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

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Place du Portage , Phase III
Core 0B2 / Noyau 0B2
Gatineau
Québec
K1A 0S5
Bid Fax: (819) 997-9776

LETTER OF INTEREST
LETTRE D'INTÉRÊT

Title - Sujet Horizon Radar / Radar transhorizon
RTP – Radar transhorizon polaire- POTHR- Polar Over the Horizon Radar

Solicitation No. - N° de l'invitation	**Date**
W7714-228152/A	2023-08-29
Client Reference No. - N° de référence du client	**GETS Ref. No. - N° de réf. de SEAG**
W7714-228152	PW-$$QF-125-29155
File No. - N° de dossier	**CCC No./N° CCC - FMS No./N° VME**
125qf.W7714-228152	

Solicitation Closes - L'invitation prend fin
at - à 02:00 PM Eastern Daylight Saving Time EDT
on - le 2023-10-03 Heure Avancée de l'Est HAE

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

Address Enquiries to: - Adresser toutes questions à:	**Buyer Id - Id de l'acheteur**
Lacoursiere, Paul	125qf
Telephone No. - N° de téléphone	**FAX No. - N° de FAX**
(343) 551-1529 ( )	( ) -

Destination - of Goods, Services, and Construction:
Destination - des biens, services et construction:

Specified Herein
Précisé dans les présentes

Comments - Commentaires

Instructions: See Herein

Instructions: Voir aux présentes

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Delivery Required - Livraison exigée	**Delivery Offered - Livraison proposée**
See Herein – Voir ci-inclus	

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Telephone No. - N°de téléphone
Facsimile No. - N° de télécopieur

Name and title of person authorized to sign on behalf of Vendor/Firm (type or print)
Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)

Signature **Date**

Issuing Office - Bureau de distribution
Electronics, Simulators and Defence Systems Div.
/Division des systèmes électroniques et des systèmes de simulation et de défense
11 Laurier St. / 11, rue Laurier
8C2, Place du Portage
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Québec
K1A 0S5

Canada

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PART 1 – PURPOSE AND NATURE OF THE REQUEST FOR INFORMATION (RFI)

1.1 Purpose of the Request for Information

1.1.1 Background

Public Services and Procurement Canada (PSPC) is launching this Request for Information (RFI) to engage industry, through consultation, on its interest, capacity and ability to supply and deliver the requirements of the Department of National Defence's Polar Over the Horizon Radar (P-OTHR) Program.

As part of this program a project exists to study the feasibility of using sky-wave over-the-horizon radar technology in the polar cap region of the Canadian Arctic for detecting air targets. This project is referred to as polar over-the-horizon radar.

One-way and two-way sounding work is already in progress in the Canadian Arctic. This Statement of Work moves beyond sounding and involves putting together radar functional components at an Arctic Site.

The services of a Contractor are required to design, build, install, and operate, a polar over-the-horizon radar site, incorporating a government-furnished power source and a government-furnished antenna array. The system will be used to determine the effect of the Aurora Borealis on target detection beyond line-of-sight.

1.1.2 The purpose of this initial RFI is to achieve the following:

a) Provide industry with initial information on the preliminary requirements of the P-OTHR project;

b) Request detailed information and feedback from industry, including preliminary cost estimates;

c) Determine the capability of industry to satisfy the requirements;

d) Request preliminary interest, input and questions;

e) Determine any limitations and restrictions to industry capabilities, such as, but not limited to, Intellectual Property Rights and other factors that would impact their ability to bid on any resulting solicitation and/or to deliver the requirements.

Respondents are requested to provide answers and feedback related to the attached drafts documents.

Further amendments to this RFI may be conducted with, but not limited to, the following objectives:

a) Provide industry with updated Statement of Requirements and sustainment requirements;
b) Refine the requirements and further develop the procurement and sustainment strategies;
c) Gather industry knowledge, expertise and recommendations with regard to best practices that would increase the success of a solicitation and/or identify any risks that would impact a solicitation;
d) Obtain industry feedback on any issues that would impact their ability to bid on any resulting solicitation and/or to deliver the requirements; and
e) Enhance competition, access and fairness to the resulting solicitation(s).

1.2 Nature of the Request for Information

This is not a bid solicitation. This RFI may not result in issuance of a solicitation and will not result in the award of any contract. As a result, interested suppliers of any goods or services described in this RFI should not reserve stock or facilities, nor allocate resources, as a result of any information contained in this RFI. Nor will this RFI result in the creation of any source list. Therefore, whether or not any interested supplier responds to this RFI, this will not preclude that supplier from participating in any

future procurement. Also, the procurement of any of the goods and services described in this RFI will not necessarily follow this RFI. This RFI is simply intended to solicit information and feedback from industry with respect to the matters described in this RFI.

Nothing in this RFI will be construed as a commitment from PSPC to issue a solicitation for this requirement. PSPC may use non-proprietary information provided in this review and/or in the preparation of any formal solicitation document.

PSPC will not be bound by anything stated herein and reserves the right to change at any time, any or all parts of the requirement, as it deems necessary. PSPC also reserves the right to revise its procurement approach, as it considers appropriate, either based upon information submitted in response to this RFI or for any other reason it deems appropriate.

1.3 Industrial and Technological Benefits

1.3.1 Application of the Industrial and Technological Benefits (ITB) Policy

The Industrial and Technological Benefits (ITB) Policy, including the Value Proposition (VP), is not expected to apply to the Polar Over the Horizon Radar (P-OTHR) project. Industry is encouraged to maximize the participation of Canadian industry to meet is requirement.
For more information about the ITB Policy, please visit www.canada.ca/itb

PART 2 – RESPONSE INSTRUCTIONS AND INFORMATION

2.1 Nature and Format of Responses Requested

Canada's current view of its requirement for the P-OTHR project and the preliminary technical requirements are all detailed in this RFI.

Respondents are invited to provide comments regarding the content of any elements of this RFI and related attached documents included in this RFI. Respondents can comment directly on, and return an electronic copy of the applicable Attachments listed. Alternatively, Respondents can comment on a different media and format by appropriately referencing the document and section commented on. Respondents should explain any assumptions they make in their interpretation of the requirements.

Further, Canada is seeking input and responses to specific documents covering important elements of the requirement prior to proceeding with developing its procurement strategy.

Respondents are invited to provide the name(s) of the person(s) who will participate to prepare supplier's responses.

2.2 Response Costs

Canada will not reimburse any respondent for expenses incurred in responding to this RFI.

2.3 Treatment of Responses

2.3.1 Use of Responses

Responses will not be formally evaluated. The responses received may be used by Canada to develop or modify procurement strategies or any draft documents contained in this RFI. Canada will review all responses received by the RFI closing date. Canada may, at its discretion, review responses received after the RFI closing date.

2.3.2 Review Team

A review team composed of representatives of PSPC and the Department of National Defence (DND) will review the responses and participate in all industry engagement activities. Canada reserves the right to hire any independent consultant, or use any Government

resources that it considers necessary to review any response. Not all members of the review team will necessarily review all responses.

2.3.3 Confidentiality

Respondents should indicate and mark any portions of their response that they consider proprietary or confidential. Canada will handle these portions in a confidential manner in accordance with the Access to Information Act of Canada.

2.3.4 Follow-up Activity

PSPC may, at its discretion, contact any respondents to follow up with additional questions or for clarification of any aspect of a response. PSPC may, at its discretion agree to meet with respondents to provide respondents with the opportunity to present and/or demonstrate their capabilities in relation to this RFI.

Respondents' presentations are at no obligation to PSPC and respondents will be responsible for all costs associated with PSPC's invitation to make a presentation.

2.4 Contents of this RFI

This RFI contains preliminary draft technical and sustainment requirements, costing information, and procurement information. Comments regarding any aspect of this RFI are requested. This RFI also may contains specific questions addressed to the industry.

2.5 Format of Responses

2.5.1 Response Preparation and Submission

Responses must be submitted only by Email to:

Name: Paul Lacoursiere
Title: Contracting Authority
Public Works and Government Services Canada
Acquisitions Branch
Directorate: Supply Team Lead; Navigation, Sonar and Radar Systems Division
Address: 11 Laurier St., PDP3, Gatineau Quebec
Telephone: Cell 343-551-1529
E-mail address: Paul.Lacoursiere@tpsgc-pwgsc.gc.ca

Due to the nature of the Request for Information, transmission of responses by mail/courier to PSPC **will not be accepted**.

2.5.2 Response Content

The first page of each document of the response provided should contain:

a) The RFI number;
b) The name of the company that the respondent is representing;
c) The title, the name, and the contact information of the respondent; and
d) The date of submission of the documents.

All pages should be identified with the company's name along with page numbers.

2.6 Enquiries

PSPC will not necessarily respond to enquiries in writing or by circulating answers to all interested suppliers as this is not a solicitation process. However, respondents who have questions regarding this RFI may direct their enquiries to the Contracting Authority named above in section 2.5.1:

2.7 Submission of Responses

2.7.1 Time and Place for Submission of Responses

The RFI will remain open until xxxx xxxx 2023

Suppliers interested in providing a response should deliver it in accordance with section 2.5 to the attention of the Contracting Authority by the time and the date listed above to the email address indicated in Part 2 section 2.5.

2.7.2 Responsibility for Timely Delivery

Each respondent should ensure their response are delivered on time to the correct email address as stated in section 2.5.

2.8 Security Requirements

There are no security requirements associated with responding to this RFI. Any future procurement actions undertaken in support of this requirement might require a government security clearance of secret.

Suppliers interested in being sponsored should begin the process to obtain their security clearance by contacting the Contracting Authority.

2.9 Official Languages

Responses to this RFI are requested to be presented in either of the Official Languages of Canada.

2.10 Industry Day and Consultations

During this RFI period, the following activities **may** take place. A formal RFI Amendment will be submitted with details if and when required:

- Industry Day(s);
- One-on-One sessions;
- Working Group Meetings.

Canada will not reimburse any respondent for expenses incurred in relation to the attendance of any of the above activities.

Following the industry consultation period, DND will review the responses received and update the provided information as applicable. This RFI will be amended with updated documents as appropriate.

Depending on the content of the additional responses, Canada may engage in additional one-on-one industry consultation sessions.

PART 3 – PRELIMINARY PROCUREMENT STRATEGY

3.1 Introduction

The procurement strategy for any of the P-OTHR project requirements has not yet been determined.
PSPC will confirm, define and identify its proposed procurement strategy following internal and industry consultations such as this initial RFI.

As outlined in section 1.2 above, nothing in this RFI will be construed as a commitment from PSPC to issue a solicitation for this requirement. No timeline has been established for the procurement of P-OTHR Project requirements. This initial and follow-on RFI will inform the development of the potential procurement strategy, requirements and timelines.

3.1.1 Trade Agreements

Unless specified otherwise, the requirement is subject to the provisions of the Canada Free Trade Agreement (CFTA), Canada - European Union Comprehensive Economic and Trade Agreement (CETA), World Trade Organization Agreement on Government Procurement (WTO-AGP), Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), Canada - Chile Free Trade Agreement (CCFTA), Canada - Colombia Free Trade Agreement, Canada - Honduras Free Trade Agreement, Canada - Korea Free Trade Agreement, Canada - Panama Free Trade Agreement, Canada - Peru Free Trade Agreement (CPFTA) and the Canada - Ukraine Free Trade Agreement (CUFTA).

3.2 Background

It is part of PSPC's mandate to plan, execute and manage the procurement of certain Goods and Services on behalf of DND above a certain value.

3.3 Additional Industry Capability

3.3.1 Indigenous Participation.

The Government of Canada is committed to reconciliation and meaningful engagement with Indigenous Peoples. This project may have considerations for Indigenous Peoples and Firms owned by Indigenous Peoples throughout the duration of the project.

As part of Canada's commitment to reconciliation with Indigenous Peoples, this procurement may require bidders to include an Indigenous Participation Requirement that provides opportunities for Indigenous Firms (including Subcontracting) and Indigenous Peoples to participate in the performance of the federal work through the provision of training and apprenticeship, labour and goods and services. All bidders may be required to provide specific planned participation possibility through a rated criteria for the Indigenous Peoples and Firms owned by Indigenous Peoples throughout the duration of the project.

Canada has worked successfully in the past to leverage capacity building for Indigenous Peoples and is pleased to continue working collaboratively with Indigenous communities and stakeholders on all federal projects.

3.4 Preliminary System Requirements and Associated Costing

The RFI will remain open until 03-10- 2023

We will except responses, anytime, prior to the solicitation closing date.

PART 4 Related Documents:

Annex A Statement of Work

Annex B Financial Evaluation Document

Annex C Technical Evaluation Document

Annex D Transmit and Receive site Document

ANNEX A

STATEMENT OF WORK

1. TITLE

Polar Over-the-Horizon Radar – Second System

2. BACKGROUND

2.1. During 2015 to 2020, Defence Research and Development Canada (DRDC) executed the All Domain Situational Awareness (ADSA) Program, which included a study of the feasibility of using sky-wave over-the-horizon radar technology in the polar cap region of the Canadian Arctic for detecting air targets. This study involved the installation of the first Canadian Polar Over-the-Horizon Radar (POTHR) system, at a location in Nunavut.

2.2. The objective of this Statement of Work (SOW) is to design, build, install, and operate a second Canadian POTHR system at a location in the Northwest Territories, which will work cooperatively with the previously installed Nunavut POTHR system. Additional information on the Nunavut POTHR system can be obtained by the Bidder from contracts W7714-186492/001/SV and W7714-186492/002/SV.

2.3. The SOW also outlines task authorization work that may be required for ongoing Technical Investigation and Engineering Services (TIES) to support further development and operation of the POTHR system.

3. ACRONYMS

ADSA	All Domain Situational Awareness
CA	Contract Authority
CDR	Critical Design Review
DRDC	Defence Research and Development Canada
FAT	Factory Acceptance Test
GFE	Government-Furnished Equipment
IDR	Initial Design Review
MPS	Master Project Schedule
NCR	National Capital Region
PDR	Preliminary Design Review
PM	Project Manager
PMP	Project Management Plan
POTHR	Polar Over-the-Horizon Radar
PRM	Project Review Meeting
RMP	Risk Management Plan
SAT	Site Acceptance Test
SDD	System Design Document
SEP	System Engineering Plan
SOW	Statement of Work
SPR	System Power Requirements
TA	Technical Authority
TIES	Technical Investigation and Engineering Services
VCR	Visit Clearance Request
WBS	Work Breakdown Structure

4. APPLICABLE DOCUMENTS & REFERENCES

AD1: Appendix A – STATEMENT OF REQUIREMENTS, Polar Over-the-Horizon Radar – Second System

AD2: Annex D – TRANSMIT AND RECEIVE SITE LOCATION, Classified SECRET

AD3: H129-48/2015E-PDF – Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kilohertz to 300 gigahertz – Health Canada

AD4: MIL-STD-1474E – Noise Limits, Design Criteria Standard – Department of Defense

5. TASKS

5.1. **System Delivery** – The Contractor must design, build, test, and install transmit and receive systems in compliance with the requirements specified in Appendix A and Annex D.

5.2. **Project Management** – The Contractor must maintain a Project Manager (PM) throughout the duration of the contract.

5.2.1. The Contractor must assign a Contractor Project Manager with the responsibility and authority to plan, execute, and control the work on behalf of the Contractor.

5.2.2. The Contractor must prepare, deliver, implement, and maintain a Project Management Plan (PMP) describing the Contractor's plan and processes for organizing, staffing, controlling, and directing the activities necessary to deliver the contractual requirements.

5.2.3. The Contractor PM must be the primary point of contact between the Contractor and the Technical Authority (TA).

5.2.4. The Contractor must prepare, deliver, implement, and maintain a Work Breakdown Structure (WBS), encompassing all the contractual requirements, and use the approved WBS as the basis for organizing, controlling, and reporting the progress of the Work of the Contract.

5.2.5. The Contractor must prepare, deliver, implement, and maintain a Risk Management Plan (RMP) that identifies key schedule, cost, and technical risks, including mitigation approaches to be considered for the five (5) highest-impact project risks.

5.2.6. The Contractor must prepare, deliver, implement, and maintain a Master Project Schedule (MPS), referencing the WBS, and identifying the major milestones in each of the project phases, including design, fabrication, testing, installation, and operations. The Contractor must use the approved master project schedule as the governing document for all scheduling activities.

5.2.7. The Contractor must prepare, deliver, implement, and maintain a Systems Engineering Plan (SEP) that addresses the technical perspective of each project phase, including all technical reviews, testing, and configuration management.

5.3. **Communication and Meetings** – The Contractor must set up, co-chair, and attend all formal and informal meetings with representatives of Canada, to review progress throughout the duration of the Contract.

5.3.1. For all formal meetings, the Contractor must:

a) Provide meeting materials including an attendee list, agenda, and where applicable, slide decks, text documents and/or spreadsheets to the TA at least two (2) business days before the meeting time;

b) Provide teleconferencing or physical meeting facilities, to facilitate the meeting;

c) Produce meeting minutes within five (5) business days of the meeting, along with a separate action items document including the items discussed, action items raised, points of contact for each action item, and updated status; and

d) Distribute the meeting minutes and action items document to all attendees, within two (2) business days following the approval of the minutes by the TA.

5.3.2. The Contractor must conduct a Kick-off Meeting, co-chaired by the Contract Authority (CA), no later than one (1) month after Contract award.

5.3.3. The Contractor must conduct Project Review Meetings (PRM) with the TA, monthly starting after Contract award, to review progress and technical issues.

5.3.4. The Contractor must conduct:

a) An initial design review (IDR) meeting, two (2) months after Contract award;

b) A preliminary design review (PDR) meeting, three (3) months after Contract award; and

c) A critical design review (CDR) meeting, seven (7) months after Contract award.

5.4. **Design Phase** – The Contractor must complete a minimum of three (3) stages of design review, initial design review, preliminary design review, and critical design review.

5.4.1. The Contractor must prepare and maintain a System Design Document (SDD). The SDD must be updated and delivered to the TA at least five (5) business days before each design review meeting (Initial, Preliminary, and Critical).

5.4.2. The Contractor must prepare and maintain a Traceability Matrix document identifying the mapping of the Statement of Requirements to the system design document. The Traceability Matrix document must be updated and delivered to the TA at least five (5) business days before each design review meeting (Initial, Preliminary, and Critical).

5.4.3. The Contractor must prepare and maintain an analysis of the System Power Requirements (SPR), in the form of a spreadsheet, identifying all equipment and their respective power requirements. The SPR must be updated and delivered to the TA at least five (5) business days before each design review meeting (Initial, Preliminary, and Critical). The analyzed system power requirements may change over time but must never exceed the levels defined in the Statement of Requirements.

5.4.4. The Contractor must prepare and maintain a Hierarchical Equipment List which documents all equipment that defines the system, including government-furnished components. The Hierarchical Equipment List must be updated and delivered to the TA at least five (5) business days before each design review meeting (Initial, Preliminary, and Critical).

5.4.5. The Contractor must identify, document, and deliver the technical specifications, data sheets and technical drawings of the equipment comprising the system to the TA. This is to facilitate the integration of the system with the Government-furnished equipment. The equipment specifications and drawings must be updated and delivered to the TA at least five (5) business days before each design review meeting (Initial, Preliminary, and Critical).

5.5. **Factory Acceptance Test (FAT)**

5.5.1. The Contractor must prepare and deliver, within twelve (12) months of Contract award, a Factory Acceptance Test Procedure, for review and approval by the TA.

5.5.2. The Contractor must prepare and deliver, within twelve (12) months of Contract award, a Factory Acceptance Test Traceability Matrix identifying a mapping of the Statement of Requirements to the steps within the FAT procedure intended to test the requirement.

5.5.3. The Contractor must perform a dry run of the full FAT procedure, to ensure challenges are resolved in advance of the FAT.

5.5.4. The Contractor must conduct a FAT Readiness Review, at least five (5) business days prior to conducting the FAT, by preparing and presenting a report to the TA documenting the results of the dry run.

5.5.5. The Contractor must conduct the FAT at the Contractor facility following the approved FAT procedure and in the presence of the TA, within twelve (12) months of Contract award.

5.5.6. The Contractor must conduct a FAT Functional Configuration Audit with the TA, no more than ten (10) business days after the FAT, and produce a report documenting the results, validating that a successful FAT has occurred and has been witnessed by the TA.

5.6. **Local Field Test**

5.6.1. Local Field Test is defined as testing of the full system, in several installments, at DRDC test beds located in the National Capital Region (NCR). The test beds are Transmit and Receive sites that are scaled down versions of the deployment sites and provide a real-life environment for testing. This testing mitigates risks associated with discovering technical challenges at the final Site Acceptance Test (SAT), where it is extremely difficult to address due to the logistics associated with site access. The Local Field Test will be on Government premises therefore, the processing of a Visit Clearance Request (VCR) is to be expected. The date of the Local Field Test is flexible, but it must occur between the FAT and the SAT.

5.6.2. The Contractor must prepare and deliver a Local Field Test Procedure, for review and approval by the TA at least one (1) month prior to the Local Field Test.

5.6.3. The Contractor must prepare and deliver a Local Field Test Traceability Matrix identifying a mapping of the Statement of Requirements to the steps within the test procedure intended to test the requirement, at least one (1) month prior to the Local Field Test.

5.6.4. The Contractor must conduct the Local Field Test following the approved procedure and in the presence of the TA.

5.6.5. The Contractor must conduct a Local Field Test Functional Configuration Audit with the TA, within one (1) month following the Local Field Test, and produce a report documenting the results, validating that appropriate testing has occurred and has been witnessed by the TA.

5.7. **System Transportation and Installation**

5.7.1. The Contractor must produce and deliver Site Installation Drawings showing equipment installation compliant with the Statement of Requirements, including the Contractor-furnished shelters, equipment in these shelters, earth well/grounding design, and shelter patch panels, within sixteen (16) months of Contract award.

5.7.2. The Contractor must package all Contractor-furnished components to provide adequate protection against damage, deterioration, and loss of identification during storage, handling, and shipment.

5.7.3. The Contractor must transport equipment to the sites in the Canadian Northwest Territories described in Annex D.

5.7.4. The Contractor must install the systems in their respective locations, as directed by the TA, connecting the systems to the Government-furnished equipment, within seventeen (17) month of Contract award.

5.8. **Site Acceptance Test (SAT)**

5.8.1. The Contractor must prepare and deliver, within sixteen (16) months of Contract award, a Site Acceptance Test Procedure, for review and approval by the TA.

5.8.2. The Contractor must prepare and deliver, within sixteen (16) months of Contract award, a Site Acceptance Test Traceability Matrix identifying a mapping of the Statement of Requirements to the steps within the SAT procedure intended to test the requirement.

5.8.3. The Contractor must perform a dry run of the SAT procedure, to ensure challenges are resolved in advance of the SAT.

5.8.4. The Contractor must conduct a SAT Physical Configuration Audit with the TA after installation and at least five (5) business days before the SAT, and produce a report documenting the results, verifying the as-built system baseline.

5.8.5. The Contractor must conduct a SAT Readiness Review after the SAT dry run and at least five (5) business days before the SAT, by preparing and presenting a report to the TA documenting the results of the dry run.

5.8.6. The Contractor must conduct the SAT following the approved SAT procedure and in the presence of the TA, within sixteen (16) months of Contract award.

5.8.7. The Contractor must conduct a SAT Functional Configuration Audit with the TA, no more than ten (10) business days after the SAT, and produce a report documenting the results, validating that a successful SAT has occurred and has been witnessed by the TA.

5.9. **Systems Operation Support**

5.9.1. The Contractor must prepare and deliver an Operations Procedure Manual for the transmit and the receive sites, for review and approval by the TA at least five (5) business days prior to conducting Operations.

5.9.2. The Contractor must prepare and deliver, within twenty-four (24) months of Contract award, a User Manual for all applications and equipment with any form of user interface and provide updates following configuration changes.

5.9.3. The Contractor must provide Spare Parts for all functional components identified in the Statement of Requirements, to be retained at the system site locations.

a) The Contractor must deliver the spare parts to the site locations prior to system installations. These are for immediate use in case of faults with equipment. Defective modules will be swapped with the spare ones and will be then sent for repair.

b) The Contractor must provide as spare parts a quantity that is at least 12.5% of the quantity installed in the system, except for high-power amplifiers (including power combiners) for which the Contractor must provide as spare parts a quantity that is at least 50% of the quantity installed in the system. For functional components with module counts not divisible by eight (8), such as operator consoles, the Contractor must supply the next higher whole number of spare modules. For additional clarity, the spare quantities are provided in the following table:

Functional Component	System Quantity	Spares Quantity	Total Quantity
Waveform generator	256 channels	32 channels	288 channels
Digital up-converter	256 channels	32 channels	288 channels
Digital-to-analog converter	256 channels	32 channels	288 channels
High-power amplifier (with harmonic filtering)	256 input channels 64 output channels 64 combiners	128 input channels 32 output channels 32 combiners	384 input channels 96 output channels 96 combiners
Operator console	1 unit	1 unit	2 units
Transmit antenna array	64 antennas 64 transmission lines	8 antennas 8 transmission lines	72 antennas 72 transmission lines
Receive antenna array	1024 antennas 1024 transmission lines	128 antennas 128 transmission lines	1152 antennas 1152 transmission lines

6. TASK AUTHORIZATION WORK

6.1. The Contractor may be required to perform various tasks within the scope of the Contract, on an "as and when requested" basis. An obligation of any work will come into force only when a Task Authorization is approved and issued in accordance with the Task Authorization Process of the Contract using the form DND-626.

6.2. The Contractor may undertake TIES tasks when further investigations are warranted or when problems occur with the POTHR systems where Contractor assistance is necessary to investigate the cause of the problem(s) and determine and evaluate solutions. To satisfy any TIES task, the Contractor must provide relevant data, report findings, and make recommendations supported by sound engineering practices as detailed in the Task Authorization.

6.3. Site Preparation

6.3.1. The Contractor may be required to clear the Transmit and Receive sites described in Annex D of vegetation obstacles to install the antenna arrays. Any such activities would need to be reviewed by the TA to ensure local restrictions are followed. Heavy machinery or solutions with detrimental impacts to the environment may not be acceptable.

6.3.2. The ground will be frozen and covered with deep snow in the winter, so there are seasonal limitations to when the site preparation work may be performed.

6.4. System Operation

6.4.1. The Contractor may be required to provide staff to operate and maintain all functional components of the system in an operational state, for fourteen (14) consecutive days up to twelve (12) hours per day. Training may be provided to operate all Government-furnished equipment at both the Transmit and Receive sites prior to Operations.

6.4.2. The Contactor must cycle up the system, transitioning the site from a power off state to an operational state at least seven (7) days prior to the start of Operations, and report any unexpected conditions or events to the TA within twenty-four (24) hours of the event. The cycle up activities may include transporting functional modules from local storage locations to the operational sites,

reconnecting modules to have the system conform to the as-built system baseline. The cycle up may also include a change in operation mode, as defined in the Statement of Requirements.

6.4.3. The Contractor must conduct the site Operations following the TA approved Operations Procedure Manual.

6.4.4. The Contractor must use spare parts to immediately replace failed system components and prepare the failed component for transportation to a Contractor facility for repair.

6.4.5. The Contractor must duplicate all recorded Data to external media that are considered part of the system. The system must have two sets of external media, such that one set is used to store the duplicate data, which is then delivered to the TA, while the other set is kept at the site for the next Operation. The site must have always at least one set of external media. The Contractor must package the external media set holding the duplicate data for shipping and provide it to a designated onsite Crown representative. The Contractor must provide the external media required to support each Operation.

6.4.6. The Contractor must delete system recorded data within seven (7) days of receiving a request from the TA.

6.4.7. The Contractor must cycle down the system to protect the site from the environment. This may include putting the site into a form of hibernation or other safe state between Operations. This hibernation should include ensuring that the equipment shelters are maintained above the minimum indoor storage temperature as defined in the Statement of Requirements to protect the equipment against damage from the cold. If it is not feasible to put the system in a hibernation mode, the cycle down activity may include disconnecting equipment and transporting it to local storage locations.

6.4.8. The Contractor must review the operational procedures, and document Lessons Learned after each operational period, then propose procedure changes to the TA.

6.5. **Hardware component**

6.5.1. The Contractor may be required to develop and deliver functional hardware components (e.g., waveform generator, high-power amplifier, antenna, etc.), in addition to the spare components identified in 5.9.3 b), to support POTHR applications.

7. DELIVERABLES

Number	Task Reference & Description of the Deliverables	Format	Delivery Date
7.1	5.2.2 – Project Management Plan 5.2.4 – Work Breakdown Structure 5.2.5 – Risk Management Plan 5.2.6 – Master Project Schedule 5.2.7 – Systems Engineering Plan	Electronic – Word and/or PDF	Updated Quarterly – Beginning one (1) month after Contract award.
7.2	5.3.1 a) – Formal Meeting Agenda and supporting meeting materials.	Electronic – Word, and/or PDF	At least two (2) business days in advance of each formal meeting.
7.3	5.3.1 c) – Formal Meeting Minutes and Action items document.	Electronic – Spreadsheet, Word, and/or PDF	Within five (5) business days of the meeting date.
7.4	5.4.1 – System Design Document 5.4.2 – Traceability Matrix	Electronic – Spreadsheet,	At least five (5) business days before each

Number	Task Reference & Description of the Deliverables	Format	Delivery Date
	5.4.3 – System Power Requirements 5.4.4 – Hierarchical Equipment List 5.4.5 – Equipment Specifications and Drawings	PowerPoint, Word, and/or PDF	design review (Initial, Preliminary, and Critical).
7.5	5.5.1 – FAT Procedure 5.5.2 – FAT Traceability Matrix	Electronic – Word, and/or PDF	Within twelve (12) months of Contract award.
7.6	5.5.4 – FAT Readiness Review Report	Electronic – Word, and/or PDF	After the FAT dry run and at least five (5) business days before the FAT.
7.7	5.5.6 – FAT Functional Configuration Audit	Electronic – Word, and/or PDF	Within ten (10) business days of the FAT.
7.8	5.6.2 – Local Field Test Procedure 5.6.3 – Local Field Test Traceability Matrix	Electronic – Word, and/or PDF	At least one (1) month before Local Field Test.
7.9	5.6.5 – Local Field Test Functional Configuration Audit	Electronic – Word, and/or PDF	Within one (1) month of the Local Field Test.
7.10	5.7.1 – Site Installation Drawings	Electronic – PDF	Within sixteen (16) months of Contract award.
7.11	5.7.4 – Install Systems at Sites	Equipment	Within seventeen (17) months of Contract award.
7.12	5.8.1 – SAT Procedure 5.8.2 – SAT Traceability Matrix	Electronic – Word, and/or PDF	Within sixteen (16) months of Contract award.
7.13	5.8.4 – SAT Physical Configuration Audit Report	Electronic – Word, and/or PDF	After the installation and at least five (5) business days before the SAT.
7.14	5.8.5 – SAT Readiness Review Report	Electronic – Word, and/or PDF	After the SAT dry run and at least five (5) business days before the SAT.
7.15	5.8.7 – SAT Functional Configuration Audit	Electronic – Word, and/or PDF	Within ten (10) business days of the SAT.
7.16	5.9.1 – Operation Procedure Manual	Electronic – Word, and/or PDF. A hard copy, in English, must be maintained onsite. A separate laminated hardcopy of the wiring and connection diagram, in	At least five (5) business days before Operations begin.

Number	Task Reference & Description of the Deliverables	Format	Delivery Date
		English, must be maintained at all times at the site.	
7.17	5.9.2 – System User Manual	Electronic – Word, and/or PDF. A hard copy, in English, must be maintained onsite	Within twenty-four (24) months of Contract award.
7.18	5.9.3 a) – System Spare Parts	Equipment	At the time of system transportation, and ongoing as required.
7.19	**Task Authorization Work** – Up to twelve (12) System Operations, each as described in 6.4, optioned and exercised individually over a maximum total period of three (3) years following the SAT. 6.4.5 – Recorded Data (external media) 6.4.8 – Lessons Learned document and Procedure Change Proposals	Electronic – Word, and/or PDF	Following each Operation phase, or as requested by the TA.

8. LANGUAGE OF WORK

8.1. The Contractor must provide all communication, deliverables, and tasks in English.

9. LOCATION OF WORK

9.1. The Contractor must perform design and FAT work at Contractor facilities.

9.2. The Contractor must perform the Local Field Test at DRDC test beds located in the NCR.

9.3. The Contractor must perform site installation, SAT, and Operations tasks in multiple remote Canadian Arctic locations, as described in Annex D.

10. TRAVEL

10.1. The Contractor must travel to multiple remote Canadian Arctic locations, as described in Annex D.

10.2. The Treasury Board Travel Directive will apply for any travel, accommodation, and living expenses. The details will be laid out in the basis of payment document.

11. GOVERNMENT-FURNISHED EQUIPMENT (GFE)

11.1. The Receive site GFE includes:

- 1024-channel Receiver as described in Appendix A
- Site for antenna array installation
- Road access within site
- Gravel shelter pad at site

- Electrical power supply
- Power cables from power source to Contractor-furnished shelter
- Logistics support as described in Annex D

11.2. The Transmit site GFE includes:

- Site for antenna array installation
- Road access within site
- Gravel shelter pad at site
- Electrical power supply
- Power cables from power source to Contractor-furnished shelter(s)
- Logistics support as described in Annex D

12. SPECIAL CONSIDERATIONS

12.1. The ground will be frozen and covered with deep snow in the winter, so there are seasonal limitations to when the antenna arrays can be installed.

12.2. Main power access is from local utilities and is beyond the control of the Government. Generators are being procured by the Government as backup power sources but will require frequent fueling.

APPENDIX A to ANNEX A

STATEMENT OF REQUIREMENTS

1. Transmitter functional requirements

1.1. Functional components

1.1.1. Waveform generator

The system must have a digital waveform generator with 256 channels, which produces, simultaneously, in-phase and quadrature digital baseband waveforms.

1.1.2. Digital up-converter

The system must have a digital up-converter with 256 channels, which converts in-phase and quadrature digital baseband waveforms into real-value digital waveforms at a specified carrier frequency.

1.1.3. Digital-to-analog converter

The system must have a digital to analog converter with 256 channels.

1.1.4. High-power amplifier

The system must have a high-power amplifier with 256 individual channels grouped into 64 output channels by combining the output of groups of 4 individual channels, using a four-way high-power combiner.

1.1.5. Operator console

The system must have a laptop computer transmit operator console that provides a user interface, applications, and equipment required to perform configuration and monitoring of the waveform generator, digital up-converter, digital-analog converter, and high-power amplifier.

1.1.6. Antenna array

The system must have a transmit antenna array with 64 elements, where each output channel of the high-power amplifier is connected to one antenna of the array by means of one coaxial transmission line.

1.2. Configuration

1.2.1. Configuration tool

A software application must be delivered that provides a single-screen configuration tool on the transmit operator console for configuring all user-selectable parameters for the waveform generator, digital up-converter, digital-analog converter, and high-power amplifier.

1.2.2. Frequency change

The configuration tool must allow a single entry to change the carrier frequency of all channels simultaneously.

1.2.3. Logging of configuration

The configuration tool must log the carrier frequency, the waveform definition file, the up-conversion rate, the transmit start time, and the transmit stop time, in a file accessible to the system operator.

1.3. Monitoring

1.3.1. Monitoring tool

A software application must be delivered that provides a single-screen monitoring tool on the operator console for displaying whether the system is transmitting or not, the carrier frequency, the name of the waveform definition file, the up-conversion rate, the most recent transmit start time, any errors preventing the intended transmissions and any system related warnings.

1.3.2. Channel health

The monitoring tool must determine the forward and reverse power of the transmitted signal in each analog transmit channel and report measured values in a 16-by-16 matrix showing the measured numerical values in decibels with an uncertainty margin of no worse than ±0.5 decibel, inside a color-coded cell, with the color codes reflecting whether the reported power levels meet certain, user selectable, pre-set threshold values.

1.3.3. Logging of monitoring

The monitoring tool must log the forward and reverse power levels of the transmit signal at a rate of no less than 1 measurement per second.

1.3.4. Ethernet packet drops

The monitoring tool must report any instances of Ethernet packet drops on any Ethernet data communication paths and abort the transmission upon discovery of the packet drop.

General information: Ethernet packet drops can lead to corrupted waveforms and violation of the system radio licence; thus packet drops are not acceptable.

2. Transmitter signal requirements

2.1. Waveform generation

2.1.1. Waveform generation rate

The system must be capable of reading 256 channels of digital in-phase and quadrature waveforms from storage and forwarding it to the 256-channel digital up-converter at a rate of up to 62.5 kilosamples per second per channel.

General information: It is estimated that the waveform generation requires a data rate of at least 250 kilobytes per second per channel, or for 256 channels, it requires a data rate of at least 64 megabytes per second.

2.1.2. Waveform storage

The system must have a minimum of 8 terabytes dedicated to waveform storage in addition to any space needed for software applications used by the system.

2.1.3. Waveform file upload

The system must allow the user to connect a Government-Furnished laptop computer to the system and upload a waveform to the system storage at a rate of at least 100 megabytes per second.

2.1.4. Shading

The system must allow the user to apply a user-defined amplitude and phase weighting to every channel, through selecting text files from the Graphical User Interface of the program. This process is referred to as “shading”.

General information: The intent of shading is to allow the user to define a 64-channel basic radar waveform that is independent of carrier frequency. Basic radar waveforms need only be modified by amplitude and phase when applied to a phased array at an arbitrary carrier frequency. The shading process requires much less storage space than programming and uploading waveform files for every conceivable carrier frequency that could be used during a test. More complicated radar waveforms, involving for example multiple simultaneous beams, may not be able to use shading.

2.1.5. Waveform sequencing

The system must be capable of storing and transmitting sequences of up to 10,000 entries. A sequence is a set of waveforms to be transmitted consecutively and automatically, where each waveform in the set is referred to as an entry. Each entry in the sequence may have a unique waveform definition, carrier frequency, start time, stop time, and shading.

General information: The primary intent of the sequence is to allow the transmitter to operate as a wide-sweep backscatter ionogram. A dedicated Government-furnished receiver outside the scope of this Statement of Requirements will be used for this operating mode. While the wide-sweep backscatter ionogram does not require a unique waveform for each carrier frequency, the ability to change waveform across entries of the sequence is retained in order to facilitate more complicated experiments.

2.1.6. Start of waveform generation

The start of waveform generation must be selectable as either manual by user command through a Graphical User Interface or automatic at a time pre-configured by the user. A failure of the system to start by either of these means during acceptance testing (such as the case of a system crash) will be considered a failure to meet this requirement.

2.1.7. Time standard

When starting at a pre-configured time, the system must generate and use a Global Positioning System-derived pulse-per-second signal as the time reference.

General information: This requirement is to ensure that transmit and receive components of the system are using the same time reference.

2.1.8. Start latency

In the case of a manual start through user command, the waveform generation must start within 30 seconds of the user command being issued.

2.1.9. Stop of waveform generation

The stop of waveform generation must be selectable as either manual through by user command through a Graphical User Interface or automatic at a pre-configured time. A failure of the system to stop by either of these means (such as the case of a system crash) will be considered a failure to meet this requirement.

2.1.10. Stop latency

In the case of a manual stop through user command, the waveform generation must stop within 30 seconds of the user command being issued.

2.2. Digital up-conversion

2.2.1. Frequency range

The digital up-converter numerically controlled oscillator must be adjustable over the range 3 to 30 megahertz at a resolution of 1 hertz.

2.2.2. Frequency selection

The operator must be able to select a single numerically controlled oscillator frequency common to all channels using the configuration tool or a waveform sequence.

2.2.3. Frequency cadence

When transmitting a sequence, the system must be able to transmit new carrier frequencies at a cadence of no less than one transmit carrier frequency every 200 milliseconds, except when a new carrier frequency involves a change of high-power amplifier harmonic filter bands, in which case the cadence must be no less than one transmit carrier frequency every 500 milliseconds.

General information: As an example, when transmitting a sequence, the system can start transmitting at carrier frequency “x” at time equals 0 seconds, start transmitting at carrier frequency “y” at time equals 0.2 seconds, and so on. There may be a gap in transmissions immediately prior to time equals 0.2 second in order for the system to re-configure from frequency “x” to frequency “y”, which is addressed in the next requirement.

2.2.4. Frequency change time

When transmitting a sequence, the system must have a maximum frequency change time of 50 milliseconds, except when a frequency change involves a change of high-power amplifier harmonic filter bands, in which case the system must have a maximum frequency change time of 500 milliseconds.

General information: As an example, when transmitting a sequence, the system can start transmitting at carrier frequency “x” at time equals 0 seconds, stop transmitting at carrier frequency “x” at time equals 0.15 seconds, start transmitting at carrier frequency “y” at time equals 0.2 seconds, stop transmitting at carrier frequency “y” at time equals 0.35 seconds, and so on.

2.2.5. Digital up-conversion factor

The selection of in-phase and quadrature sample rates must consist of at least the following selections: 62.5 kilohertz, 31.25 kilohertz, 25.0 kilohertz, and 12.5 kilohertz, with the up-conversion rate common to all channels.

2.2.6. Phase coherence

At the start of waveform generation, the numerically controlled oscillators for all channels must start from the same state to ensure that the in-phase and quadrature waveforms of all channels are multiplied by the same digital sinusoids in the up-conversion process.

General information: The phase coherence requirement can be confirmed by verifying the inter-channel time skew requirement, described below, using a tonal signal.

2.2.7. Amplitude resolution

All the signal processing on the waveform must be represented at an amplitude resolution of no less than 32 bits. After digital up-conversion, the least significant 16 bits should be set to zero.

2.3. Digital-to-analog conversion

2.3.1. Conversion rate

The waveform must be represented at a rate of 100 megasamples per second.

2.3.2. Frequency standard

The system must generate and use a Global Positioning System-disciplined 100 megahertz signal as the frequency reference for the digital-to-analog conversion.

2.3.3. Amplitude resolution

The waveform must be represented at an amplitude resolution of no less than 16 bits. The 16 bits must be the most significant 16 bits passed by the digital up-conversion.

2.3.4. Inter-channel time skew

The maximum time skew between any pair of channels is 1 nanosecond.

2.3.5. Length of waveform

The length of the waveform must be limited only by the data storage capacity of the system.

General information: This requirement can lead to waveforms that are several hours in length.

2.3.6. Spurious signals

The system must only produce an output that is a replica, at the up-conversion frequency of operation, of the programmed in-phase and quadrature waveforms as defined in the user-uploaded files. No extra signals whether random, transient, or otherwise, must be transmitted by the system.

General information: Extra signals that are not based on the in-phase and quadrature waveforms can result in violations of the system radio licence and in unwanted artifacts in the radar system data.

2.4. High-power amplification

2.4.1. Maximum output power

Each of the 256 individual channels in the power amplifier must provide an output power of no less than 1 kilowatt continuous wave at all carrier frequencies and under all load conditions presented by the antenna array, as measured at a reference plane at the power amplifier end of the cables connecting the power amplifier and the antenna array elements. This requirement refers to forward power (power with a Poynting vector flowing from the power amplifier towards the antenna array) at the fundamental frequency. This power is measured at a reference plane that is after harmonic filtering, but before the cable runs to the antennas.

General information: The forward power of the system is therefore no less than 256 kilowatts.

2.4.2. Power adjustability

The power amplifier output power must be adjustable by varying the amplitude of the input waveform.

General information: The power amplifier will likely work in compression, so there is no explicit linearity requirement.

2.4.3. Power variation across channels

For a common drive amplitude across all channels of the power amplifier, the maximum difference in output power between any pair of channels of the power amplifier must be no more than 0.5 decibels.

2.4.4. Reverse power

Each channel of the power amplifier must be able to operate continuously and indefinitely with up to 1 kilowatt of reverse power (power with a Poynting vector flowing from the antenna array towards the power amplifier), under all load conditions presented by the antenna array as measured at a reference plane at the power amplifier end of the cables connecting the power amplifier and the antenna array elements, and under all forward power levels.

2.4.5. Modulations

The power amplifier must support linear frequency modulated pulses, with defined rise and fall times.

2.4.6. Rise time

The power amplifier must be capable of producing output waveforms across all channels with rise time of no more than 100 microseconds.

General information: Rise time is defined as the time it takes the output signal to change from 10% to 90% of its maximum amplitude.

2.4.7. Fall time

The power amplifier must be capable of producing output waveforms across all channels with fall time of no more than 100 microseconds.

General information: Fall time is defined as the time it takes the output signal to change from 90% to 10% of its maximum amplitude.

2.4.8. Frequency range

The power amplifier must operate over a frequency range of 3 megahertz to 30 megahertz.

2.4.9. Harmonic suppression

The power amplifiers must incorporate high-power harmonic filters that suppress odd and even harmonics of the carrier frequency to below -60 decibels-carrier up to 30 megahertz, and -170 decibels-carrier above 30 megahertz.

General Information: This requirement is related to harmonic emissions from the power amplifier, which is nonlinear and thus when fed a signal at frequency *f* emits not only at *f* but also at *nf*, where *n*=2, 3, 4, and so on. For example, when transmitting at 6 megahertz, the requirement states that at 12, 18, 24 and 30 megahertz the output power must be 60 decibels below the fundamental signal and that at 36, 42, 48, and so on, the output power must be 170 decibels below the fundamental signal.

General information: A filter bank may be required, such as a bank with channels covering frequency bands 3-5, 5-8, 8-13, and 13-21 megahertz.

General information: The 170 decibels suppression requirement above 30 megahertz arises from the presence of an aeronautical communications station located next to the antenna array.

General information: Non-harmonic out-of-band emissions are addressed under the Phase noise and Spurious-free dynamic range requirements.

2.4.10. Phase noise

The single-sideband phase noise in the analog output signal of each channel must be below -90 decibels-carrier per hertz at all frequencies offset by more than 1 hertz from the user-selected carrier-frequency, and below -170 decibels-carrier per hertz at all frequencies above 30 megahertz, as measured at the output of the power amplifier including the filter.

2.4.11. Spurious-free dynamic range

Each channel output must have a full-scale single-tone spurious-free dynamic range of at least 90 decibels within the 100 kilohertz-wide frequency band centered at the user-selected carrier-frequency, and at least 70 decibels at all frequencies outside this 100 kilohertz-wide band up to 30 megahertz, and 170 decibels at frequencies above 30 megahertz, as measured at the output of the power amplifier including the filter.

General information: It is preferable that the spurious emissions do not combine coherently across channels, so that the spurious-free dynamic range will improve when channels are combined by a phased antenna array.

3. Transmitter physical requirements

3.1. Shelter

3.1.1. Sheltered components

The waveform generator, digital up-converter, digital-to-analog converter, and high-power amplifier, must reside in a transmit equipment shelter to provide protection from the weather.

General information: Multiple shelter units may be needed to meet maximum shelter size constraints.

3.1.2. Location

The transmit equipment shelter must be located at a site in the Canadian Northwest Territories as given in Annex D.

3.1.3. Dimensions

The transmit shelters must each fit within a 20-foot long by 8-foot wide by 8.5-foot high envelope and weigh no more than 20,000 pounds without the waveform generator and power amplifier modules installed.

General information: The above sizes conform to a standard-height 20-foot ISO shipping container.

General information: Final rack mounting of electronic equipment may occur after the transmit shelter has been placed in its final location.

3.1.4. Lifting

The transmit shelters must each be suitable for overhead lift using a crane or side lift using a forklift.

3.1.5. Placement

The transmit shelters must each be positioned on a wooden block foundation that sits on a Government-furnished gravel pad.

3.2. Antenna array

3.2.1. Location

The transmit antenna array must be located at a site in the Canadian Northwest Territories as given in Annex D.

3.2.2. Dimensions and spacing of antenna elements

The transmit antenna array must consist of an 8-by-8 square grid array of monopole antennas. Each monopole must be 9 meters tall and have a feed height of one meter measured from the ground. The monopole must be constructed from two separate metal pieces, one is 1 meter tall and the second is 8 meters tall. The two metal pieces must be connected by inserting a short section of dielectric material. The monopole must have a diameter of 3 inches and must be positioned to have a spacing of 8 meters from the other monopoles in the surrounding rows and columns of the grid. Each monopole must have 32 ground radial wires of 18 American Wire Gauge and 9 meters length. The ends of the radials must be secured to the ground with metal ground staples.

3.2.3. Input transformer

Each transmit antenna element must have at its input an impedance transformer. The transformer must have an impedance transformation ratio of 50-ohm to 200-ohm. The 200-ohm port is connected between the monopole and the ground radials at the feed height. The transformer must be able to handle an input power of no less than 4 kilowatts continuous wave.

3.2.4. Transmission line

The transmit transmission lines connecting the high-power amplifiers to the transmit antenna array must be 300 meters in length and have a one-way attenuation of no more than 3 decibels at 20 megahertz. All transmit cables must be the same length within ±0.1 meter. All transmit cables must be male N-type and have hexagonal nuts on both ends to facilitate use of a torque wrench. The transmit cable must be connected to the 50-ohm port of the input transformer.

3.2.5. Lightning protection

Each transmit transmission line must incorporate a lightning arrestor to protect the system from lightning strikes.

3.3. Environmental

3.3.1. Outdoor operating temperature range

The transmit shelters and antenna array must be capable of operating in ambient outdoor temperatures between -50 degrees Celsius and +30 degrees Celsius.

General information: The shelters can be heated and/or air conditioned to allow sheltered equipment to operate over a narrower temperature range.

3.3.2. Indoor storage temperature range

In the event of power interruptions and loss of heating, the transmit sheltered equipment must be able to survive in an unpowered state down to a temperature of -40 degrees Celsius.

General information: Coolant for any liquid-cooled equipment must have anti-freeze properties to -40 degrees Celsius.

3.3.3. Wind resistance

The transmit shelters and antenna array must be capable of operating in winds up to 100 kilometers per hour.

3.3.4. Ice resistance

The transmit shelters and antenna array must be capable of operating with ice accumulation of up to 10 centimeters.

3.3.5. Snow resistance

The transmit shelters and antenna array must be capable of operating with snow accumulation of up to 100 centimeters.

3.3.6. Insect resistance

All air ducts for the transmit shelters must be screened at a resolution of no coarser than 0.25 centimeter to avoid entry of insects.

3.3.7. Bullet resistance

The transmit shelters must be able to withstand entry of bullets from a 7.62 millimeter caliber rifle with a bullet velocity of 800 meters per second.

General information: Bullet holes have been observed in previous experience.

3.3.8. Entry resistance

All transmit shelter doors must be a high-security type, inward-opening, with no external moving parts (rotating door handles, padlocks, and so on).

General information: The outside of the shelter doors could have a deadbolt keyhole and a fixed (non-rotating) handle, which would satisfy this requirement.

3.4. Power

3.4.1. Power draw

The transmit system power draw must not exceed 600 kilovolt-amps.

General information: The system may draw a relatively small amount of power between operational periods in order to keep sheltered equipment minimally heated.

3.4.2. Connections

The transmit system must connect using fixed wiring to a Government-furnished outdoor transformer and Government-furnished power cables.

General information: The Government-furnished transformer output will be 120/208 volts wye at 750 kilovolt-amps.

General information: System components may use single-phase power at either 120 volts line-neutral or 208 volts line-line.

3.4.3. Breaker panels

The transmit shelters must have internal wall-mounted electrical circuit breaker panels from which power is distributed to all equipment and fixtures.

3.4.4. Grounding

The transmit system must have a common earthing well, where separate earthing sub-systems are tied together.

3.5. Layout

3.5.1. Doors

The transmit shelters must each have at minimum two personnel doors.

General information: This is for safety, in case one door gets blocked by snow or ice.

3.5.2. Compartments

The transmit shelters must have at least two areas, consisting of one area for the equipment and one area for the operators.

3.5.3. Soundproofing

The equipment and operator areas must be separated by a soundproof wall and door. The soundproofing must conform to MIL-STD-1474E Noise Limits standard.

General information: MIL-STD-1474E is a publicly available document.

3.5.4. Operator area

The operator area must have two operator console positions, each with a portable computer that can be removed between operational periods.

3.5.5. Emergency accommodations

The operator area must have sufficient floor space such that 2 people can lay out sleeping mats if stranded due to weather.

3.5.6. Tools storage

The equipment area must have storage for typical tools for expected repairable items.

3.5.7. Spares storage

The equipment area must have storage space equivalent to 12.5 percent of sheltered equipment.

3.6. Patch Panel

3.6.1. Number of jacks

The transmit shelter must have patch panel(s) with a total of 64 jacks, for all transmission cable runs to the elements of the antenna array.

3.6.2. Location

The patch panel should be in the transmit shelter but can comprise weatherized standalone unit(s) outside the shelter if there is insufficient space in the shelters.

General information: The intent of the patch panel is to provide an intermediate junction point between the sheltered equipment and the outdoor antennas to facilitate antenna testing and troubleshooting.

3.6.3. Patch panel jack type

All patch panel jacks on the antenna side of the panels must be female N-type. Jacks on the electronics side of the panels are at the discretion of the Contractor.

3.6.4. Patch panel jack spacing

All patch panel jacks must be spaced by at least 10 centimeters to accommodate connection of cables with gloved hands.

3.6.5. Patch panel weather protection

The patch panel must be protected from weather, such as wind, ice, and snow, by a removable weather guard.

3.7. Radiation safety

3.7.1. Radiation hazard compliance

The operator area inside transmit shelter must meet the H129-48/2015E-PDF Safety Code 6 guidelines from Health Canada regarding radiation safety during operations.

General information: H129-48/2015E-PDF is a publicly available document.

3.7.2. Kill button

The transmit shelter must have an emergency “Stop Radiating” push button, that must stop radiation within 1 second of being pressed.

4. Receiver functional requirements

4.1. Functional components

4.1.1. Government-furnished receiver

The system must interface with, operate with, and record data using, a 1024-channel Government-furnished receiver.

General information: The Government-furnished receiver is a D-TA System 23. The receiver has a front end with 1024 channels of analog filtering and low-noise amplification, followed by an analog-to-digital converter with 1024 channels, a digital down-converter with 1024 channels, a recorder, and an operator console. The receiver has a low-power transmitter and transmit antenna that periodically transmits a calibration signal to perform a phase and amplitude calibration of the 1024-element receive antenna array. The receiver has a Jackson Labs LN Rubidium Global Positioning System antenna and receiver.

4.1.2. Contractor-furnished receive antenna array

The system must have a Contractor-furnished receive antenna array with 1024 elements, where each antenna of the array is connected to one channel of the Government-furnished receiver by means of one coaxial transmission line.

5. Receiver signal requirements

General information: There are no receiver signal requirements for the Contractor. Signal requirements are encapsulated in the Government-furnished receiver.

6. Receiver physical requirements

6.1. Shelter

6.1.1. Sheltered components

The Government-furnished receiver must reside in a single Contractor-furnished receive equipment shelter to provide protection from the weather. Cable connections to the Government-furnished receiver must be fulfilled through a two-stage arrangement. The first stage is done through a separate external patch panel to which the 1024 coaxial cables from the antenna array elements are connected. The second stage is done through intermediate 1024 cables connecting the patch panel to the Government-furnished receiver inside the shelter.

General information: The Government-furnished receiver will occupy the space of four standard 38-rack unit 19-inch racks of 30-inch maximum depth (152 rack units total). The racks are not Government-furnished.

6.1.2. Location

The receive equipment shelter must be located at a site in the Canadian Northwest Territories as given in Annex D.

6.1.3. Dimensions

The receive shelter must fit within a 20-foot long by 8-foot wide by 8.5-foot high envelope and weigh no more than 20,000 pounds without the electronics installed.

General information: The above sizes conform to a standard-height 20-foot ISO shipping container.

General information: Final rack mounting of electronic equipment may occur after the receive shelter has been placed in its final location.

6.1.4. Lifting

The receive shelter must be suitable for overhead lift using a crane or side lift using a forklift.

6.1.5. Placement

The receive shelter must be positioned on a wooden block foundation that sits on a Government-furnished gravel pad.

6.2. Antenna array

6.2.1. Location

The receive antenna array must be located at a site in the Canadian Northwest Territories as given in Annex D.

6.2.2. Dimensions and spacing of antenna elements

The receive antenna array must consist of a 32-by-32 square grid array of monopole antennas. Each monopole must be 6 meters tall and have a feed height of 60 centimeters measured from the ground. The monopole must be constructed from two separate metal pieces, one is 60 centimeters tall and the second is 5.4 meters tall. The two metal pieces must be connected by inserting a short section of dielectric material. The monopole must have a diameter of 3 inches and must be positioned to have a spacing of 16 meters from the other monopoles in the surrounding rows and columns of the grid. Each monopole must have 8 ground radial wires of 18 American Wire Gauge and 6 meters length. The ends of the radials must be secured to the ground with metal ground staples. The monopole must have a 50-ohm port connected between the taller metal piece and the ground wires and must be placed at the feed height.

General information: The transmit and receive arrays intentionally have different element counts, monopole heights, feed heights, monopole spacings, ground radial counts, and ground radial wire lengths.

6.2.3. Transmission line

The receive transmission lines connecting the receive antenna array to the receiver must be no more than 600 meters in length and have a one-way attenuation of no more than 15 decibels at 20 megahertz. All receive cables must be male N-type and have hexagonal nuts on both ends to facilitate use of a torque wrench. The transmission line must be connected to the 50-ohm port of the monopole.

General information: Unlike the transmit array cables, the receive arrays cables may have different lengths in order to reduce cost.

6.2.4. Lightning protection

Each receive transmission line must incorporate a lightning arrestor and a limiter to protect the system from lightning strikes.

6.3. Environmental

6.3.1. Outdoor operating temperature range

The receive shelter and antenna array must be capable of operating in ambient outdoor temperatures between -50 degrees Celsius and +30 degrees Celsius.

General information: The shelter can be heated and/or air conditioned to allow sheltered equipment to operate over a narrower temperature range.

6.3.2. Indoor storage temperature range

In the event of power interruptions and loss of heating, the receive sheltered equipment must be able to survive in an unpowered state down to a temperature of -40 degrees Celsius.

General information: Coolant for any liquid-cooled equipment must have anti-freeze properties to -40 degrees Celsius.

6.3.3. Wind resistance

The receive shelter and antenna array must be capable of operating in winds up to 100 kilometers per hour.

6.3.4. Ice resistance

The receive shelter and antenna array must be capable of operating with ice accumulation of up to 10 centimeters.

6.3.5. Snow resistance

The receive shelter and antenna array must be capable of operating with snow accumulation of up to 100 centimeters.

6.3.6. Insect resistance

All air ducts for the receive shelter must be screened at a resolution of no coarser than 0.25 centimeter to avoid entry of insects.

6.3.7. Bullet resistance

The receive shelter must be able to withstand entry of bullets from a 7.62 millimeter caliber rifle with a bullet velocity of 800 meters per second.

General information: Bullet holes have been observed in previous experience.

6.3.8. Entry resistance

All receive shelter doors must be a high-security type, inward-opening, with no external moving parts (rotating door handles, padlocks, and so on).

General information: The outside of the shelter doors could have a deadbolt keyhole and a fixed (non-rotating) handle, which would satisfy this requirement.

6.4. Power

6.4.1. Power draw

The power draw of receive system components provided by the Contractor, and not those furnished by the Government, must not exceed 20 kilovolt-amps.

General information: The system may draw a relatively small amount of power between operational periods in order to keep sheltered equipment minimally heated.

General information: The power draw of the Government-furnished receiver equipment will not exceed 40 kilovolt-amps.

6.4.2. Connections

The receive system must interface to a Government-furnished outdoor transformer and Government-furnished power cables.

General information: The Government-furnished transformer output will be 120/208 volts wye at 75 kilovolt-amps.

General information: System components may use single-phase power at either 120 volts line-neutral or 208 volts line-line.

6.4.3. Breaker panels

The receive shelter must have an internal wall-mounted electrical circuit breaker panel from which power is distributed to all equipment and fixtures.

6.4.4. Grounding

The receive system must have a common earthing well, where separate earthing sub-systems are tied together.

6.5. Layout

6.5.1. Doors

The receive shelter must have at minimum two personnel doors.

General information: This is for safety, in case one door gets blocked by snow or ice.

6.5.2. Compartments

The receive shelter must have at least two areas, consisting of one area for the equipment and one area for the operators.

6.5.3. Soundproofing

The equipment and operator areas must be separated by a soundproof wall and door. The soundproofing must conform to MIL-STD-1474E Noise Limits standard.

General information: MIL-STD-1474E is a publicly available document.

6.5.4. Operator area

The operator area must have two operator console positions, each with a portable computer that can be removed between operational periods.

6.5.5. Emergency accommodations

The operator area must have sufficient floor space such that 2 people can lay out sleeping mats if stranded due to weather.

6.5.6. Tools storage

The equipment area must have storage for typical tools for expected repairable items.

6.5.7. Spares storage

The equipment area must have storage space equivalent to 12.5 percent of sheltered equipment.

6.6. Patch Panel

6.6.1. Number of jacks

The receive shelter must have a standalone patch panel with a total of 1024 jacks, for all transmission cable runs to the elements of the antenna array.

6.6.2. Location

The patch panel must consist of weatherized standalone unit(s) outside the shelter.

General information: The intent of the patch panel is to provide an intermediate junction point between the sheltered receive equipment and the outdoor antennas to facilitate antenna testing and troubleshooting.

6.6.3. Patch panel jack type

All patch panel jacks on the antenna side of the panels must be female N-type. Jacks on the electronics side of the panels are at the discretion of the Contractor.

6.6.4. Patch panel jack spacing

All patch panel jacks must be spaced by at least 10 centimeters to accommodate connection of cables with gloved hands.

6.6.5. Patch panel weather protection

The patch panel must be protected from weather, such as wind, ice, and snow, by a removable weather guard.

ATTACHMENT 2

FINANCIAL BID PRESENTATION AND EVALUATION OF PRICE

1. Financial Bid Presentation

Bidders must submit their financial Bid in accordance with the following:

(a) A firm lot price for the Core component, which must not exceed the maximum funding specified in Part 2.

(b) Firm hourly Labour Rates for the Task Authorization component.

(c) A firm unit price for individual functional hardware components, for the Task Authorization component.

(d) The total amount of Applicable Taxes are to be shown separately, if applicable.

(e) The information should be provided in accordance with the Financial Evaluation Matrix in Annex B - Basis of Payment.

(f) For Canadian-based Bidders, prices must be in Canadian funds, Applicable Taxes excluded and Canadian customs duties and excise taxes included.

For foreign-based Bidders, prices must be in Canadian funds, Applicable Taxes, Canadian customs duties and excise taxes excluded. Canadian customs duties and excise taxes payable by Canada will be added, for evaluation purposes only, to the prices submitted by foreign-based Bidders.

For the purpose of the Bid solicitation, Bidders with an address in Canada are considered Canadian-based Bidders and Bidders with an address outside of Canada are considered foreign-based Bidders.

1.1 Item 1 - Core component

A firm lot price for the Work defined in Annex A - Statement of Work, excluding section 6 - Task Authorization Work, which must not exceed the maximum funding specified in Part 2 of this Bid solicitation. The total amount of Applicable Tax is to be shown separately, if applicable. Bidders must propose milestone amounts in accordance with Table 2-1 below.

Table 2-1: Proposed Milestones

Milestone Number	Milestone Description and Required Deliverables	Percent	Cumulative Percent
1	Kickoff meeting, with initial version of project management documents: 5.2.2 – Project Management Plan 5.2.4 – Work Breakdown Structure 5.2.5 – Risk Management Plan 5.2.6 – Master Project Schedule 5.2.7 – Systems Engineering Plan	5	5

Milestone Number	Milestone Description and Required Deliverables	Percent	Cumulative Percent
2	Initial design review, with initial version of system design documents: 5.4.1 – System Design Document 5.4.2 – Traceability Matrix 5.4.3 – System Power Requirements 5.4.4 – Hierarchical Equipment List 5.4.5 – Equipment Specifications and Drawings	5	10
3	Preliminary design review, with updated version of system design documents: 5.4.1 – System Design Document 5.4.2 – Traceability Matrix 5.4.3 – System Power Requirements 5.4.4 – Hierarchical Equipment List 5.4.5 – Equipment Specifications and Drawings	10	20
4	Critical design review, with final version of system design documents: 5.4.1 – System Design Document 5.4.2 – Traceability Matrix 5.4.3 – System Power Requirements 5.4.4 – Hierarchical Equipment List 5.4.5 – Equipment Specifications and Drawings	15	35
5	Factory acceptance test plan: 5.5.1 – FAT Procedure 5.5.2 – FAT Traceability Matrix	2.5	37.5
6	Factory acceptance test readiness: 5.5.4 – FAT Readiness Review Report	2.5	40
7	Factory acceptance test completion: 5.5.6 – FAT Functional Configuration Audit	20	60
8	Local field test plan: 5.6.2 – Local Field Test Procedure 5.6.3 – Local Field Test Traceability Matrix	2.5	62.5
9	Local field test completion: 5.6.5 – Local Field Test Functional Configuration Audit	2.5	65
10	Site installation plan: 5.7.1 – Site Installation Drawings	2.5	67.5
11	Site installation completion: 5.7.4 – Install Systems at Sites	2.5	70
12	Site acceptance test plan: 5.8.1 – SAT Procedure 5.8.2 – SAT Traceability Matrix	2.5	72.5
13	Site acceptance test readiness: 5.8.4 – SAT Physical Configuration Audit Report 5.8.5 – SAT Readiness Review Report	2.5	75

Milestone Number	Milestone Description and Required Deliverables	Percent	Cumulative Percent
14	Site acceptance test completion: 5.8.7 – SAT Functional Configuration Audit	10	85
15	Manuals and spares: 5.9.1 – Operation Procedure Manual 5.9.2 – System User Manual 5.9.3 a) – System Spare Parts	5	90
16	Holdback	10	100

1.1.1 Price Breakdown

Bidders are requested to detail the following elements for each milestone of the Work, as applicable:

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

(b) Equipment: Specify each item required to compete the Work and provide the pricing basis of each one, Canadian customs duty and excise taxes included, as applicable. The items will be deliverable to Canada upon completion of the Contract.

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

(d) Travel and Living Expenses: Indicate the number of trips and the number of days for each trip, the cost, destination, and purpose of each journey, together with the basis of these costs which may not exceed the limits of the Treasury Board (TB) Travel Directive. With respect to the TB Directive, only the meal, private vehicle and incidental allowances in Appendices B, C, and D of the Directive, https://www.njc-cnm.gc.ca/directive/d10/en, and the other provisions of the Directive referring to "*travellers*", rather than those referring to "*employees*", are applicable. The Treasury Board Secretariat's Special Travel Authorities, https://www.canada.ca/en/treasury-board-secretariat/services/travel-relocation/travel-government-business.html, also apply.

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

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

(g) Applicable Taxes: Identify any Applicable Taxes separately.

(h) Canadian Content: Identify the costs of the proposal used to support calculations of offering 80% Canadian goods and/or services.

1.2 Item 2 - Task Authorization component

1.2.1 Labour: The Bidder is requested to provide firm hourly rates for each category of resources for each year of the Contract period, including three (3) option years.

The total extended cost of labour will be calculated by taking the average hourly rate proposed for the Contract and option periods, multiplied by an annual estimated level of effort in hours as defined in Table 2-2 below. The estimated level of effort specified is only an approximation of requirements given in good faith and is provided for financial Bid evaluation purposes only. It does not represent a commitment by Canada.

Table 2-2: Task Authorization (Labour rates)

	Hourly Rate							
A **Labour Category**	**B** **Contract Year 1**	**C** **Contract Year 2**	**D** **Option Year 1**	**E** **Option Year 2**	**F** **Option Year 3**	**G** **Average (B+C+D+E+F) ÷5**	**H** **Estimated Annual Effort in Hours**	**I** **Total Cost by Resource (G x H)**
Project Manager							50	
Senior Systems Engineer							75	
Systems Engineer							225	
Senior Software Engineer							50	
Software Engineer							175	
Senior Hardware Engineer							75	
Hardware Engineer							200	
Technologist							650	
Assembler							50	

1.2.2 Additional hardware: The Bidder is requested to quote a firm unit price for each individual functional hardware component, listed in Section 5.9.3 of Annex A - Statement of Work, anticipated to be procured under the Task Authorization component.

For evaluation purposes, the unit price should be scaled to correspond to the cost per system channel. For example, if the proposed waveform generator component is a four (4) channel unit, then the unit price should be divided by four (4) to represent the price per channel. The estimated quantity is only an approximation of requirements given in good faith and is provided for financial Bid evaluation purposes only. It does not represent a commitment by Canada.

Table 2-3: Task Authorization (Hardware cost)

	Unit Price					
A Functional Component	**B Option Year 1**	**C Option Year 2**	**D Option Year 3**	**E Average (B+C+D) ÷3**	**F Estimated Annual Quantity (channels)**	**G Total Price by Functional Component (E x F)**
Waveform generator					16	
Digital up-converter					16	
Digital-to-analog converter					16	
High-power amplifier (with harmonic filtering)					32	
Antenna					16	
Transmission line					16	

2. Evaluation of Price

For evaluation purposes only, the price of the Bid will be determined as follows:

Total Bid Price = Total Price for Item 1 + Total Price for Item 2 (1.2.1 + 1.2.2)

Annex C Technical Evaluation Document

MANDATORY AND POINT RATED TECHNICAL CRITERIA

1. Mandatory Technical Criteria

A breakdown of the mandatory technical criteria is given in Table 1-1 below.

Table 1-1: Mandatory Technical Criteria

	Mandatory Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	For use by Canada		
			Evaluation of Bidder's Response	Compliant	Not Compliant
M1	**Project Technical Approach** As part of the Bid, the Bidder must demonstrate how the goods to be delivered will be compliant with the Statement of Requirements (SOR) in Appendix A of Annex A - Statement of Work (SOW). This demonstration must consist of responses to each paragraph in the SOR, where each response must prove the Bidder understands the corresponding requirement and must explain how the delivered goods will comply with that requirement. In addition, the Project Technical Approach must provide the following information: a) A Design concept for the delivered goods, b) An analysis of the approximate power requirements of the delivered goods, and c) Potential shelter layouts for the delivered transmit and receive shelters.				
M2	**Corporate Experience** The Bidder must have completed, within ten (10) years prior to the closing date of this solicitation period, at least three (3) projects, as the prime Contractor, in				

	Mandatory Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	For use by Canada		
			Evaluation of Bidder's Response	Compliant	Not Compliant
	radiofrequency transmission or reception, of similar complexity to the scope detailed in the Annex A - Statement of Work (SOW), of which one (1) must have a minimum value of one (1) million Canadian dollars excluding applicable Taxes. The Bidder must demonstrate the required experience by submitting at minimum the following information for each project: a) Project title, b) Organization for which the work was completed, c) Project start and end dates, d) Outline of the Bidder's role within the project and work completed, e) Details of the radiofrequency work and explanation on how that work relates to the SOW, f) Value of each project, and g) A reference for each project who can confirm and validate the information provided. For each reference provided, the Bidder must provide valid contact information so that Canada may, at its sole discretion, contact the reference to confirm the information provided is factual. The contact information must include the name and address of the company, Department or Agency to whom the service was provided and the name, title, and telephone number of a contact within the organization that can verify the information.				
M3	**Corporate Organizational Structure** The Bidder's proposal must identify the proposed team that will complete the work identified in Annex A - Statement of Work (SOW). The proposed team must be comprised of at least one (1) Project Manager, with a				

	Mandatory Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	For use by Canada		
			Evaluation of Bidder's Response	Compliant	Not Compliant
	minimum of seven (7) years of project management experience, one (1) Systems Engineering Lead, with a minimum of ten (10) years of engineering experience in the field of radiofrequency system engineering, and one (1) Systems Engineer, with a minimum of five (5) years of engineering experience in the field of radiofrequency system engineering. As a minimum, the following information must be provided for each proposed team member: a) Name and title, b) Title, role, and responsibility for the work to be completed in the SOW, c) Role and responsibility within the corporate organizational structure, d) Education background, and e) Work experience demonstrating how the individual's experience relates to the work to be completed in the SOW.				
M4	**Project Management Documentation** The Bidder must submit a Project Management Plan and a Risk Management Plan that outlines its approach and methodology to complete the work identified in Annex A - Statement of Work (SOW). The Project Management Documentation must include: a) Team organization, responsibilities, and communication approach, b) Management approach in planning, integrating, monitoring, and controlling project, c) Management of Task Authorizations, and d) Compliance verification, access to the work, and reporting.				

	Mandatory Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	For use by Canada		
			Evaluation of Bidder's Response	Compliant	Not Compliant
	This includes a Responsibility Assignment Matrix (RAM) that demonstrates areas of responsibility among members of the Bidder's team. The team organization approach must demonstrate a method for effective performance and administration of the Work with little or no potential for disruption in schedule and cost. The Bidder must also provide a detailed schedule which shows all elements of Work to be performed. The schedule includes information relative to critical path, resources, network activity and schedule contingency for each task. The Bidder must thoroughly identify potential risks in performance of the Work, their evolution throughout the Contract period, and provide risk mitigation strategies that are sound and can be reasonably successfully implemented. The Project Management Documentation must include a comprehensive plan on how Task Authorizations will be managed. Detailed contingency plans which include the process for adding additional surge capacity must be identified. The proposed approach must also ensure that Canada will have full and timely access to the Work throughout the Contract for participation in, or witnessing of system and sub-system testing, and the verification of the Contractor's compliance to elements of the Statement of Requirements (SOR).				
M5	**Task Authorization** The Bidder must propose at least one (1) resource for each Resource Category in Table 1-2 below for the Task Authorization component of Annex A - Statement of Work (SOW). The Bidder must demonstrate that all proposed personnel meet the minimum mandatory				

	Mandatory Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	For use by Canada		
			Evaluation of Bidder's Response	Compliant	Not Compliant
	education, or knowledge gained through experience, and the minimum mandatory experience.				

Table 1-2: Resource Category - Task Authorization

Resource Category	Mandatory Education or Knowledge Gained Through Experience	Experience	For use by Canada	
			Compliant	Not Compliant
Project Manager	• Certificate, diploma, or degree in engineering, physics, science, mathematics, or project management field, from a recognized Canadian post-secondary institution or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the Canadian Information Centre for International Credentials (CICIC). OR • Seven (7) years of experience in the past ten (10) years working as a project management specialist.	• Minimum of seven (7) years of project management experience on projects of similar scope and complexity. Similar scope and complexity refer to Defence and/or Security research and development Contracts over one (1) million dollars.		
Senior Systems Engineer	• Undergraduate degree in a program specializing in the engineering, physics, science, or mathematics field, from a recognized Canadian University or an acceptable	• Minimum of six (6) years of system engineering experience in radiofrequency transmission and/or reception. AND		

Resource Category	Mandatory Education or Knowledge Gained Through Experience	Experience	For use by Canada	
			Compliant	Not Compliant
	equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR • Six (6) years of experience in the past ten (10) years working as a systems engineer.	• Minimum of three (3) years of scientific or engineering experience in the integration and development of radiofrequency transmission and/or reception platforms.		
Systems Engineer	• Undergraduate degree in a program specializing in the engineering, physics, science, or mathematics field, from a recognized Canadian University or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR • Four (4) years of experience in the past ten (10) years working as a systems engineer.	• Minimum of four (4) years of system engineering experience in radiofrequency transmission and/or reception. AND • Minimum of three (3) years of scientific or engineering experience in the integration and development of radiofrequency transmission and/or reception platforms.		
Senior Software Engineer	• Certificate, diploma, or degree in the computer science, engineering, physics, science, or mathematics field, from a recognized Canadian post-secondary institution or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC.	• Minimum of six (6) years of application software engineering experience. AND • Minimum of three (3) years of experience developing software applications for radiofrequency transmission platforms.		

Resource Category	Mandatory Education or Knowledge Gained Through Experience	Experience	For use by Canada	
			Compliant	Not Compliant
	OR • Six (6) years of experience in the past ten (10) years working as a software engineer.			
Software Engineer	• Certificate, diploma, or degree in the computer science, engineering, physics, science, or mathematics field, from a recognized Canadian post-secondary institution or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR • Four (4) years of experience in the past ten (10) years working as a software engineer.	• Minimum of four (4) years of application software engineering experience. AND • Minimum of three (3) years of experience developing digital signal processing or radiofrequency transmission software applications.		
Senior Hardware Engineer	• Undergraduate degree in an engineering program, specializing in the electronic, electrical, microwave, or mechanical field, from a recognized Canadian University or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR	• Minimum of Six (6) years of electronics, and/or microwave engineering experience. AND • Minimum of three (3) years of experience developing complex signal processing circuits and applications.		

Resource Category	Mandatory Education or Knowledge Gained Through Experience	Experience	For use by Canada	
			Compliant	Not Compliant
	• Six (6) years of experience in the past ten (10) years working as a hardware engineer.			
Hardware Engineer	• Undergraduate degree in an engineering program, specializing in the electronic, electrical, microwave, or mechanical field, from a recognized Canadian University or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR • Four (4) years of experience in the past ten (10) years working as a hardware engineer.	• Minimum of four (4) years of electronic, and/or microwave, engineering experience. AND • Minimum of two (2) years of hardware design, development, and testing of radiofrequency transmission systems		
Technologist	• Certificate, diploma, or degree in the electronic, microwave or mechanical discipline from a post-secondary Canadian institution or an acceptable equivalent from a foreign institution, as determined by one of the agencies referred by the CICIC. OR • Six (6) years of experience in the past ten (10) years working as an electronic, microwave or mechanical technologist.	• Minimum of six (6) years of experience as an electronic, microwave, and/or mechanical technologist. AND • Minimum of three (3) years of experience as a hardware technologist.		

Resource Category	Mandatory Education or Knowledge Gained Through Experience	Experience	For use by Canada	
			Compliant	Not Compliant
Assembler		• Minimum of three (3) years of experience as an assembler or fabricator.		

2. Point Rated Technical Criteria

A breakdown of the point rated technical criteria is given in Table 2-1 below. The Bid must meet the minimum allowable score for each criterion as defined in Table 2-2 to be selected.

Table 2-1: Point Rated Technical Criteria

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
P1	**Project Technical Approach** The Project Technical Approach described in **M1** will be further evaluated as follows:				
	1. Initial design concept		0 points – Bidder does not provide an end-to-end view in the form of a list or an annotated block diagram, nor an initial equipment selection that fully supports Annex A - Statement of Work (SOW). 5 points – Bidder provides an end-to-end view in the form of a list or an annotated block diagram that fully supports Annex A - Statement of Work (SOW). 10 points – Bidder provides an end-to-end view in the form of a list or an annotated block diagram as well as a complete end-to-end identification of initial equipment		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
			selection that fully supports Annex A - SOW. 20 points – Bidder provides an end-to-end view in the form of a list or an annotated block diagram as well as a complete end-to-end identification of initial equipment selection, and identifies how the proposed equipment will, at a minimum, meet the required performance numbers of Annex A - SOW.		
	2. Power requirements		0 points – Bidder does not provide evidence of power requirements. 1 point – Bidder provides evidence of power requirements. 3 points – Bidder provides the power requirements of key equipment. 5 points – Bidder provides the power requirement of all equipment.		
	3. Shelter layout		0 points – Bidder does not provide one layout option with supporting rationale. 1 point – Bidder provides one layout option with supporting rationale.		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
			3 points – Bidder provides one layout option and a second option designed to further minimize footprint of shelter. 5 points – Bidder also provides evidence that shelter layout proposed meets the size and weights constraints described in the SOW.		
				Total **Minimum Mandatory Score: 16** **Maximum points: 30**	
P2	**Corporate Experience** The Bidder's claimed transmitter projects described in **M2** will be further evaluated as follows:				
	1. Transmitters		0 points – One (1) project does not include: digital waveform generators, digital-to-analog converters, and high-power amplifiers. 10 points – One (1) project includes: digital waveform generators, digital-to-analog converters, and high-power amplifiers. 20 points – Two (2) projects each include: digital waveform generators, digital-to-analog converters, and high-power amplifiers. 30 points – Each project includes: digital waveform generators, digital-		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
			to-analog converters, and high-power amplifiers.		
				Total **Minimum Mandatory Score: 10** **Maximum points: 30**	
P3	**Corporate Experience** The Bidder's claimed receiver projects described in **M2** will be further evaluated as follows:				
	1. Receivers		0 points – One (1) project does not include: radio receivers, analog-to-digital converters, and data recorders. 5 points – One (1) project includes: radio receivers, analog-to-digital converters, and data recorders. 10 points – Two (2) projects each include: radio receivers, analog-to-digital converters, and data recorders. 15 points – Three (3) projects each project include: radio receivers, analog-to-digital converters, and data recorders.		
				Total **Minimum Mandatory Score: 0** **Maximum points: 15**	
P4	**Corporate Experience** The Bidder's claimed antenna projects described in **M2** will be further evaluated as follows:				
	1. Antennas		0 points – One (1) project does not include antenna construction or installation.		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
			5 points – One (1) project includes antenna construction or installation. 10 points – Two (2) projects each include antenna construction or installation.		
				Total **Minimum Mandatory Score: 0** **Maximum points: 10**	
P5	**Corporate Organizational Structure** The team described in **M3** will be further evaluated as follows:				
	1. The Project Manager has managed a project, within ten (10) years prior to the closing date of this solicitation period, of value, excluding applicable Taxes, greater than:		0 point – 0 to 999,999.999 Canadian dollars. 1 point – One (1) million to 1,999,999.999 Canadian dollars. 3 points – Two (2) million to 4,999,999.999 Canadian dollars. 5 points – Five (5) million Canadian dollars and above.		
	2. The Systems Engineering Lead has led the engineering effort for a radiofrequency transmission or reception project, within ten (10) years prior to the closing date of this solicitation period, of value, excluding applicable Taxes, greater than:		0 point – 0 to 999,999.999 Canadian dollars. 1 point – One (1) million to 1,999,999.999 Canadian dollars. 3 points – Two (2) million to 4,999,999.999 Canadian dollars. 5 points – Five (5) million Canadian dollars and above.		
	3. The Systems Engineer has supported the		0 point – 0 to 999,999.999 Canadian dollars.		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
	engineering effort for a radiofrequency transmission or reception project, within ten (10) years prior to the closing date of this solicitation period, of value, excluding applicable Taxes, greater than:		1 point – One (1) million to 1,999,999.999 Canadian dollars. 3 points – Two (2) million to 4,999,999.999 Canadian dollars. 5 points – Five (5) million Canadian dollars and above.		
				Total **Minimum Mandatory Score: 7** **Maximum points: 15**	
P6	**Corporate Organizational Structure – Transmitters** The team described in **M3** will be further evaluated as follows:				
	1. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of digital waveform generators.		0 points – 0 to 4.999 years. 1 point – 5 to 9.999 years. 3 points – 10 to 14.999 years. 5 points – 15 or more years.		
	2. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of digital-to-analog		0 points – 0 to 4.999 years. 1 point – 5 to 9.999 years. 3 points – 10 to 14.999 years. 5 points – 15 or more years.		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
	converters.				
	3. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of high-power amplifiers.		0 points – 0 to 4.999 years. 2 points – 5 to 9.999 years. 5 points – 10 to 14.999 years. 10 points – 15 or more years.		
				Total **Minimum Mandatory Score: 7** **Maximum points: 20**	
P7	**Corporate Organizational Structure – Receivers** The team described in **M3** will be further evaluated as follows:				
	1. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of radiofrequency receivers.		0 points – 0 to 4.999 years. 1 point – 5 to 9.999 years. 3 points – 10 to 14.999 years. 5 points – 15 or more years.		
	2. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of		0 points – 0 to 4.999 years. 1 point – 5 to 9.999 years. 3 points – 10 to 14.999 years. 5 points – 15 or more years.		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
	analog-to-digital converters.				
	3. The team collectively has the number of years of experience listed below, acquired within the ten (10) years prior to the closing date of this solicitation period, in the design, development, and module-level testing of data recorders.		0 points – 0 to 4.999 years. 2 points – 5 to 9.999 years. 5 points – 10 to 14.999 years. 10 points – 15 or more years.		
				Total **Minimum Mandatory Score: 0** **Maximum points: 15**	
P8	**Project Management Documentation** The Project Management Documentation described in **M4** will be further evaluation as follows:				
	1. Project management plan		0 points – Bidder does not propose a project organizational structure chart and identifies a list of deliverables to be produced consistent with Annex A - Statement of Work (SOW). 5 points – Bidder proposes a project organizational structure chart and identifies a list of deliverables to be produced consistent with Annex A - Statement of Work (SOW). 10 points – Bidder also proposes progress reviews and describes configuration management.		
	2. Risk management plan		0 points – Bidder's proposal does not identify key schedule,		

	Point Rated Criteria	Bidder's Response (Include proposal reference with page and paragraph numbers)	Rating Method	For use by Canada	
				Evaluation of Bidder's Response	Points Awarded
			technical, and cost risks. 5 points – Bidder's proposal identifies key schedule, technical, and cost risks. 10 points – Bidder has also identified five (5) potential largest project risk and has produced a plan to manage these risks.		
				Total **Minimum Mandatory Score: 10** **Maximum points: 20**	
P9	**Open Radiofrequency Architectures** The Project Technical Approach described in **M1** will be further evaluated as follows:				
	1. Open architectures		0 points –Bidder does not propose a solution employing the elements of an open radiofrequency nor hardware architecture nor an open software architecture. 10 points – The Bidder proposes a solution employing open hardware and software architectures and provides a fully documented Application Programming Interface (API).		
				Total **Minimum Mandatory Score: 0** **Maximum points: 10**	

Table 2-2: Point Rated Technical Score

Point Rated Criteria		Maximum Score Available	Minimum Allowable Score	Bid Result		
				Achieved Score	Compliant	Not Compliant
P1	Initial design concept	20	10			
	Power requirements	5	3			
	Shelter layout	5	3			
P2	Transmitters	30	10			
P3	Receivers	15	0			
P4	Antennas	10	0			
P5	Project Manager	5	3			
	Systems Engineering Lead	5	3			
	Systems Engineer	5	1			
P6	Waveform generators	5	1			
	Digital-to-analog converters	5	1			
	High-power amplifiers	10	5			
P7	Radiofrequency receivers	5	0			
	Analog-to-digital converters	5	0			
	Data recorders	10	0			
P8	Project management plan	10	5			
	Risk management plan	10	5			
P9	Open architectures	10	0			
Total:		**170**	**50**			

3. Basis of Selection

3.1 Basis of Selection - Highest Combined Rating of Technical Merit and Price

3.1.1 To be declared responsive, a Bid must:

(a) comply with all the requirements of the Bid solicitation; and

(b) meet all mandatory technical criteria; and

(c) obtain the required minimum points specified for criteria numbers P1, P2, P5, P6, and P8 for the technical evaluation; and

(d) obtain the required minimum of 50 points overall for the technical evaluation criteria which are subject to point rating.
The rating is performed on a scale of 170 points.

3.1.2 Bids not meeting (a) or (b) or (c) and (d) will be declared non-responsive.

3.1.3 The selection will be based on the highest responsive combined rating of technical merit and price. The ratio will be 70% for the technical merit and 30% for the price.

3.1.4 To establish the technical merit score, the overall technical score for each responsive Bid will be determined as follows: total number of points obtained/ maximum number of points available multiplied by the ratio of 70%.

3.1.5 To establish the pricing score, each responsive Bid will be prorated against the lowest evaluated price and the ratio of 30%.

3.1.6 For each responsive Bid, the technical merit score and the pricing score will be added to determine its combines rating.

3.1.7 Neither the responsive Bid obtaining the highest technical score nor the one with the lowest evaluated price will necessarily be accepted. The responsive Bid with the highest combined rating of technical merit and price will be recommended for award of Contract.

$$\textbf{Total Weighted Score} = \left(\frac{\textbf{Lowest Compliant bid Price}}{\textbf{Bidder's Total Evaluated bid Price}} \times \mathbf{30}\right) + \left(\frac{\textbf{Technical Point Rated Score}}{\textbf{Maximum Score Available for bid}} \times \mathbf{70}\right)$$

3.1.8 When a calculation includes a decimal, results will be rounded to the nearest hundredth value. For example:

i. 7.254 to the nearest hundredth equals 7.25
ii. 7.255 to the nearest hundredth equals 7.26

3.1.9 In case of a tie, the Bidder with the lowest evaluated Bid price will be recommended for Contract award.

3.2 Evaluation Example

Table 3-1 below illustrates an example where all three Bids are responsive and the selection of the Contractor is determined by a 70/30 ratio of technical merit and price, respectively. The total available points equals 100 and the lowest evaluated price is $450,000 (45).

Table 3-1: Basis of Selection - Highest Combined Rating of Technical Merit (70%) and Price (30%)

		Bidder 1	Bidder 2	Bidder 3
Overall Technical Score		92/100	89/100	75/100
Bid Evaluated Price		$550,000.00	$500,000.00	$450,000.00
Calculations	**Technical Merit Score**	$\frac{92}{100} \times 70 = 64.40$	$\frac{89}{100} \times 70 = 62.30$	$\frac{75}{100} \times 70 = 52.50$
	Price Score	$\frac{45}{55} \times 30 = 24.55$	$\frac{45}{50} \times 30 = 27.00$	$\frac{45}{45} \times 30 = 30.00$
Combined Rating		88.95	89.30	82.50
Overall Rating		2nd	1st	3rd

ANNEX D

TRANSMIT AND RECEIVE SITE LOCATION

The Transmit and Receive Site location(s) are described in a Classified document. Bidders meeting the Security Requirements at Part 7 - Resulting Contract Clauses will be able to view the information during an optional meeting to be coordinated with the Contracting Authority during the Bid solicitation period. Personnel viewing the document mush have a secret clearance and will be required to sign a Non-Disclosure Agreement (NDA).