

Canadian Space Agency

ANNEX A

Phase 0 for the Atmospheric Imaging Mission for Northern Regions (AIM-North)

Statement of Work (SOW)

Date: September 28, 2018

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1 INTRODUCTION

1.1 SCOPE

This Statement of Work (SOW) defines industrial activities to complete the Phase 0 for the Atmospheric Imaging Mission for Northern Regions (AIM-North). AIM-North is a mission proposed by Environment and Climate Change Canada for monitoring Air Quality and Greenhouse Gases (AQ-GHG) over the arctic, sub-arctic, and boreal regions, which includes the vast majority of Canada.

1.2 BACKGROUND

Environment and Climate Change Canada (ECCC) has identified the Arctic as a priority region that is significantly under-sampled, and has identified the need for increased observations to better monitor and understand sources and sinks of air pollution and greenhouse gases.

ECCC worked with CSA and the Canadian industry over the period 2016-2018 to explore several possible candidate concepts to address the observation gap [RD-1, RD-4].

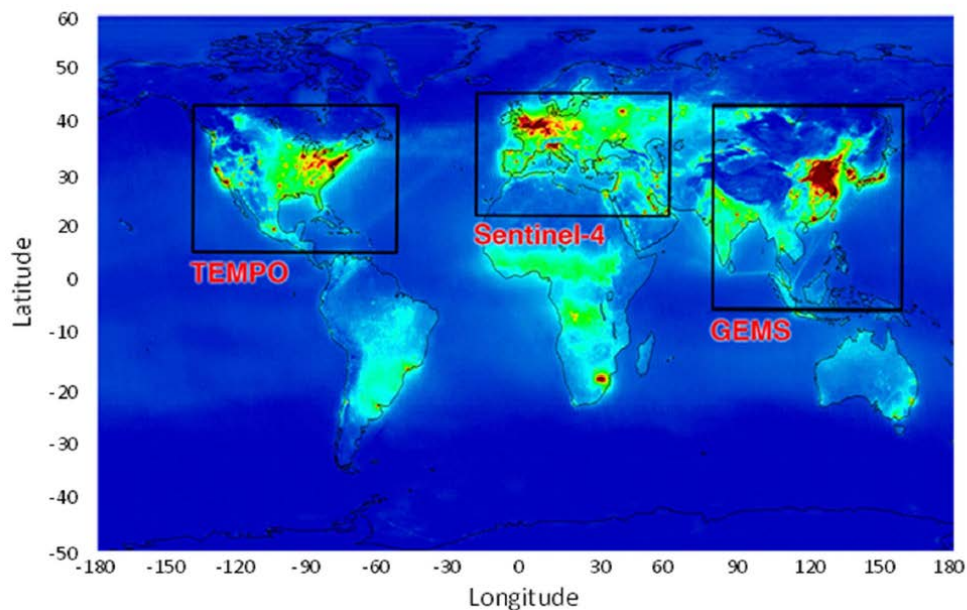


Figure 1: Proposed systems for Air Quality Monitoring shown on a map of NO₂ concentrations. The 3 GEO systems planned for the 2020s will leave an observation gap at higher latitudes.

The baseline concept selected at the end of the concept study is a 2-satellite system in Molniya orbit. Each satellite would carry two payloads: an Air Quality (AQ) payload and a Greenhouse Gas (GHG) payload. Both payloads are imaging spectrometers measuring the radiance over appropriate spectral bands ranging from UV (Ultraviolet) to IR (Infrared). The current concept is challenging in terms of the number of bands, spectral resolution, spatial resolution, temporal coverage, and area to be monitored. It requires refinement to reduce risks, costs, and optimize the design and the data collection in areas of interests for ECCC.

The GHG payload concept is still considered to be in flux. An imaging FTS (Fourier Transform Spectrometer) has been selected as the baseline at the end of the concept study, but there are several issues related to the long integration time required to achieve the desired spectral resolution and bandwidth, and signal-to-noise ratio (SNR). Over the 450s period needed to acquire a spectrum, the spacecraft position varies with respect to the initial instantaneous ground footprint creating apparent motion of the pixels and a variation in radiance that may impact the accuracy and spatial resolution of the observations. Additionally, the atmospheric column observed over this time will also have changed due to both the geometric effect and atmospheric transport. Therefore the advantages and disadvantages of instead using a dispersive grating spectrometer with a significantly shorter integration time must be understood.

Concerning the AQ instrument, one conclusion reached in the concept study is that the requirements placed on the AQ payload could be met by an instrument similar to the TEMPO (Tropospheric Emissions: Monitoring of Pollution) or Sentinel-4 UVN (Ultraviolet/Visible/Near-Infrared) instruments if such instruments were in a highly elliptical orbit. Thus, a potential approach would be to procure the AQ instrument internationally rather than developing a similar instrument in Canada.

During the mission concept study, the possibility of enhancing the mission with a cloud imager was given brief consideration. The primary motivation behind the cloud imager would be to find cloud-free regions to inform the GHG and AQ instruments pointing. This is especially important for GHGs since during normal mission operations, ~90% of observations would be rejected due to clouds effects. GOSAT-2 will use an intelligent pointing approach from LEO, where a quick cloud image of the FoR will be used to determine the optimal pointing location within the FoR and thus increase the yield of cloud-free data when traversing a partially cloudy region. A similar approach may be even more effective from HEO (or GEO) due to the much larger FoR at any given instant and potentially enable greater pointing options depending on the concept of operations. Preliminary consideration in the mission concept study determined that the required instrumentation could be very small (< 1 kg) and low cost, but further study and optimization of this potentially high impact enhancement is required in Phase 0. Real-time cloud data over northern latitudes would be valuable to weather forecasting, hence an imager with both day and night bands and good spatial resolution is desired. It should be noted that an alternative strategy may be to have the mission acquire the required information to enable intelligent pointing from alternative sources in near-real time.

While definition of the AIM-North concept progressed, international partners in the US and EU also identified observation gaps in the North and started investigating other new mission concepts for this region. The possibility of realizing the AIM-North mission objectives through an international partnership is an option that must be seriously considered.

The focus of this Phase 0 is to complete the definition process with ECCC, confirm the selection of key technologies for the payloads and agree on core mission objectives that could be achieved either by a flagship Canadian mission or as a Canadian contribution to an international partnership.

1.3 DOCUMENT CONVENTIONS

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

- a) “Shall” or “Must” is used to indicate a mandatory requirement;
- b) “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;
- c) “May” indicates an option;
- d) “Will” indicates a statement of intention or fact, as does the use of present indicative active verbs.

In the following, the term 'Contractor' is used to describe the team that will conduct the study, which could be a mixed team drawn from industry, universities or research institutes.

2 DOCUMENTS

2.1 APPLICABLE DOCUMENTS (AD)

This section lists the documents that are required for the bidder to develop the proposal.

AD No.	Document No.	Document Title	Rev. No.
AD-1	CSA-SE-STD-0001	Systems Engineering: Technical Review Standards	A
AD-2	AIMN-RD-001	AIM-North Mission Objectives Document	A
AD-3	CSA-ST-GDL-0001	CSA Technology Readiness and Risk Assessment Guidelines	B
AD-4	CSA-ST-FORM-0001	Technology Readiness and Risk Assessment (TRRA) Worksheet	E
AD-5	CSA-ST-RPT-0002	Technology Readiness and Risk Assessment Data Rollup Tool	H
AD-6	CSA-ST-FORM-0003	Critical Technology Element (CTE) Identification Criteria Worksheet	A
AD-7	CSA-ST-RPT-0003	Technology Roadmap worksheet	A

2.2 REFERENCE DOCUMENTS (RD)

The following documents provide additional information or guidelines that either may clarify the contents or are pertinent to the history of this document.

Table2.2-1: Reference Documents

RD No.	Document Number	Document Title	Rev. No.	Date
RD-1.	N/A	AIM-North Website		
RD-2.	ABBCABOM-04403	GESQA Observational Requirements Review	D	15 August 2018
RD-3.	PMBOK Guide	A Guide to the Project Management Body of Knowledge	6 th Ed.	2017
RD-4.		Short Statement for Arctic Observing Summit (AOS); Atmospheric Imaging Mission for Northern Regions: AIM-North		June 2018

3 REQUIREMENTS

3.1 GENERAL

The Contractor must manage the project to effectively achieve project performance, 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 report project costs, schedule, technical, performance and risk issues as defined herein.

3.2 OBJECTIVES

The general objectives of this study are to:

- Review and refine the mission concept for AIM-North to bring it to the level of maturity sufficient to meet the exit criteria [AD-1] required for a Mission Concept Review (MCR) and a Mission Requirement Review (MRR));
- Identify key Canadian technologies that could be a contribution to an international partnership;
- Identify international technologies that could enhance a Canadian led mission in a partnership
- Refine the cost estimates and development plans to support the preparation of a business case.

More specific objectives relate to the gates that the project must pass:

Objectives Relating to MCR:

- Review and comment on the Mission Objectives Document (MOD) [AD-2] to ensure that it is written in a manner that allows different possible mission level implementations without having to reconfirm the needs expressed by ECCC. This will facilitate the formation of the User Requirements Document during the first phase of the study.
- Assess value and interests for the potential enhancements to the MOD. Particular focus should be given to a cloud imager to inform pointing decisions;
- Build a performance model allowing to quantify compliance to observation requirements appearing in the MOD for the different observation scenarios and payload options;
- Determine detailed payload resource allocations including an assessment of the impact on the space and ground segments for different payload options

- Enable an informed decision on payload options (three specific options will be investigated) in order to select an option to build a Mission Conceptual Design
- Prepare engineering budgets for the main sub-systems.
- Elaborate the different elements to describe a mission concept that will serve to meet the potential Mission Requirements, and develop a Mission Conceptual Design (MCD) for a Canadian Mission accordingly (DID-0220);
- Explore ways to lower mission cost;
- Prepare concept of operation including: interfaces to external systems, operations, data collection scenarios, processing, and calibration.
- Identify areas of potential international partnership
- Prepare the compliance matrix to URD/MOD requirements;
- Report the Current Best Estimate (CBE) of performance with respect to anticipated or preliminary mission and system requirements and confirm that the concept meets the requirements;
- Successfully complete pertinent MCR Exit Criteria [AD-1]

Objectives Relating to MRR:

- Prepare a list of Mission Requirements for a Canadian mission that responds to the User Requirements and the Mission Objectives [AD-2].
- Establish traceability between user's objectives captured in the URD/MOD and Mission Requirements
- Report the Current Best Estimate (CBE) of performance of the Mission Conceptual Design with respect to each Mission Requirement
- Prepare the Mission Requirement List (DID-0230) for a Canadian mission.
- Assess current state of relevant technology through a Technology Risk and Readiness Assessment (TRRA) and identify Critical Technology Elements (CTE) that require early development
- Prepare Mission Planning and Development Report (DID-0240) with detailed bottom-up cost estimates. The cost estimate must be bottom-up and consistent with a detailed product tree derived from the Mission Conceptual Design and consistent with the TRRA

- Successfully complete pertinent MRR Exit Criteria [AD-1]
- Develop an initial draft list of System Level Requirements (DID-0250) of the main subsystems consistent with the mission conceptual design and concept of operations.

Objectives Relating to Business Case Preparation and Science Maturation

In parallel to the Phase 0 activities discussed in this SOW, the preparation of a User Requirements Document (URD) and a Business Case, to obtain authorization to continue the project after the Phase 0, will be the responsibility of ECCC and CSA's program scientists.

- To substantiate the business case, it is planned to conduct Observation System Simulation Experiments (OSSEs) to demonstrate the usefulness of the data and confirm the mission requirements.
- Discussion with OGDs will be conducted to assess interest in the data and potential enhancements, which may require extra analysis and updates on the engineering budgets and concept of operation.
- It is also planned to do initial work on the retrieval algorithms and observation scenarios such that a simple performance model can be developed to predict the accuracy and precision (bias and RMS (Root Mean Square)) of the retrieved products as a function of the instrument parameters.

Several of these activities will be assisted by separate science contracts and are not covered by this SOW. Some of the deliverables and updated requirements will be available as outputs from those contracts to conduct the activities covered by this SOW and are therefore mentioned in the following work descriptions.

3.3 DETAILED TASKS

3.3.1 Requirements Review and Sensitivity Analysis

The Contractor shall first review the AIM-North Mission Objectives Document (MOD) [AD-2] and the mission concept [RD-1, RD-4] produced at the end of the previously completed concept study.

The AIM-North MOD is an updated and expanded version of the AQ/GHG Observational Requirements [RD-2].

One of the important objectives of the Phase 0 is to finalize the Mission Objectives along with their justification to produce the User Requirements Document (URD) such that it can be endorsed by ECCC and used as the top-level document from which all other requirements will be derived in the follow-up phases of the project.

The contractor shall flag missing, ambiguous, or undefined requirements appearing in the AIM-North MOD and propose a preliminary set of specifications and Mission Requirements such that a complete set of Mission Level requirements with no TBD (To Be Determined) can be produced for AIM-North.

The contractor shall prepare a compliance matrix linking the requirements contained in the AIM-North MOD and the preliminary set of proposed Mission Requirements. These AIM-North Mission Requirements will evolve throughout the course of the study and will be connected to the elements of the AIM-North mission concept to be developed here.

For each element of the compliance matrix, the contractor shall perform a sensitivity analysis in order to estimate how each requirement (or group of requirements) is driving the cost and complexity of the mission. The analysis shall be quantitative as much as possible to estimate how development and operation costs could be impacted if the requirements are reduced or increased

Based on the sensitivity analysis, the contractor shall propose changes to the AIM-North Mission Objectives to reduce development cost and risk while maintaining the achievements of the core mission objectives. The compliance matrix, sensitivity analysis, and proposed changes shall be documented in a Mission Objectives Review Report (DID-0200) and presented at Review Meeting (RM1)

No later than 2 weeks after this Review Meeting (RM1), CSA and ECCC will provide an updated AIM-North MOD potentially as informed by the results of the sensitivity analysis.

3.3.2 Instrument Concept Update

The contractor shall develop the three distinct payload options appearing in the table below:

Table 3.3.2-1 AIM-North Payload Options

AIM-North Payload Options	Option 1: Baseline	Option 2: Dispersive	Option 3: Embedded
GHG Instrument type	iFTS	dispersive	dispersive
AQ Instrument type	dispersive	dispersive	dispersive
Notes	AQ payload can be potentially procured	AQ payload can be potentially procured	Unlikely that AQ can be procured

The first option represents the baseline technologies associated with the previous concept study [RD-1]. As detailed in the previously completed mission concept study a potential complication with the use of an imaging FTS for the GHG instrument is the long scan duration (450 seconds) associated with interferogram acquisition. The Contractor shall address this potential issue by developing a model to determine the amount of pixel movement for several representative points spread across the Field of View (FOV) during image acquisitions throughout the area of interest. Several targets throughout the required coverage area shall be considered (i.e. targets shall not be limited to sub-satellite points). This model shall account for satellite movement, altitude variation, earth rotation, and nominal spacecraft jitter. This model must then be used to determine the impact on spatial resolution, and spectral purity for a spectrally and spatially inhomogeneous scene in the absence of post-processing. Following this, the Contractor shall propose and develop an imaging strategy that will use the output of the model to determine any imaging constraints or nominal target schedules that balances coverage requirements with the minimization of image errors. Assuming it is necessary to demonstrate the ability of the technology to meet the image quality and coverage requirements, the Contractor shall also propose and develop correction routines through post- or on-board processing to mitigate anticipated issues and demonstrate that the correction routine is sufficient to recover the requisite spatial, spectral, and temporal sampling.

The second option represents an alternative to iFTS technology for the GHG Instrument. It is assumed that a dispersive line imager operating in push broom mode will have a much faster integration time than the iFTS, with a duration of 1 or 2 seconds, but still require approximately the same period of time to sweep through the requisite Field of Regard (FoR). In this case, a dispersive multi-channel spectrometer will be advanced to an equal level of maturity as the iFTS (described in RD-1) to facilitate informed comparisons between the two technologies with respect to the performance, compliance to observational requirements, resource estimates (mass, power, volume, data rates), and impacts on other elements of the mission such as, but not necessarily limited to, on-board processing, solar arrays, down link, and ground segment needs. A concept for a dispersive GHG instrument has been discussed briefly in the previous study.

The third option proposes to embed the dispersive AQ channels within a dispersive GHG instrument. This option is possible because the AQ and GHG mission objectives share several commonalities such as GiFoV (Ground instantaneous Field of View), FoR (Field of Regard), and temporal sampling (revisit) so that the instruments can potentially share the same fore-optics, scanning mirror, baffle and entrance slit. In this case, there would be a single multi-channel spectrometer operating in push broom mode to fulfill the observation requirements of the two main mission goals. Again, this option needs to be advanced to an equal level of maturity as the previous options to facilitate informed comparisons.

In all three options discussed above, the payloads shall be minimally advanced to include the following:

- detailed product tree
- optical design,
- performance analysis,
- error budget,
- compliance assessment,
- first order opto-mechanical design,
- detailed resource estimates (mass, power, volume, data rates),
- assessment of impact on space segment / bus (for example on-board storage, on-board processing, antennae, down link, solar arrays, cloud imager, etc.),
- assessment of impact on ground segment (for data volume, storage, data processing, etc.).

As mentioned earlier, a cloud imager could have a large impact on increasing the cloud-free data yield, especially for the GHG observations, while at the same time providing real-time cloud data for weather forecasting or other applications. Therefore, this supporting instrument should be considered for all three options discussed above.

It is important to note the instrument concept can potentially include an AQ instrument provided by a partner or procured from a foreign supplier (e.g. TEMPO, Sentinel-4/ UVN) for Options 1 and 2 above as a method to reduce overall mission costs. If the Contractor chooses to pursue this route, sufficient details on a procured AQ instrument must be provided to validate all statements of compliance and/or identify any needed augmentations or alterations. Further, assuming this approach is pursued, the Contractor must provide sufficient expertise on the project team to facilitate detailed discussion and design decisions.

For all payload options, the Contractor shall perform all analysis using an orbital scenario provided by CSA, which is currently a two satellite constellation in 12-hour Molniya orbit. The CSA may propose a different orbit (for example, a 24-hour Tundra or 16-hour TAP orbit) during the course of the execution of this work package.

The contractor shall prepare a first breakdown on the instrument error budget including as a minimum: pointing accuracy, SNR, spectral accuracy, spatial resolution, and optical distortions. The level of details in the instrument error budget shall be sufficient to ensure that there is a traceable flow down between the instrument parameters and the estimated product accuracy and precision as assessed by ECCC. The instrument error budget shall ensure compliance to the

mission success criteria and provide reasonable margins to account for the uncertainty in future design phases.

The current version of the AIM-North MOD [AD-2] does not impose an instrument Field of View (FoV) but rather an area to be observed (i.e. Field of Regard (FoR)) with requirements on the acceptable Solar Zenith Angle (SZA) and revisit time. The contractor has the flexibility to select the FOV but shall describe the scanning strategy and concept of operations that would be used to cover the full area of interest within the requisite time.

The contractor shall document the concept for the three payload options in the Instrument Concept Report (ICR) as per DID-0210. The initial draft of the ICR shall be discussed with CSA and ECCC at Review Meeting #2 (RM2) such that guidance can be provided.

After RM2, the contractor shall finalize its proposed concept for the instruments with a level of detail sufficient to:

- Ensure compliance to observation requirements;
- Prepare detailed engineering budgets for the instrument options;
- Determine the impact of the Payload options on other elements of the Mission Concept
- Identify key technologies and long-lead items to produce a detailed development plan that can be costed with confidence in the following work packages.

The updated instrument concepts shall be presented at the Instrument Concept Review (ICR) which will include a detailed trade study to assess the relative merit of each option. Particular focus will be given to compliance to the AIM-North Mission Objectives as well as anticipated impact at the mission level, including assessments of cost, complexity, schedule, and risk. Following the analysis, the Contractor shall provide a well justified recommendation. After the successful conclusion of the ICR the CSA and ECCC will select one of the three payload options to continue the development of the Mission Conceptual Design.

3.3.3 Mission Concept Review

Based on the selected payload option the contractor shall develop the mission conceptual design as per DID -0220 and present it at the Mission Concept Review (MCR). The proposed mission concept shall be for a complete, Canadian-led mission, meeting the minimum success criteria of the URD or MOD [AD-2]. The level of detail shall be sufficient to ensure that exit criteria for a MCR are met [AD-1].

At the MCR, the contractor can present alternative approaches to either to reduce or augment the scope of the mission. No later than 2 weeks after the MCR, CSA and ECCC will inform the contractor about the preferred approach if applicable.

3.3.4 Mission Requirements

Based on preferred approach agreed at the MCR, the Contractor shall develop the list of Mission Requirements. The Mission Requirements List will be used as a key input to the CSA Mission Requirements Document (MRD). The contractor is not responsible for delivering the MRD.

The list must be broken down as per the main elements of the mission and essentially be a first draft of the main sub-system requirements, with enough details to establish a credible and costed development plan.

Each requirement in the list must be traceable to a Mission Objective or User Requirement. If it cannot be traced directly, it must be justified with respect to mission constraints, CSA objectives, regulations, etc. Further, this list must include Current Best Estimates of performance for the current mission concept and statements of compliance.

The list must be provided in Excel Format and sent to the Technical Authority for comments. After initial comments are provided, the contractor shall produce the final version of the Mission Requirements List (MRL) as per DID – 0230 and present it at the Mission Requirements Review (MRR). The level of detail shall be sufficient to ensure that exit criteria for a MRR are met [AD-1].

3.3.5 Mission Planning and Development

Based on the agreed list of Mission Requirements, the Contractor shall update the Mission Conceptual Design Document as required and prepare the Mission Planning and Development Report that will be presented at the Mission Requirement Review.

Mission Planning and Development includes:

- identification of the mission schedule;
- identification of the development and manufacturing approach;
- identification of the technology development required to bring the technology readiness to the appropriate level at the appropriate time consistent with mission schedule;
- identification of the bottom-up mission cost;
- provision of mission risk assessment

Note that the CSA will not impose Product Assurance Requirements at this stage. Rather the Contractor shall propose an appropriate level of Product Assurance. The information requested in sub-sections 3.3.5.1 to 3.3.5.6 must be presented in the Mission Planning and Development Report (DID - 0250).

3.3.5.1 Overall Mission Schedule

The Contractor must suggest a preliminary Mission Schedule for the overall life cycle of the mission. The timeline must include key milestones such as Preliminary Design Review, Critical Design Review and Launch. See AD-1 for a full description of all the possible reviews, which may vary depending on the nature of the mission architecture.

3.3.5.2 Development and Manufacturing Approach

The Contractor must provide an overview of the development and manufacturing approach, specifying the major tasks required in the development and manufacturing cycles and the general strategy best suited for this approach. Identification of the potential long-lead items is also necessary.

3.3.5.3 Technology Readiness and Risk Assessment (TRRA)

The Contractor must identify the required technology development requirements to bring the technology to the proper TRL at the appropriate time to meet the mission schedule.

The TRRA process and the TRL definitions are provided in [AD-3]. The Contractor must also include a preliminary Critical Technologies Development Plan [AD-4], which 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 Critical Technologies Development Plan must be provided as a section of the Mission Planning and Development Report.

3.3.5.4 Mission Cost Estimate

The Contractor must provide a Mission Cost Estimate, for all phases (A to F) leading to the development, implementation, operation and disposal.

Along with the cost estimate, a detailed bottom-up justification for those costs must be included with estimates for manpower, material, procurement for Phase A and B. The detailed bottom-up cost estimate must be consistent with a detailed product tree for the various elements of the mission.

3.3.5.5 Instrument Cost Estimates

The mission cost estimates shall be organized such that it is possible to isolate the complete development cost for the payloads and the other main elements of the mission.

A separate cost shall be presented in case CSA decides to pursue providing the payloads as part of an international partnership, in which case the total may differ to account for the different management structure.

3.3.5.6 Mission Risk Assessment

The contractor shall provide a Mission Risk Assessment. Risk management is central to project management practices. During the course of mission design and implementation, the project team will continuously identify and assess risks, define mitigation actions, and assign resources to execute the mitigation measures.

The feasibility study will establish a first project risk assessment which identifies risks in programmatic, technical, manufacturing and material, and product assurance categories. Each risk will be assessed for probability of occurrence and mission impact, to generate an itemized risk level that contributes to the total project risk exposure. While a qualitative assessment is considered sufficient for this feasibility study, the impact of the risks will be quantified by their financial impact where possible, in order to determine a risk exposure cost for the program.

3.3.6 Preliminary System Requirements

The contractor shall develop an initial list of preliminary System Level Requirements (DID-0240). A draft version of DID-0240 shall be presented at the MRR and a final version provided at the Final Review Meeting (FRM).

This list shall capture the requirements of the main subsystems consistent with the mission conceptual design and concept of operations. This list will capture lower level details of the Mission Conceptual Design that respond to the previously determined Mission Requirements. This list of preliminary system requirements must be traced to the Mission Requirements. It will be used to validate completeness of the Mission Requirements and Conceptual Design as well as to capture all system level assumptions made in the determinations of mission risk, schedule, and bottom-up costing. The Preliminary System Requirements must also capture the assumed Product Assurance Requirements.

3.4 DELIVERABLES

The deliverables for the activity are listed in Table 3.4-1.

Table 3.4-1 Deliverables

Reports and Documents	Due Date
Mission Objectives Review Report	RM1 – 2 weeks
Instrument Concept Report	RM2 – 2 weeks (draft) ICR – 2 weeks (final)
Mission Conceptual Design Document	MCR – 2 weeks (draft) FRM – 2 weeks (final)
Mission Requirements List	MCR – 2 weeks (draft) MRR – 2 weeks (final)
Preliminary System Requirements List	MRR – 2 weeks (draft) FRM – 2 weeks (final)
Mission Planning and Development Report	FRM – 2 weeks
Minutes/ Presentations	
Kick-off Meeting Presentation	KOM – 1 week
Mission Objectives Review Presentation	RM1 – 1 week
Preliminary Instrument Concept Presentation	RM2 – 1 week
Instrument Concept Review Presentation	ICR – 1 week
Mission Concept Review Presentation	MCR – 1 week
Mission Requirements Review Presentation	MRR – 1 week
Final Review Meeting Presentation	FRM – 2 week
Minutes of Meetings	Meeting Date + 1 week
Action Item Log for Reviews and Teleconference	Meeting Date + 1 day
Final Data Package	2 weeks before Contract End Date
Final Version of all documents	
Executive Report	
BIP and FIP Disclosure Report	
Technical Notes	As required.
Software and models used for performance analysis	

3.5 SCHEDULE

The work described in this SOW should be completed within 18 months.

3.6 MEETINGS

Table 3.6-1 lists the meetings planned for this activity with a suggested schedule and meeting location. The Contractor can propose an alternative schedule and locations.

TABLE 3.6-1 MEETINGS

Meeting	Date	Location
Kick-off Meeting [KOM]	ARO + 2 weeks	Contractor
Mission Objectives Review [RM1]	ARO + 2 months	Teleconference
Preliminary Instrument Concept Review [RM2]	ARO + 4 months	Teleconference
Instrument Concept Review [ICR]	ARO + 8 months	Contractor
Mission Concept Review [MCR]	ARO + 12 months	ECCC
Mission Requirements Review [MRR]	ARO + 16 months	Teleconference
Final Review Presentation [FRM]	ARO + 18 months	CSA
Technical Interchange Meetings [TIM]	Monthly	Teleconference

3.7 DOCUMENTATION AND NAMING CONVENTION

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

Documents shall be delivered in the original software application format. One electronic copy of each deliverable document shall be transferred to the CSA to the address and in the format specified in DID-0000, Appendix B. No paper copy is to be delivered.

All simulation scenarios that have been considered (e.g. with STK) must be delivered in electronic format.

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

3.8 PROJECT MANAGEMENT REQUIREMENTS

The Contractor is responsible for establishing and maintaining a project management control system according to [RD-3] necessary to meet the requirements provided in the next sub-sections.

3.8.1 Team Organization

The Contractor must set up and maintain a project organization specific to this project. 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 and will act as the single point of contact within its project organization for communications between the Contractor and the Technical Authority (TA). In the absence of the single point of contact, the Contractor must designate an alternate to maintain continuity of communication between the Contractor and the TA.

The Contractor must also identify other key personnel who are considered essential to the performance of the contract. The Contractor must assign personnel with appropriate qualifications and experience to all posts within the project organization.

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.

3.8.2 Communications and Access

The Contractor must establish and maintain a close management and technical interface with CSA technical and project authorities to assure a coordinated program effort and monitoring of the total program cost, schedule and performance.

The Contractor must provide access to its plant and personnel, at mutually agreeable dates, by representatives of CSA and ECCC or other organizations nominated by the CSA, for review of program status.

The Contractor must provide temporary accommodation and other facilities for the use of the CSA representatives (and the nominated attendees) visiting the Contractor's premises for reviews, meetings, audits, liaison, etc.

The accommodation must be adequate for the purposes of the visit and the facilities provided must include telephone, faxing, photocopying and Internet access.

All documentation and data generated by the Contractor for the project must be accessible to the TA for review.

3.8.3 Project Meetings

The Contractor must hold the meetings described in Section 3.6. Some or all of these meetings may be attended by representatives of the CSA and ECCC, and/or other organizations nominated by the CSA. CSA reserves the right to invite additional knowledgeable people (Public Servants or others under NDA) to these meetings.

All meetings will be held between the Contractor and the TA at a mutually agreeable time. The Contractor must provide formal notification of the proposed meeting date to the TA no less than 10 working days before the meeting.

For meetings held at government venues, the Contractor must inform the TA of the names of Contractor and Subcontractor attendees no less than 10 working days before each meeting.

Technical Interchange Meetings are to be held by teleconferences monthly, and additional teleconferences or face-to-face review meetings may be held if necessary when mutually agreed to by the Contractor and the CSA project manager.

Meetings can be alternatively replaced by videoconference or teleconferences for cost and/or time savings and when appropriate to support the scope of the meeting.

3.8.3.1 Kick-off Meeting

Within two weeks of the contract award (or at a date mutually agreeable to by the PA, the TA and the Contractor) a Kick-Off Meeting should be scheduled by the Contractor. The Contractor should provide the meeting agenda at least five working days before the meeting. The presentation should include the following content:

- Review of contract deliverables;
- Work requirements;
- Foreground Intellectual Property (FIP) and Background Intellectual Property (BIP);
- Licensing issues if any;
- Project's funding and expected cash-flow;
- Presentation to include the required copyrights and intellectual property disclosure;
- Other items as deemed appropriate.

This meeting will be held at Contractor Facilities.

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

3.8.3.2 Review Meetings

During the contract, various meetings will be necessary to evaluate progress of the work. The Meetings will be held according to the schedule in Table 3.6-1. The Meetings are intended to provide an opportunity for the Contractor, the PA, the TA, and other invited attendees to review and discuss the following in detail, as necessary:

- The contents of the contract deliverables;
- The technical work of each task;
- Foreground Intellectual Property (FIP) and Background Intellectual Property (BIP);
- Discuss project management issues;
- Presentation to include the required copyrights and intellectual property disclosure;
- Other items as deemed appropriate.

The Contractor's project manager, the systems engineer and all key Contractor participants, including at least one representative from each Subcontractor, must attend all Review meetings.

3.8.3.3 Final Review Meeting

The Final Review Meeting will be held at the Canadian Space Agency at the end of the contract. The specific intent of this meeting will be to discuss in detail the results obtained and the proposed follow-on activities. The Final Review Meeting is intended to provide an opportunity for the Contractor, the PA, the TA and other invited attendees to review and discuss the project.

- Contract deliverables;
- Foreground Intellectual Property (FIP) and Background Intellectual Property (BIP);
- Licensing issues if any;
- Final Funding and cash-flow;
- Discuss project management issues;
- Presentation to include the required copyrights and intellectual property disclosure;
- Other items as deemed appropriate

The Contractor must submit the Final Data Package 10 working days before Contract End Date; document versions must be as per the CDRL.

The Contractor's project manager, the systems engineer and all key Contractor participants, including at least one representative from each Subcontractor, must attend the Final Review Meeting.

3.8.3.4 Technical Interchange Meetings

Technical Interchange Meetings [TIM] should be held on an as-needed basis as determined by the Technical Authority to discuss progress and consolidate input from the CSA and ECCC or other nominated organizations.

3.8.4 Agendas, Minutes and Action Item Log

The Contractor must provide a Meeting Agenda for all reviews and meetings including teleconferences and must deliver these to the TA no less than 5 working days before the meeting and must have it approved by the TA.

The Contractor must produce the minutes for all reviews and meetings including teleconferences and must deliver these to CSA no more than 5 working days after the meeting.

The Contractor must maintain a detailed Action Item Log (AIL) throughout the project to track actions resulting from all reviews and meetings including teleconferences using the following red-yellow-green spotlight method:

- 'Green' implying that the action item will be completed on-time.
- 'Yellow' implying that there exist an issue which will prevent meeting the deadline, and
- 'Red' implying that the action is past due.

Also, a chart indicating how many action items are open and how many are closed since the beginning of the project shall be produced at the meetings. The AIL must be delivered the next business day following the review or meeting (including teleconference).

3.8.5 Project Reporting

3.8.6 Documents Deliverables

The Contractor must deliver all documentation listed in the CDRL tables (Appendix A) as a minimum. The format and content of the deliverables must be in accordance with the requirements specified in the Data Item Descriptions (DIDs) (Appendix B), both the specific DID identified in the CDRL and the General Preparation Instructions, DID-0000.

Except for the documents that will remain CSA documents, the Contractor may propose documents in a contractor's format provided the purpose, scope and content equal or exceed the DID requirements. Subject to CSA approval, the content of the Contractor's document will replace the content of the document specified in the DID.

SI units must be used/supplied by the Contractor. Conversion factors must be supplied for all non-SI units used in the deliverable documents (including dates as YYYY-MM-DD).

The Contractor must obtain approval from the CSA for all CDRL Documents so indicated in the CDRL table (see Section 3.8.6.1).

3.8.6.1 Documents Delivered for Approval

The term “Approval” as used in this document and in other documents referred to herein, means written approval by CSA, of documents submitted by the Contractor. Once approved, the document is authorized for further use by CSA. The TA 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 TA’s approval. No request or document for which approval is required must be acted upon or implemented by the Contractor until such approval is provided. Such requests and documents will be reviewed promptly by the TA and the necessary written approval or disapproval will be provided after their receipt by CSA. In the event of a failure by the TA to approve or disapprove the document within 15 calendar days, the documents may be deemed approved. In the event that a request or document is disapproved, the TA will advise the Contractor in writing as to the reasons for such disapproval and will define the additions, deletions or corrections that the TA 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.

3.8.6.2 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 TA of a document for review shall imply that the document has been reviewed, commented on, revised as necessary, and has been determined to meet the requirements. The TA 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 TA does not concur with a document submitted for review, the TA will so notify the Contractor. Such notification will include a full explanation of the reasons for the lack of concurrence and will recommend the additions, deletions or corrections that the TA deems beneficial to the needs of the project.

The Contractor is obligated to consider implementation of the changes suggested by CSA insofar as the changes are in accordance with the relevant DID in Appendix B and this SOW. If written notification of concurrence is not provided by CSA within 15 calendar days of the receipt of the document, the document will be deemed to have been reviewed by the TA without comment.

3.8.7 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. At the request of the TA, copies of subcontractor documentation must be delivered to the TA.

The Contractor must ensure that all of the relevant requirements of this Statement of Work are flowed down to the subcontract Statements of Work.

3.9 INTELLECTUAL PROPERTY

The Contractor shall prepare Background and Foreground Intellectual Property (BIP and FIP) Report, identifying the BIP and FIP that will be generated in this study.

4 GOVERNMENT FURNISHED EQUIPMENT AND INFORMATION

There is no Government Furnished Equipment (GFE) associated with this SOW.

APPENDICES

APPENDIX A CONTRACT DATA REQUIREMENTS LIST (CDRL)

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

LEGEND:

A = Approval (in the Approval Category)

CF = Contractor's format

X = Ad-hoc, as and when requested

TABLE A-1: CDRL

Title	DID No.	Approval Category
Meeting Agenda	0004	A
Minutes of Meetings	0005	A
Action Items Log (AIL)	0006	A
Mission Objectives Review Report	0200	A
Instrument Concept Report	0210	A
Mission Conceptual Design Document	0220	A
Mission Requirements List	0230	A
Preliminary System Requirements List	0240	A
Mission Planning and Development Report	0250	A
BIP and FIP Disclosure Report	0260	A
Executive Report	0270	A
Technical Notes	CF	X

APPENDIX B DATA ITEMS DESCRIPTIONS (DIDs)

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DID-0000 - General Preparation Instructions

PURPOSE:

This DID describes the standard format for the preparation of deliverable project documentation. All documentation must be written in English and must be delivered in electronic format. Documentation must be prepared in the Contractor's format, however it must meet the requirements of this DID.

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. Electronic Copies

Electronic documents must be prepared using the most appropriate tool (Microsoft Word, Excel, MS Project, etc.); released versions must be delivered in electronic format and may be in PDF. Schedules must be submitted in Microsoft Project format. Documents must be delivered via e-mail or direct transfer (FTP). For direct transfer, a notification of the document's readiness and location on a Contractor repository must be sent.

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

WXYZ-CDRL-NUM-CIE_ContractNumber_sent2007-03-30

where:

WXYZ:	A 4-8 letter acronym of the project
CDRL-NUM:	The CDRL Identifier
CIE:	Name of the Company (no space, no hyphen)
Contract Number:	For example: _9F028-07-4200-03
_sentYEAR-MONTH-DAY:	Date Tracking Number

Electronic documents or notifications of their availability on Contractor repositories must be sent to the e-mail address of the TA.

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

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

The DVD-ROM label must present the following information:

- a) Company Name

- b) Document Title
- c) Document Number and Revision Status
- d) CDRL Number
- e) Contract Number

1.2. Electronic Documents Format

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

1.2.1. 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.

1.2.2. 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.

2. DOCUMENT STRUCTURE AND CONTENT

2.1. Overall

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

- a) Cover/Title Page;
- b) Table of Contents;
- c) Scope;
- d) Applicable and Reference Documents;
- e) Body of Document; and
- f) Appendices
- g) The following property notice of all internal pages: *Use, duplication or disclosure of this document or any of the information contained herein is subject to the Property Notice at the front of this document.*

2.2. Cover/Title Page

The title page must contain the following information:

- Document Number and date: Volume x of y (if multivolume)
- Rev. indicator / date of Rev.
- Document Title
- Project Name
- Contract No.
- CDRL Item No. or Nos., if one document responds to more than one CDRL, subject to prior approval from the TA.
- Prepared for: Canadian Space Agency
- Prepared by: Contractor name, CAGE Code, address, and phone number
- Product tree identifier, if applicable
- © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR]
- The following property notice: *This document is a deliverable under contract no. _____. It 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 of any of the information contained herein for other than the specific purpose for which it was disclosed is expressly prohibited outside the Government of Canada except as the Crown may otherwise agree to in writing.

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 figure, table, and appendix, in that order.

2.4. Scope

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

- a) Identification (number, title) of the system, hardware, or software to which the document applies;
- b) A brief overview of the system to which the document applies; and
- c) A summary of the purpose and content of the document.

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.

3. DOCUMENT REVISIONS

Changes in revised documents must be identified by a sidebar.

4. SUBMISSION OF DATA

Data must be submitted via Letter of Transmittal (or an electronic equivalent as mutually agreed by the TA and the Contractor), and acknowledged. The Letter of Transmittal will contain as a minimum, the Contract Serial Number, the CDRL Number and the Title. 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.

DID-0004 – Meeting Agenda

PURPOSE:

To clarify the purpose, content and timings 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 issues;
- f. Project management issues;
- g. Other topics;
- h. Review of any action items as a result of the current meeting and
- i. Set or confirm dates of future meetings.

DID-0005 – Minutes of Meetings

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 and must include 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 and the CSA,
 - d. Name and address of the Contractor;
2. Purpose and objective of the meeting;
3. Location;
4. Agenda;
5. Summary of the discussions, assumptions, decisions and agreements reached;
6. List of the attendees by name, position, phone numbers and e-mail addresses as appropriate;
7. Listing of open action items and responsibility for each action to be implemented as a result of the review;
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.”

The list of action items must include the following information:

1. the action item number;
2. a description of the action required;
3. the date the action item was opened;
4. the person responsible for ensuring that the action is carried out;
5. the due date for the action;
6. the status of the action (open or closed); and
7. any comments or remarks relevant to the action.

Once an action item is closed, the action item list should also indicate the date the action was complete.

DID-0006 – Action Items Log

PURPOSE:

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

PREPARATION INSTRUCTIONS:

The AIL must be in a tabular form, with the following headings in this order:

1. Item Number;
2. Red, yellow, green stoplight
3. Item Title;
4. Open Date;
5. Source of AI (e.g. MCR meeting, RID, etc.);
6. Originator;
7. Office of Prime Interest;
8. Person responsible (for taking action);
9. Target/Actual Date of Resolution;
10. Status (Open or Closed);
11. Remarks; and
12. Chart of graphical representation of open, closed, and total action items.

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-0200 – Mission Objectives Review Report

PURPOSE:

To review the AIM-North Mission Objectives and flow them down to a preliminary set of Mission Requirements. It is intended to be a brief initial assessment of the impact the AIM-North Mission Objectives will have on the mission concept, requirements, cost, complexity, and risk. In addition this document is intended to aid in the formation of the final Mission Objectives, and the development of a User Requirements Document.

PREPARATION INSTRUCTIONS:

The document must include as a minimum:

1. Review and summarize AIM-North Mission Objectives [AD-2]
2. Identify changes from previous AQ/GHG Mission concept [RD-1, RD-2]
3. Preliminary Mission Requirements
 - a. Flow down Mission Objectives to preliminary Mission Requirements
 - b. Provide traceability to Mission Objectives in a compliance matrix
 - c. Determine areas of incomplete, missing, ambiguous, or undefined information
 - d. Propose specifications to form a complete set of requirements
4. Sensitivity Analysis
 - a. Perform sensitivity analysis for all requirements
 - b. Impact on cost/complexity/risk/schedule
 - c. Determine challenging requirements
 - d. Determine key cost drivers
 - e. Assess impact on AIM-North space segment
 - f. Assess impact on AIM-North ground segment
5. Provide recommendations on requirements to reduce mission complexity

DID-0210 – Instrument Concept Report

PURPOSE:

To assess the impact of three different payload options on the AIM-North mission. This report is critical as it will be used as an input to select the payload option to most effectively meet the mission's needs. The down selected the payloads will be used to mature the Mission Concept Design.

PREPARATION INSTRUCTIONS:

The document must include as a minimum:

1. Introduction
 - a. Scope
 - b. Purpose
 - c. List of Assumptions
 - i. orbit,
 - ii. procurement of AQ payload,
 - iii. bus accommodation,
 - iv. etc.
2. Preliminary Applicable System/Mission Requirements (SNR, effl, etc.)
 - a. Traceability to Mission Objectives
3. Conceptual design of the three payload options
 - a. detailed product tree
 - i. GHG (iFTS), AQ(dispersive)
 - ii. GHG (dispersive), AQ (dispersive)
 - iii. Imbedded multi-channel dispersive spectrometer (AQ and GHG)
 - b. Identification of Key Technologies
 - c. Identification of Long-Lead Items
4. Optical design
5. Concept of operations
6. Performance analysis
7. Error budget
8. iFTS pixel movement
 - a. consequences
 - i. spectral mixing in inhomogeneous scene
 - ii. spatial resolution
 - b. imaging strategy
 - c. imaging constraints
 - d. correction technique
 - e. on-board processing requirements
9. Opto-mechanical design

10. Detailed resource estimates
 - a. mass,
 - b. power
 - c. volume
 - d. data rates
11. Impact on space segment / bus
 - a. cloud imager
 - b. on-board storage
 - c. on-board processing
 - d. antennae
 - e. down link
 - f. solar arrays
 - g. etc.
12. Impact on ground segment
 - a. data volume
 - b. storage
 - c. data processing
13. Compliance Assessment,
 - a. Compliance matrix to preliminary mission requirements
 - b. Current Best Estimates (CBE) of performance
14. Recommendations
 - a. Detailed comparison and Trade study
 - b. Recommendations

DID-0220 – Mission Conceptual Design Document

PURPOSE:

To develop mission concept. Assess the ability to meet primary objectives and report on the feasibility to meet the secondary mission objectives. Further this document must substantiate that the mission concept satisfies the MCR Exit Criteria appearing in AD-1

PREPARATION INSTRUCTIONS:

The document must include as a minimum:

1. An introduction including the scope, the purpose and a list of assumptions (if any);
2. Mission concept justification: providing a discussion of the main drivers and rationale for the selection of the concept
3. Mission overview including system decomposition
4. Identification of all interfaces
5. Space Segment Description and Performance Analysis
 - a. Payload
 - b. Spacecraft
 - c. Bus
 - d. Additional elements if applicable
6. Orbit Description
7. Constellation or formation-flying geometry
8. Concept of Operation;
9. Coverage Analysis
10. Space-to-Ground link;
11. Detailed Engineering Budgets, including: mass, power, data rates, on-board storage, ADCS, propulsion;
12. Launch Options and Accommodation;
13. Ground Segment Description
14. Data Products and Data Latency;
15. Calibration and Validation;
16. Compliance to Mission Requirements;

DID-0230 – Mission Requirements List

PURPOSE:

To capture the mission requirements. This document is in Excel format and is designed to facilitate the efficient exchange of information with the User and Science Team..

CONTENT:

The document includes the following:

- 1) A list of all mission requirements to respond to known and/or anticipated user requirements including explanatory notes when required. This list shall be organized by the high level mission architecture (e.g. Mission, Spacecraft, Bus, Payload, Ground Segment, Operations, etc.)
- 2) A traceability matrix to identify the correlation between mission requirements and Mission Objectives [AD-2] or User Requirements,
- 3) Current Best Estimate of Performance (CBE) for the current mission concept with respect to each requirement
- 4) Statement of compliance for the current Mission Concept with respect to each requirement
- 5) A list of any mission goals that would enhance the mission objectives if implemented including explanatory notes when required;
- 6) Any appendices required to provide detailed information pertinent to the mission requirements that is not suitable to be contained in the main document as explanatory notes.

DID-0240 – Preliminary System Requirements List

PURPOSE:

To list the preliminary System Requirements associated with the Mission Conceptual Design and provide traceability to the associated Mission Requirements.

This list will capture the lower level details of the Mission Conceptual Design that respond to the previously determined Mission Requirements. This will be used to validate the completeness of the Mission Conceptual Design and Mission Requirements while capturing the assumptions used in the Mission Planning and Development Report, such as the bottom-up costing and product tree associated with the Technology Readiness and Risk Assessment, and Product Assurance Requirements.

This document is in Excel format.

CONTENT:

The document includes the following:

- 1) A list of all System Level Requirements to respond to known and/or anticipated Mission Requirements (DID-230). This list shall be organized by the mission architecture (e.g. Mission, Spacecraft, Bus, Payload, Ground Segment, Operations, Product Assurance, etc.) and be consistent with the Mission Conceptual Design (DID-220).
- 2) A traceability matrix to identify the correlation between System Requirements and Mission Requirements,
- 3) Current Best Estimate of Performance (CBE) for the current mission conceptual design with respect to each requirement
- 4) Statement of compliance for the current Mission Concept with respect to each requirement

DID-0250 – Mission Planning and Development Report

PURPOSE:

To define the programmatic activities required to initiate and develop the mission.

PREPARATION INSTRUCTIONS:

The plan must include the following:

1. An introduction including the scope, the purpose and a list of assumptions (if any);
2. A description of the mission including its objectives;
3. Detailed mission product tree
4. Technology Readiness and Risk Assessment (TRRA);
5. Technology Roadmap (TRM);
6. Identification of Critical Technology Elements (CTE)
7. Technology development activities to be performed, detailing the urgency, criticality and the main risks and challenges of each activity;
8. Possible technology demonstrations;
9. Identification of development and manufacturing approach
10. Bottom-up life cycle cost for a Canadian mission;
11. Separated Life cycle costs for the development of a Canadian payload for contribution to an international mission
12. Estimated mission schedule including all major milestones;
13. Preliminary mission risk assessment;
14. Potential collaborations;
15. Proposed Canadian capabilities development strategy;
16. Recommendations for follow-on activities.

DID-0260 – FIP and BIP Disclosure Report

PURPOSE:

To fully disclose all FIP and BIP resulting from the study.

PREPARATION INSTRUCTIONS:

The report shall include the following:

- an introduction including the scope and the purpose;
- a list and description of all FIP resulting from the study; and
- a list and description of all BIP required by CSA for use of the FIP resulting from the study.

DID-0270 – Executive Report

PURPOSE:

To provide a summary of the work accomplished during the contract.

PREPARATION INSTRUCTIONS:

The Executive Report will be placed in the public domain (e.g. CSA's library, publication and/or website).

The report should not exceed ten (10) pages.

The Contractor will submit an electronic copy of the Executive Report in the Final Data Package. The structure for the Executive Report is as follows:

- 1) Introduction;
- 2) Project Objectives;
- 3) Approach / Project Tasks;
- 4) Accomplishments;
- 5) Science/Technology:
 - a) Innovative Aspects;
 - b) Application Fields;
- 6) Business Potential, Benefit and Impact on the organization;
- 7) Ownership of Intellectual Property; and
- 8) Publications / References.

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

Copyright 20XX by Canadian Space Agency

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

APPENDIX C ACRONYMS AND ABBREVIATIONS

AD	Applicable Document
ADCS	Attitude Determination and Control System
AI	Action Item
AIL	Action Item Log
AIM-North	Atmospheric Imaging Mission for Northern Regions
AQ	Air Quality
ARO	After Receive Order
BIP	Background Intellectual Property
CBE	Current Best Estimate
CSA	Canadian Space Agency
CTE	Critical Technology Element
CDRL	Contract Data Requirements List
DID	Data Item Description
ECCC	Environment and Climate Change Canada
Effl	effective focal length
FIP	Foreground Intellectual Property
FOR	Field of Regard
FOV	Field of View
FRM	Final Review Meeting
FTS	Fourier Transform Spectrometer
GEO	Geosynchronous Orbit
GFE	Government Furnished Equipment
GHG	Greenhouse Gas
GiFOV	Ground Instantaneous Field of View
iFTS	imaging Fourier Transform Spectrometer
HEO	Highly Elliptical Orbit
ICR	Instrument Concept Report
IFOV	Instantaneous Field of View
IP	Intellectual Property
IR	Infrared
KOM	Kick-Off Meeting
LEO	Low Earth Orbit
MCD	Mission Concept Document
MCR	Mission Concept Document
MOD	Mission Objectives Document
MRD	Mission Requirements Documents
MRL	Mission Requirements List
MRR	Mission Requirements Review
NDA	Non-Disclosure Agreement
OGD	Other Government Department
OSSE	Observation System Simulation Experiment
PA	Project Authority
RD	Reference Document
RM	Review Meeting
RMS	Root Mean Square

SNR	Signal to Noise Ratio
SOW	Statement of Work
SZA	Solar Zenith Angle
TA	Technical Authority
TAP	Three Apogee
TBD	To Be Determined
TEMPO	Tropospheric Emissions: Monitoring of Pollution
TIM	Technical Interchange Meeting
TRL	Technology Readiness Level
TRRA	Technology Readiness and Risk Assessment
TRM	Technology Roadmap
UV	Ultraviolet
UVN	Ultraviolet/Visible/Near Infrared
URD	User Requirements Document