiness and Risk Assessment
V&V	Verification and Validation
WBS	Work Breakdown Structure
WMAP	Wilkinson Microwave Anisotropy Probe
WP	Work Package

APPENDICES

A.1 DOCUMENT NAMING CONVENTIONS

Context

This appendix presents the naming convention to follow for any documentation generated under any resulting contract.

Documents must contain 4 main components:

1. Project identifier
2. Contract Number
3. Document title
4. Date Tracking number

WXYZ-TYPE-NUM-CIE_ContractNumber document title rev no._sent**YYYY-MM-DD**

1. Project Identifier

The project identifier must contain:

WXYZ: A 4-8 letter acronym of the project

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

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

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

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

2. Contract Number

For example: _9F028-07-4200-03

3. Document Title

Revision number or letter

4. Date Tracking Number

_sentYEAR-MONTH-DAY_draft

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

A.2 DATA ITEMS DESCRIPTION (DID)

DID-0001 – MEETING AGENDA	19
DID-0002 – KICK-OFF MEETING PRESENTATION	20
DID-0003 – MEETING MINUTES	21
DID-0004 – FINAL REVIEW MEETING PRESENTATION	22
DID-0006 – FINAL REPORT	23
DID-0008 TRRA - TECHNOLOGY READINESS AND RISK ASSESSMENT WORKSHEETS AND ROLLUP 25	
DID-0009 TECHNOLOGY ROADMAP WORKSHEETS	26
DID-0010 – FINAL REVIEW MEETING PRESENTATION	27
DID-0011 – CONTRACTOR PERFORMANCE EVALUATION.....	28
DID-0012 – CONTRACTOR DISCLOSURE OF INTELLECTUAL PROPERTY.....	29
DID-0013 – FINAL DATA PACKAGE	30

DID-0001 – Meeting Agenda

PURPOSE:

To specify the purpose and content of a meeting

PREPARATION INSTRUCTIONS:

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

1. DOCUMENT HEADER:

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

2. DOCUMENT BODY:

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

DID-0002 – Kick-off Meeting Presentation

PURPOSE:

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

PREPARATION INSTRUCTIONS:

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

- 1) Review major assumptions for the study;
- 2) Review of contract deliverables;
- 3) Work requirements;
- 4) Project's funding and expected cash-flow; and
- 5) Other items as deemed appropriate.

DID-0003 – Meeting Minutes

PURPOSE:

To provide a record of decisions and agreements reached during reviews/meetings, and action items

PREPARATION INSTRUCTIONS:

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

- 1) Title page containing the following:
 - a) Title, type of meeting and date;
 - b) Project title, project number, and contract number;
 - c) Space for signatures of the designated representatives of the Contractor, the CSA and the Public 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) Summary of action items;
- 7) List of the attendees by name, position, phone numbers and e-mail addresses as appropriate;
- 8) Listing of open action items and responsibility for each action to be implemented as a result of the review, numbered per the action items list;
- 9) Other data and information as mutually agreed; and
- 10) 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-0004 – Final Review Meeting Presentation

PURPOSE:

To present the overall results of the work done in the project including the assessment of Science Readiness Level

PREPARATION INSTRUCTIONS:

The Final Review Meeting Presentation will reflect the final report and must contain the following information, as a minimum:

- 1) Presentation of the work conducted;
- 2) Review of science requirement against required elements, including review of 2-page illustrated summary suitable for publication;
- 3) Contractor's assessment of completed study against Science Readiness Level;
- 4) Discussion of Technical and/or scientific and issues if any;
- 5) Discuss concept / maturation study work;
- 6) Final Funding and cash-flow;
- 7) Discuss project management issues;
- 8) Other items as deemed appropriate; and
- 9) Presentation's slides to include the required copyrights and intellectual property disclosure.

DID-0006 – Final Report

PURPOSE:

Provide a well-documented validated science case and review of requirements and approach for the targeted mission contribution. This will provide a well-documented report for reference in follow-on phases

PREPARATION INSTRUCTIONS:

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

The Mission Contribution Study document must contain the following information:

- 1) Fact sheet – a one or two page illustrated summary of the proposed science investigation, science objectives, approach and measurement goals, anticipated mission architecture, payload, technologies and data products, suitable for public.
- 2) Executive Summary
- 3) Introduction
 - a) Context and needs for the mission in the discipline.
 - b) Description of tools and approaches used in order to define the investigation above.
- 4) Science Objectives
 - a) Main and secondary science objectives described with traceability to CSA and/or community strategic priorities as requested in this Statement of Work.
 - b) Measurement goals described with justification addressing the identified science objectives. Identify Science Readiness Level (SRL)..
 - c) Links, complementarities, dependencies, competition and / or contribution to targeted or future observatories towards science objectives.
- 5) Instrumentation Approach
 - a) Review of payload instrument(s) and components, configuration, design, interfaces.
 - i) Description of the system or instrument or components
 - (1) Preliminary requirements, interfaces, including environmental, functional and performance
 - (2) System budget estimates including, as appropriate:
 - (a) Mass budget, power budget, processing/computing budget, thermal budget,
 - (b) Operational timeline
 - (c) Software development
 - ii) Sub-options description (if applicable)
 - iii) Concept design trades of proposed concepts and technologies

-
- iv) TRRA and Roadmap assessment with respect to identified sub-systems and elements.
 - b) Key technology drivers and needs; identifying options and technology items needing further evaluation, development, prototyping.
- 6) Canadian Capacity
- a) Summary of Canadian science capacity and resources available in Canada to carry out the proposed investigation (mission), identifying existing and future needs for support. This includes a summary of relevant organizations and known complementary R&D initiatives.
 - b) Canadian Industrial Capabilities
 - i) Expertise critical to realization of the concept. Preliminary TRRA at the system level. Modifications and level-of-effort required to adapt or develop technology.
- 7) International Collaborations
- a) Opportunities for scientific collaborations.
 - b) Description of potential or interested partners, outlining benefits to mission development and science outcomes.
- 8) Programmatic
- a) Summary of the overall cost estimate of the potential instrument contribution, by project phases (0, A to D) including phase E (operations with data reduction or support if applicable) and science investigations support and by FY breakdown.
 - b) Preliminary development schedule. Identified high risk elements (or sub-systems) and development plan.
 - c) Fit with respect to community and CSA priorities, government policies, benefits to Canadians and spin offs.

DID-0008 TRRA - Technology Readiness and Risk Assessment with Worksheets

PURPOSE:

Referring to the Technology Readiness and Risk Assessment (TRRA) Guidelines (RD-07), the TRRA describes in a systematic and objective fashion, at a specific point in time (milestone) in the development process, the technological readiness of a system for a particular spaceflight mission or environment, the criticality of the constituent technologies, and the expected degree of difficulty to achieve the remaining technology development steps.

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

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

PREPARATION INSTRUCTIONS:

The Technology Readiness and Risk Assessment must be carried out in accordance with the CSA Technology Readiness and Risk Assessment Guidelines (RD-07) using the CSA provided 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 TRRA summary template (CSA-ST-FORM-0004).

All the completed worksheets must be provided to CSA, and a summary of the TRRA assessment and recommendations must be included in the project Technical Report. The project Technical Report should also contain the Technology Development Plan, Technology Roadmap (RD-08) and appropriate inputs to the Risk Assessment, Budget, and Schedule.

DID-0009 Technology Roadmap Worksheets

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The Technology Roadmap must be done using RD-08 as per RD-07.

DID-0010 – Final Review Meeting Presentation

PURPOSE:

To present the overall results of the work done in the project

PREPARATION INSTRUCTIONS:

The Final Review Meeting Presentation will reflect the final report and must contain the following information:

- 1) Presentation of the work conducted (content of technical and/or scientific report, the concept, plan, interfaces, feasibility, etc.);
- 2) Summary of science and technology assessments against required elements;
- 3) Summary of technical and programmatic issues, assessments;
- 4) Deliverables of the contract;
- 5) BIB and FIP (Intellectual Property); licenses if applicable;
- 6) Final Funding and cash-flow;
- 7) Discuss project management issues;
- 8) Other items as deemed appropriate; and
- 9) Presentation's slides to include the required copyrights and intellectual property disclosure

DID-0011 – Contractor Performance Evaluation

PURPOSE:

To provide an evaluation of the overall success of the project

PREPARATION INSTRUCTIONS:

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

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

DID-0012 – Contractor Disclosure of Intellectual Property

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The Disclosure must address the questions listed in the document CONTRACTOR DISCLOSURE OF INTELLECTUAL PROPERTY that can be found at:

<ftp://ftp.asc-csa.gc.ca/users/GPITT-IPMTT/pub/>.

DID-0013 – Final Data Package

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

PREPARATION INSTRUCTIONS:

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