

Annex A
Statement of Work
(Version 1.0)

**For The Provision of Power Supply Systems
for the High Arctic Data Communication System Microwave
Radio Repeaters**

November 16, 2022

Annex A – Statement of Work

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List of Contract Deliverables

The Contractor must provide the following, but not limited to, contract deliverables in accordance with the Statement of Work and Technical Specifications.

#	Description	SOW Paragraph
1	Installation and Transition plan	5.5
2	Transportation plan of proposed system to Ellesmere Island	5.6
3	System Reliability Study and Calculations (to be included in technical bid)	3.2-Appendix B
4	Progress Design Review (PRM) Meetings - Documentation – Agendas - Minutes	6.7-6.8-6.9-6.10
5	Action Items discussed and agreed and PRM– Agendas - Minutes	6.7-6.8-6.9-6.10
6	Critical Design Review (CDR) Meetings Documentation– Agendas - Minutes	3.3
7	Action Items discussed and agreed and CDR– Agendas - Minutes	3.3
8	Factory Acceptance Test Plan and Procedures	4.2
9	Factory Acceptance Test Report	4.2
10	Site Acceptance Test Plan and Procedures	4.3
11	Site Acceptance Test Report	4.3
12	Pre-Installation Planning Meeting– Agendas - Minutes	5.4
13	Hand-Over Meeting– Agendas - Minutes	6.9
14	One (1) Prototype Unit (including installation, commissioning and spare parts)	3.5
15	Six (6) Production Units (including installation, commissioning and spare parts)	3.5
16	Preliminary/Conceptual Design Brief (to be included in technical bid)	2.1
17	Project Cost Breakdown (to be included in financial bid)	6.11
18	Work Breakdown Structure (WBS) (to be included in financial bid)	6.11
19	O&M Manual	7.3
20	As-built drawings	7.3
21	Project Management Plan (to be included in technical bid)	6.5
22	Project Schedule for 2025 final completion (to be included in technical bid)	6.6
23	O&M Training	8
24	Warranty	7.2

1.0 Scope

1.1 Purpose

The Department of National Defence (DND) has a requirement for the replacement of one of the two existing power supply systems of the High Arctic Data Communications System (HADCS) microwave repeaters. The requirements associated with this capability are derived from Canada's continued need for maintaining sovereignty of the North.

1.2 Background

The High Arctic Data Communications System (HADCS) is a hybrid microwave/satellite/ terrestrial system that provides a strategic communication link between Canadian Forces Station (CFS) Alert, Nunavut (NU) and Ottawa via Eureka. The geostationary satellite footprint patterns do not reach above 80° North latitude; therefore to extend the high speed data communication link to CFS Alert, six unmanned Line-Of-Sight (LOS) microwave repeaters were installed on mountain tops from CFS Alert to Eureka as shown in Figure 1. The geographic locations (latitudes and longitudes) of the six microwave repeater sites will be provided upon contract award.

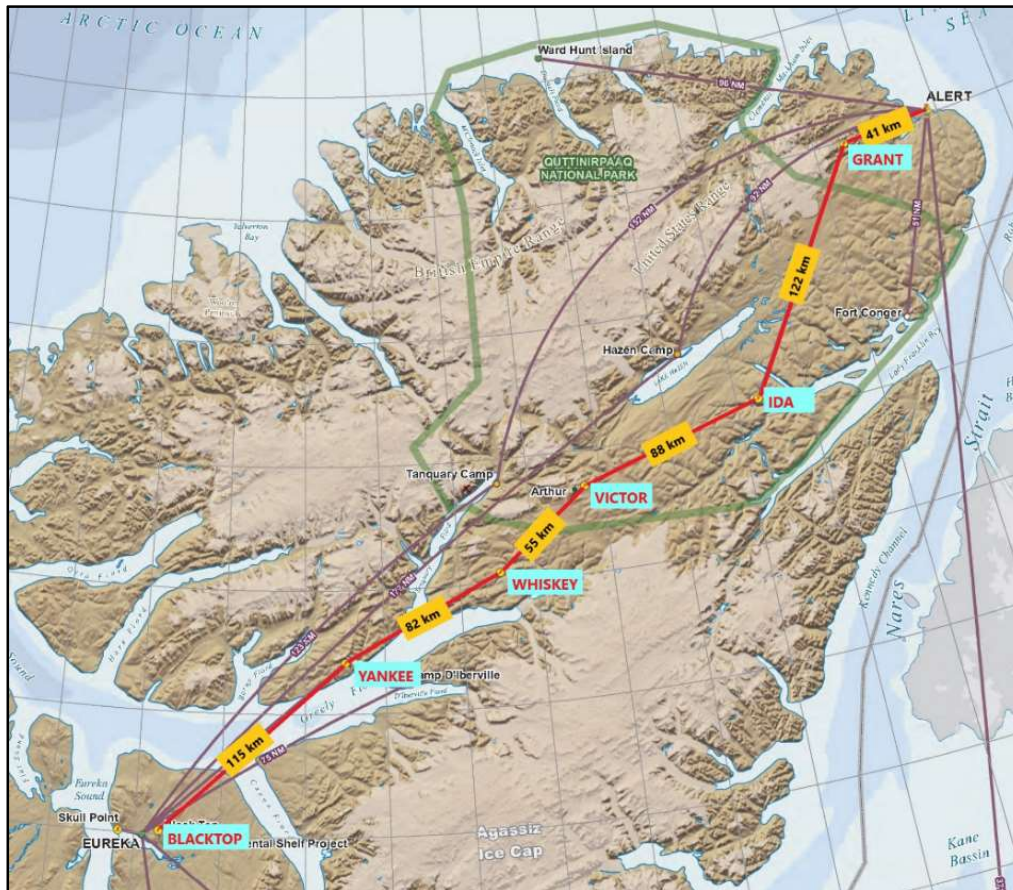


Figure 1: Location map of HADCS repeater sites from CFS Alert to Eureka

1.2.1 Current Power Supply System Architecture

The six microwave repeater sites each have two radio systems that are operating at two different frequencies. Each of the radio systems are powered by their dedicated solar energy Power Supply System (PSS).

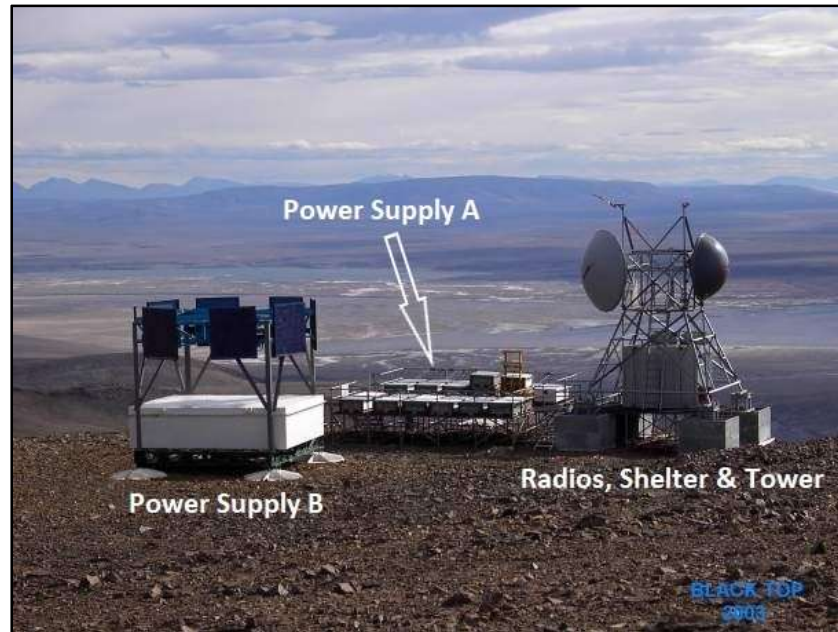


Figure 2: Typical power supply configuration for Radios A and B at microwave repeater sites

PSS A, also called Semi-Annual Power Supply System, is the dedicated power source for radio system A. This PSS includes the following sub-systems:

- One (1) moderate capacity lead-acid battery bank that can be recharged by an array of south-facing photovoltaic panels that are mounted vertically on the antenna tower (panels cannot be seen on Figure 2).
- Two (2) banks of non-rechargeable zinc air-alkaline batteries (also called primary bank A & B)
- Shunt resistors to avoid overcharging of lead-acid battery bank
- One (1) solar power controller with built in telemetry RS232 command set

During the sunny season (mid-April to late August), power is provided by the photovoltaic panels and/or the lead-acid battery bank depending on weather conditions. When the sunless season begins (mid-October), power is supplied by the lead-acid battery bank until its charge becomes insufficient to carry the load of the radios. When the charge of the lead-acid batteries becomes insufficient, one of the two air-alkaline battery bank is enabled to provide power to radio system A for the remaining of the sunless season (until late February) The solar power controller is programmed to achieve the above noted control philosophy.

The non-rechargeable air-alkaline batteries need to be replaced every 3 to 4 years, which has high procurement and logistical costs given the batteries are heavy and the sites are only accessible by helicopter. These remote locations are only accessible by aircraft for less than 6 months during the year as there are restrictions to fly in the winter when there is minimal visibility. Prime access to the microwave repeater sites is during the months of June and July due to temperature and weather conditions, but access to the sites is also possible during other months of the sunny season for work on site.

Ambient temperatures at the microwave repeater sites range from -45°C to +20°C. Ambient temperatures at CFS Alert range from -50°C to +20°C. The highest elevation of the repeater site is over 4000 ft. The system must also be able to operate at this altitude and extreme temperatures mentioned above. Figure 3 shows the existing configuration of the HADCS PSS A for each of the six (6) microwave repeater sites. The microwave terminals located in CFS Alert and Eureka are both connected to commercial power and are not a part of this requirement.

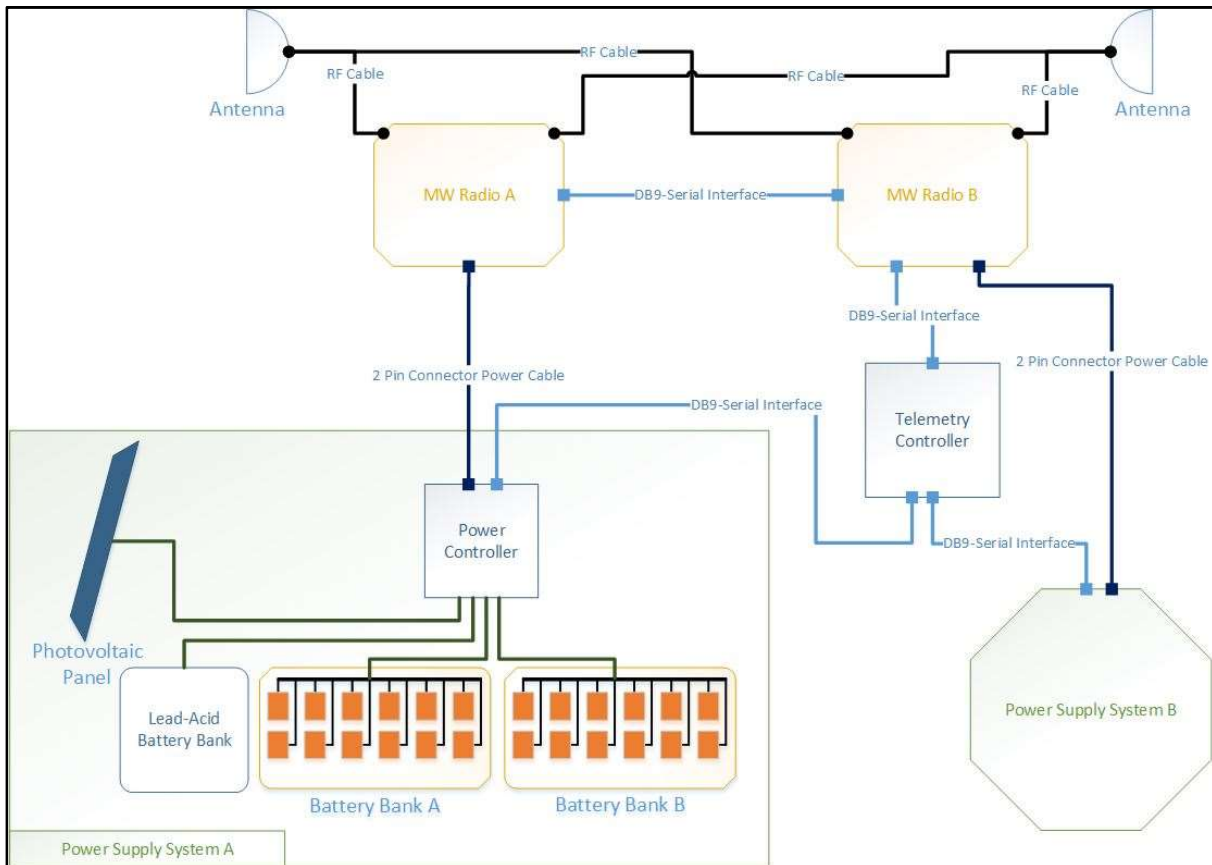


Figure 3: High Level Configuration for HADCS Power Supply Systems

This PSS A is separated into subsystems as described previously. Its connected load, the LOS MW radio system A, is approximately 35W, and can operate at a varying battery voltage output range of 11.3 to 20VDC due to battery discharge. The power controller connects to the radio via a two pin connector. The telemetry data for the power supply is transmitted through the telemetry controller via a RS232 command set.

Presently, the power for LOS MW radio system A is provided by two (2) sets of zinc-air battery banks and one (1) lead acid battery bank as previously noted. Each non-rechargeable air-alkaline battery bank has 12 battery boxes. Each battery box has 12 batteries for a total of 288 batteries per site. Primary A and B battery banks are constructed in groups of 1.5 Volt 3600 Ah batteries to form an 18 volt battery source with 43,200 Ah capacity per bank

1.3 Contract Objectives

DND is seeking a reliable, high availability and low maintenance solution to replace PSS A (**Figure 3**) presently located at the six remote microwave repeater sites located throughout Ellesmere Island.

- The objective of this contract is to replace PSS A, which is currently at the end of its lifecycle.
- The proposed solution must reduce the in-service support costs and level of effort necessary for the maintenance of the PSS A at each remote sites.

Potential solutions may include but are not limited to:

- a. Solar panels and batteries that can operate in extreme temperatures and altitudes or any other type in which enclosures can have heaters;
- b. Hybrid system with small wind turbine; or
- c. Fuel cells: direct methanol, hydrogen, regenerative/unitized

Respondents may offer alternative solutions to the ones presented above if they can demonstrate in their bid that their solutions meets or exceeds the technical specifications (Appendix B).

1.4 DND Authorities

The DND technical team will be comprised of:

- a. Technical Authority (TA);
- b. Life Cycle Material Manager (LCMM); and
- c. Senior Technologist.

2.0 Requirements

2.1 General

The Contractor must carry out all work necessary to design, supply, manufacture, assemble, integrate, install, test and support the microwave power system at each of the six microwave repeater sites in accordance with this SOW and Technical Specification as outlined in Appendix B. The bidders must demonstrate that their proposed solution meets or exceeds all requirements outlined in this SOW and in the Technical specifications by the means of a Preliminary/Conceptual Design Brief as described in the Evaluation Criteria document. The Contractor must also submit other documents as part of their bid as noted in the deliverable list and evaluation criteria document. All the work must be performed in accordance with this Statement of Work and with the Technical Specifications document (Appendix B)

2.2 Summary of Requirements

The following list summarizes the main requirements of this SOW. Details are provided in the following subsequent sections:

- a. System Design, Manufacture and Installation and Integration;
- b. Testing and Acceptance;
- c. Site Survey & Installation;
- d. Project Management.
- e. Maintenance and In-service Support; and

- f. Training;

3.0 System Design, Manufacture, Installation and Integration

3.1 General

The Contractor must implement a program to design, manufacture, Install and integrate the microwave repeater PSS required to satisfy the Technical Specifications as per Appendix B. The program must specifically address the following areas:

- a. Power controller(s), which monitors and controls the electrical energy from the power source to the microwave repeater, controls the temperature of the energy storage components to an optimal level as required and also provides telemetry data to the microwave repeater;
- b. Power source, which provides the electrical energy; and
- c. System structure, which houses and supports all sub-components of the power system.

3.2 System Reliability

The Power Supply System will operate at unattended remote Arctic locations inaccessible six months each year during the “sunless” season; hence, reliability of the power system is highly important. The power system must be designed to be fail-safe, such that a critical failure, where there is a loss of normal system functionality, does not prevent the power system from providing the required electrical energy to the microwave repeater. As part of the bid and in accordance with the list of deliverables the Contractor must provide a system reliability study that:

- a. fully demonstrate that the power system design is fail-safe as defined in the Technical Specification;
- b. provide reliability prediction calculations for the power system based on the requirements specified in the Technical Specification;
- c. evaluate the possibility of condensation at various points within the system and demonstrate the means by which and such condensation cannot affect the operation of the system and;
- d. This information must be provided as a report in PDF format.

The reliability study must also be updated as required at each design phase based on the design modifications.

3.3 Critical Design Review

The Contractor must conduct various Critical Design Reviews (CDR). The CDR must be held at the Contractor's facility and/or via teleconference. The CDR is an in-depth technical review of the Contractor's proposed design. The purpose of the CDR is for the Contractor to present documentation sufficient to satisfy the DND TA that the proposed design will meet all requirements of this SOW and the Technical Specification (Appendix B). The design submitted at the CDR must become the Baseline Design. In preparation for the CDR, the Contractor must submit a CDR agenda and documentation to be presented at the CDR. The Contractor must provide minutes for the CDR. Action items agreed upon at the CDR must be included in the minutes. The minutes must be submitted to the DND TA for review and approval prior to release.

CDR Meetings will be required to discuss work progress and review of the on-going work at the following design stages.

- a. 66% prototype design completion
- b. Pre-Prototype PSS deployment (approx.80% design completion)
- c. Post-Prototype PSS deployment (approx.95% design completion)
- d. Pre-Production PSS deployment (100% design completion)

3.4 System Integration:

Contractor must be responsible to integrate new Power Supply System with existing interface of existing connected equipment on site as described in technical specifications.

3.5 System Manufacture

Following the design phase of pre-prototype and pre-production deployment, the Contractor must provide and manufacture six (6) Power Supply Systems and one (1) prototype (pilot) for a total of seven (7) Power Supply Systems.

- 3.5.1 Prototype (Pilot): The prototype Power Supply System must remain at CFS Alert for a minimum period of one (1) year, or longer as required, and must be updated as required following test results. Once the test period of the prototype is completed (as per section 4.3), the prototype must be converted to a production unit and left at CFS Alert as a test facility for future integration and test requirements.
- 3.5.2 Production units: The six (6) final production units must be updated as required following test results of the prototype deployment. The production of the six (6) production units must only be initiated once the prototype testing period is complete and all necessary design updates have been completed and approved by DND TA.
- 3.5.3 Installation and Commissioning: Installation and commissioning of all Power Supply Systems (7) are to be provided by Contractor in accordance with section 5 of the statement of work. The prototype must be installed at CFS Alert and the production units must be installed at each remote sites as shown on **Figure 1**.
- 3.5.4 Provision of Spare Parts: The Contractor must spare the proposed prototype and production units as required in consultation with DND. Minimum sparing: 100% for all electronics and cables.

3.6 Workmanship Requirements

Workmanship must be of a level of quality adequate to assure that processed products meet the performance requirements of the engineering drawings and the criteria specified herein. Parts must not be cracked, scored, chipped, broken, or otherwise damaged beyond the limits of the original part specification.

4.0 Testing and Acceptance

4.1 General

Formal acceptance testing must be conducted by the Contractor and witnessed by the DND TA or a delegated representative. This acceptance testing will be limited to the prototype site acceptance test at CFS Alert and Factory Acceptance Tests at the Contractor's facility. These acceptance tests must demonstrate the correct functioning of the equipment in accordance with the Technical Specifications document in Appendix B.

4.2 Factory Acceptance Test

The Factory Acceptance Tests must verify that the power system to be installed at CFS Alert (prototype) and on the microwave repeater sites (production units) does perform in accordance with the Technical Specification. These tests must validate all Contractor design assumptions and calculations. The test plan and procedures used in this verification must be developed by the Contractor and approved by the DND TA. The Contractor must record the results of all the completed tests and submit a test report to DND for review and approval. In an event that a test result does not meet or exceed the technical specification requirement outlined in Appendix B, DND may request the Contractor to modify the design or components of the power system.

4.2.1 Temperature Cycling

The microwave power system must be capable of operating within the temperature range specified in the Technical Specifications. The Factory Acceptance Test Plan must address the requirement for temperature cycling all components of the power system to ensure compliance. All power system components must be tested to operate within the temperature ranges as dictated by the Contractor's Baseline Design. Each component must undergo five thermal cycles through its designed operational temperature range as defined by the Baseline Design. The procedures for the temperature cycling are as follows:

- a. the component under test must be verified operational under room temperature, 25°C;
- b. the test chamber temperature must be reduced at an average rate of 2.5°C per minute until the required ambient temperature in the chamber is met;
- c. the component must be kept at the required ambient temperature for a period of 30 minutes during which time it must be verified operational;
- d. the temperature will then be raised to room temperature at an average rate of 2.5°C per minute;
- e. returning the component under test back to room temperature from the 30 minute period at the required ambient temperature constitutes one thermal cycle. Upon completion of the fifth thermal cycle, the component must be verified operational at room temperature thus completing the temperature cycling test; and
- f. should a component fail one of its operational verification tests, the testing must stop immediately. The Contractor will then have the option of repairing the component or substituting a completely new component. A repaired component must have to be successful in completing five consecutive thermal cycles after repair.

4.2.2 System Mock-up

The Factory Acceptance Test Plan and procedures must include a system mock-up to verify all installation and testing procedures, and the operating parameters of the power system. The mock-up verification must fully demonstrate the correct functioning of Contractor's power system design in accordance with the Technical Specification and validate all Contractor design assumptions and calculations.

4.3 Site Acceptance Tests

The Site Acceptance Tests must verify that the power system once installed at CFS Alert and at the microwave repeater sites operate in accordance with the Technical Specifications. The test plan used in this verification must be developed by the Contractor and approved by the DND TA prior to the installation. The Contractor must record the results of the tests and submit a test report to DND TA. For the site acceptance tests for the prototype installed at CFS Alert, the Contractor must produce three (3) reports as described below:

- Trial Test Report 1 : July to October
- Trial Test Report 2 : November to February
- Trial Test Report 3 : March to July

At CFS Alert, a computer must be installed to routinely request data from the prototype. The contractor must analyze the data and provide plots for critical data of their system in the above noted reports. The contractor must advise DND as soon as any unusual behavior is observed through the telemetry or data gathering system.

4.4 Pass-Fail Criteria

All factory and site acceptance tests must be witnessed by the DND TA. All test criteria must be clear and measureable. A test will be deemed to have passed if the equipment has met the measurable test criteria. Likewise, a test will be deemed to have failed if the equipment assembly has not met the measurable test criteria. The Contractor must modify, change or repair the non-conforming equipment and applicable test or tests must all be redone. The Contractor must also document what needed to be modified, changed or repaired on the non-conforming equipment. This information must be made available to the DND TA upon request.

5.0 Site Survey & Installation

5.1 General

The Contractor must install, commission and test all equipment in accordance with this SOW and the Technical Specifications. The installation must be accomplished using a two phase approach.

The initial phase of the installation will require the Contractor to install the prototype (pilot) Power Supply System at CFS Alert and perform a site survey and preliminary installation work at each of the six sites.

The second phase of the installation will require the Contractor to install a Power Supply System at each of the six sites and then perform the transition from the old power supply system to the new.

The Contractor must prepare a schedule following the below phased approach in order to meet the deadline as mentioned in section 6.6 – Project Schedule.

5.2 Installation Phase I

The Contractor must install and commission the prototype (pilot) at CFS Alert. The prototype Power Supply System must remain at CFS Alert for a minimum period of one (1) year. The prototype configuration must include the power controller and the necessary power supplies to simulate all power sources. The prototype configuration must have the functionality of a production unit power system located at the microwave sites.

In addition to the prototype installation work, the Contractor may be required to perform a site survey at one (1) of the remote site and preposition all possible system equipment in preparation for the second phase of the installation during the following summer as required.

5.3 Installation Phase II

The Contractor must install and commission a production unit power system at each of the six microwave sites and then perform final system transition at all sites. The contractor must also convert the prototype at CFS Alert to a production at CFS Alert. The prototype will stay at CFS Alert for future integration and testing requirements.

5.4 Pre-Installation Planning Meeting

The Contractor must attend a pre-installation planning meeting to be held in Ottawa no later than the March prior to each installation phase. The purpose of the meeting is to gather all parties including DND, contractors and other government agencies that will be involved in or affected by the installation, to plan, coordinate and schedule all activities. At the meeting, the Contractor must present a draft installation and transition plan, detailed sufficiently to reflect the requirements of this SOW and the Technical Specification.

5.5 Installation and Transition Plan

The Contractor must develop an installation and transition plan for each installation phase. The plan must be based on the SOW requirements and the work schedules agreed upon at the pre-installation review meeting. The plans must be submitted to the DND TA for final review and approval. Installation plan must include commissioning strategy.

5.6 Transportation Plan

The Contractor must submit a transportation plan of new power system (prototype and production units) for CFS Alert and remote repeater sites using marine vessels and/or fixed rotary wing aircraft to DND TA for review and acceptance.

6.0 Project Management

6.1 General

The Contractor must implement a project management system and related tools to the extent necessary to satisfy the provisions of this SOW and the Technical Specification. The Contractor must institute a system of project management that ensures that the equipment design, configuration, manufacturing, assembly, testing, documentation, quality assurance and technical reviews are coordinated in accordance with this SOW and the Technical Specification.

In addition to the project controls, the Contractor must implement additional controls, as necessary, to ensure that all technical, logistics support, and risk management requirements are satisfied;

6.2 Project Manager

The Contractor must appoint a person to act as the Project Manager (PM). The PM must be vested with appropriate authority within the Contractor's organization to plan, coordinate, control and supervise the project development and execution. The PM must be the focal point of all communications between the Contractor and DND.

6.3 Sub-Contractor

In the event the Contractor employs a sub-contractor to carry out a portion of the work, the Contractor must provide the TA with the following additional information for each sub-contractor:

- The sub-contractor's identification (including name, business address, and telephone, fax numbers, and resume);
- The sub-contractor's qualifications;
- A list of the sub-contractor's personnel (including business address and telephone number);
- A description of the portion of the work the sub-contractor will perform; and
- The sub-contractor's security clearance.

This information must also be provided at the bid phase

6.4 Project Monitoring

DND will monitor the work in progress at all times;

The Contractor must, upon request, allow DND access to the facilities where work is being performed;

When requested, the Contractor must provide DND any data accumulated as a result of work carried out to satisfy this SOW; and

Opportunities for technical dialogue between the TA and the assigned Contractor personnel must be provided on a continual and co-operative basis.

6.5 Project Management Plan

The Contractor must submit a Project Management Plan in accordance with the list of deliverables. The Project Management Plan must be submitted as part of the Contractor's bid. The Plan must include as a minimum:

- a. a proposed project team organization chart;
- b. the qualifications of project team personnel; and
- c. The project schedule.

6.6 Project Schedule

The Contractor must provide a project schedule with the bid in accordance with the list of deliverables. The proposed project schedule must be submitted as part of the Bidder's Project Management Plan. The schedule must describe how the Contractor intends to ensure successful achievement of the requirements in this SOW and the Technical Specification in order to deliver a fully commissioned system at the six (6) repeater site no later than summer of 2025. The schedule must show timelines for all tasks and contract data deliverables listed in the SOW, and clearly display the interdependence of various tasks and deliverables. Visibility into project progress, such as early or late completion of tasks and milestones, and other schedule adjustments, must be shown as variances to the schedule using visible notation and marking on a Gantt-chart type. Changes to the schedule require prior approval of the Contracting Authority, and must be staffed as a contract amendment. The project schedule must form the basis of milestone payments.

6.7 Progress Review Meeting

The Contractor must attend scheduled progress review meetings (PRM) whenever the DND TA deems it necessary to discuss or review any work progress and review the on-going work or any contractual points. The kick-off and hand-over meetings will be the only scheduled progress review meetings. For planning/costing purposes the Contractor must assume two review meetings will be required in Ottawa. Progress review meetings must be held at the Contractor's or DND premises as mutually agreed. The Contractor must provide agendas and minutes for the meetings. Action items agreed upon at a meeting must be included in the minutes. The minutes of a meeting must be submitted to the DND TA for review prior to release.

6.8 Kick-Off Meeting

A kick-off meeting must be held within 10 calendar days after contract award. This meeting is intended to review:

- a. the system requirements to ensure that both parties have a thorough understanding of the requirements;
- b. the system specifications and ensure that the Contractor has a thorough understanding of all technical specifications; and
- c. the proposed schedule and ensure that any initial concerns are resolved.

The Contractor must participate in the Kick-Off Meeting in person and/or via a videoconference;

As a minimum, the Kick-Off Meeting agenda must address the following:

- a. Project Name: / Contractor teams:/Meeting Date:/Meeting Time:/Meeting Location;
- b. Introductions: brief identification of people at the meeting and their role on the project;
- c. Contract Overview: a general overview of the contract;
- d. Contract Details: more specific details including:
 - Scope, Goals, Objectives;
 - What the project is intended to accomplish;
 - What the project is not intended to accomplish;
 - Project Timeline;
 - Key milestones;
 - Key target dates; and
 - Identified challenges and risks
- e. Contractor Team Roles & Responsibilities: discuss a list of Contractor team members, their contact information, and their roles/responsibilities;
- f. The TA Roles & Responsibilities: discuss a list of TA members, their contact information, and their roles/responsibilities.
- g. The Procurement Authority and Contracting Authority roles and responsibilities;
- h. Next Steps: A specific instruction to everyone about what is happening next, including what each person is expected to do.

6.9 Hand-Over Meeting

A hand-over meeting must be held no later than 30 calendar days after completion of the final installation. This meeting is intended to:

- a. Review the whole installation program to ensure that the Technical Specification requirements have been satisfied; and

- b. Identify and record any deficiencies, and determine the corrective action to be taken by DND or the Contractor.

6.10 Meetings Requirements

Progress/Technical Review Meetings Progress review meetings (PRMs) and Critical Design Review meetings (CRM) will be required to discuss work progress and review of the on-going work. The Contractor must co-ordinate the Progress and/or Technical Review meetings when requested by the PA or the CA.

Meetings may be called by DND or the Contractor for any proposed contract amendments, contractual discussions, or whenever the DND or Contractor project teams deem it necessary.

Opportunities for technical dialogue between the TA or his representatives and the assigned Contractor personnel must be provided on a continual and co-operative basis. The Contractor must conduct meetings in the Ottawa area. The Contractor must ensure that the Contract Manager and personnel with the required engineering and technical knowledge are available to deal with all issues listed on the list of agenda of items.

The Contractor must prepare the agenda and submit it for DND's approval five days prior to the meeting. The meeting agenda must provide information with respect to the purpose, agenda items to be discussed, meeting location and schedule. Meeting minutes must be taken by the Contractor and submitted for DND approval within seven days after the meeting. If the Contractor calls a formal meeting, the Contractor must submit for approval a recommended agenda to the TA at least five working days prior to the formal meeting.

6.11 Project Cost Breakdown and Work Breakdown Structure

As part of its bid, the Contractor must provide project cost breakdown and work breakdown structure (WBS)

The Contractor should provide substantive cost estimates and cash flows including identification of sub-contractor costs for the proposed solution(s). Regardless of acquisition model, the Contractor should breakdown cost estimates to the greatest extent possible. Contractors are to address the following in their price:

- Acquisition costs for power system elements by sub-system.
- Any overhead costs such as project management, transportation, travel, and insurance should also be included and identified.
- Key cost drivers and risks should be identified. Risk may be captured using a multi-point estimate with the best and worst case scenario costs. For example, project implementation delay due to unforeseen circumstances of Arctic weather conditions.
- Any underlying assumptions (i.e. inflation, type of contract, basis of payment, mark-up, fees) used to establish these cost estimates and cash flows should be described.
- Currency exchange considerations should be highlighted where used.
- Costs should reflect Nominal Dollars (\$Current Year), which is defined as the dollar value of a product at the time it was produced.

7.0 Maintenance and In-Service Support

7.1 General

DND will assume responsibility for maintenance of power systems following the successful installation and commissioning, the delivery of specified trainings, documentations and spares, and after the expiry of the warranty period.

7.2 Warranty Period (including post installation monitoring)

The Contractor must provide a warranty period that must cover the maintenance of the PSS, its equipment and all associated items including installation/replacement of parts and labour. The warranty must also include the software. Software modifications to rectify software trouble reports must be covered under this warranty. The warranty period must begin with the installation of the first production unit at the remote site and must end 36 months after the installation of the final unit at the remote site. The contractor must continue to monitor the system also provide regular reports as described in 4.3 on the condition of the power system throughout the warranty period.

7.3 O&M Manual & As-Built Drawings

The Contractor must develop an O&M manual for the microwave power system. The manual must be sufficiently detailed to be used as an operation, maintenance and training document. The manual must be constructed to allow the easy removal and insertion of pages. The Contractor must have completed the final version of the O&M manual prior to the required training specified in Section 8.

The Contractor must provide as-built drawings (pdf and AutoCAD format) for the prototype and the production units of the microwave power supply system for all components, systems and subsystems, including source code and object code

8.0 Training

8.1 General

The Contractor must provide formal hands-on initial training for up to two (3) DND technicians and two (2) engineers at the Contractor facility for the operation and maintenance (O&M) of all equipment procured under this contract, before production units deployment. The training must address maintenance, configuration and theory of operations. DND will conduct subsequent in-house regenerative training based on the initial training and O&M Manual provided by the Contractor. The Contractor must provide:

- a) Course outlines and training manuals to the TA for approval thirty (30) consecutive calendar days before the start of the training;
- b) The date, time and location of the training; and
- c) A copy of the training manual in hard copy or electronic format to each candidate registered for the training.

9.0 Government Furnished Equipment

DND may be able to provide Government Furnished Equipment. The Contractor must submit request for equipment loan to the TA in writing. Government Furnished Equipment loans will be permitted, subject to equipment availability. In the advent that the requested equipment is unavailable from Government's stock, the Contractor must be responsible to acquire the equipment as required.

10.0 Travel, Material Transportation, Lodging and Meals

10.1 Prototype (pilot)

Transportation to CFS Alert for the prototype (pilot) PSS, equipment and the associated installation personnel will be provided by DND from CFB Trenton. The respondents must be responsible to provide the transportation of all equipment and personnel to CFB Trenton. Lodging and meals for all personnel stationed at CFS Alert will be provided by DND.

10.2 Production Units

For the installation phase of the six (6) production units, transportation of the Power Supply Systems to Ellesmere Island will be dependent on the final design and configuration of the system, as described in Contractor transportation plan. The production units may be flown by DND to Ellesmere Island from CFB Trenton or alternatively may be shipped by commercial marine vessels designed for arctic conditions from the Port of Montreal, Quebec. The Contractor must ensure that all equipment shipped to Ellesmere Island is crated and packaged to meet marine shipping requirements or is shipped inside 20-foot ISO containers (sea cans). The final destination of the vessel is still to be determined but shall be either Eureka or Thule Air Force Base in Greenland. Transportation from CFB Trenton, Eureka or Thule AFB to the six (6) repeater sites will be provided by DND. Contractor must be responsible to provide the transportation of all equipment and personnel to CFB Trenton, Resolute Bay or the Port of Montreal. Lodging and meals for all personnel stationed on Ellesmere Island will be provided by DND. The transport via rotary aircraft of the Power Supply Systems to the remote sites will be provided by DND.

11.0 **Business Outcomes**

Canada remains committed to exercising the full extent of its sovereignty in Canada's North. The desired business outcomes for the HADCS Microwave Repeater PSS project are consistent with the new initiatives stated in Canada's Defence Policy (Strong Secure Engaged).

- To enhance its Joint Intelligence, Surveillance and Reconnaissance capabilities, the Defence team will:
 - New Initiative 69 - Prioritize Arctic Joint Intelligence, Surveillance and Reconnaissance as a Defence research and development priority to produce innovative solutions to surveillance challenges in the North.
- To enhance the Canadian Armed Forces' ability to operate in the Arctic and adapt to a changed security environment, the Defence team will:
 - New Initiative 106 - Enhance the mobility, reach and footprint of the Canadian Armed Forces in Canada's North to support operations, exercises, and the Canadian Armed Forces' ability to project force into the region.

12.0 **Risk Assessment**

The intent is to minimize risk by leveraging existing technology with an established Technology Readiness Level (TRL) where possible. Should new technology be incorporated or existing technology be used in a substantially innovative manner, it should be identified along with its TRL and an elaboration on how any associated risk has been minimized with respect to the added value gained by its use.

It should be noted that deployment to all locations on Ellesmere Island is taken at the Contractor's own risk and the Contractor is responsible to obtain insurance for unforeseen circumstances related to personal injury. However, it should be noted that DND will transport the Contractor's employees under the HADCS Summer Maintenance Activities umbrella for personnel deployment to Ellesmere Island. A CFTPO task (Canadian Forces Taskings, Plans and Operations) will be initiated by DND for the deployment of the Contractor's personnel to Ellesmere Island. Emergency medical evacuation of the Contractor personnel will be covered by HADCS Summer Maintenance Activities if required.

13.0 **Recommendations, Suggestions and Comments**

Should any requirement impose a limitation on the Contractor's optimal solution, it should be identified to DND. The Contractor must also specify any additions or amendment they would propose to the Business Outcomes in order to provide or ensure a more optimal solution.

Contractors are greatly encouraged to offer alternatives to any of the concepts outlined in this SOW. These alternatives must be accompanied by a comprehensive analysis that articulates how the proposed amendment is more advantageous to DND with regard to operational suitability, effectiveness, schedule, cost, and risk.

14.0 Accronyms

Term	Description
Ah	Amp hours
C	
CDR	Critical Design Review
CFS	Canadian Forces Station
CG	Controlled Goods
CA	Contract Authority
D	
DND	Department of National Defence
F	
FOC	Full Operational Capability
H	
HADCS	High Arctic Data Communications System
HLMR	High Level Mandatory Requirements
I	
IOC	Initial Operating Capability
ITB	Industrial and Technological Benefits
ISS	In-Service Support
L	
LOS	Line-Of-Sight
M	
MRPS	Microwave Repeater Power Supply
MW	Microwave
N	
NMS	Network Management System
P	
PRM	Progress Review Meetings
PSS	Power Supply System
T	
TRL	Technology Readiness Level
TA	Technical Authority
TRM	Technical Review Meetings

