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

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Specified Herein / Précisé aux présentes

LETTER OF INTEREST
LETTRE D'INTÉRÊT

Title-Sujet In-Service Support for the NRCAN Satellite Facilities / Service de soutien installations satellites de RNCan	
Solicitation No. - N° de l'invitation 23240-150036/B	**Date** 2015-01-27
Client Reference No. - N° de référence du client 23240-150036	
GETS Reference No. - N° de référence de SEAG PW-15-00668981	
File No. – N° de dossier 003ST.23240-150036	**CCC No./N° CC – FMS NO. / N° VME**
Solicitation Closes – L'invitation prend fin **at – à 5:00 PM** **on – le 2015-02-16**	**Time Zone / Fuseau horaire** Eastern Standard Time (EST) / Heure normale de l'est
F.O.B. – F.A.B **Plant-Usine :** ☐ **Destination:** ☐ **Other-Autre:** ☒ X	
Address Enquiries to: - Adresser toutes questions à: Crncan, Adriana	**Buyer Id – Id de l'acheteur** 003ST
Telephone No. - N° de téléphone (819) 956-1353	**FAX No. - N° de FAX** (819) 997-2229
Destination of Goods, Services and Construction: **Destinations des biens, services et construction :** Specified Herein Précisé aux présentes	

Comments - Commentaires

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

Instructions : See Herein

Instructions : voir aux présentes

Issuing Office - Bureau de distribution
Science Procurement Directorate/Direction de l'acquisition
de travaux scientifiques
11C1, Phase III
Place du Portage
11 Laurier St. / 11, rue Laurier
Gatineau, Québec K1A 0S5

Delivery Required - Livraison exigée See Herein – voir aux présentes	**Delivery Offered - Livraison proposée**
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**	

Canada

REQUEST FOR INFORMATION (RFI) for

In-Service Support Services NRCAN Satellite Infrastructure

THIS IS *NOT* A REQUEST FOR PROPOSAL, QUOTATION, OR INVITATION TO BID NOTICE.

TABLE OF CONTENTS

Canada

1. INTRODUCTION

Public Works and Government Services Canada (PWGSC), on behalf of Natural Resources Canada (NRCan), is releasing this Request for Information (RFI) to:

a) inform industry and to seek input of the possible procurement of the "In Service Support" which includes the Operation and Maintenance (O&M) of the NRCan Satellite Infrastructure facilities located in Prince Albert - SK, Gatineau - QC and Inuvik -NWT, as well as to support NRCan while achieving their plan for commercial development at the Inuvik Satellite Station Facility (ISSF); and

b) seek industry comments on the documents pertaining to the draft Request for Proposal (RFP) (to follow), specifically the draft Statement of Work (SOW) at Annex "C", including the attachments, and the draft Evaluation Criteria at Annex "D".

Engagement provides Industry with the opportunity to present their capabilities and considerations regarding Canada's requirements for the operation and maintenance of NRCan Satellite Infrastructure. Canada may use the information gathered to determine changes that should be included that will meet its needs and be consistent with Industry standard practices.

The Industry Consultative Process begins following the publication on Buy and Sell of the Request for Information (RFI) Package, and concludes with the dissemination of the RFI Findings Document. The Industry Consultative Process may also include One-on-One Industry Meetings if requested by the Respondents, submission of RFI Responses and Post RFI Response Submission Meetings (if required).

Following any requested One-on-One Industry Meetings, the next step will be for the Respondents to submit their responses to this RFI. Once responses are received and reviewed by Canada, Respondents may be invited to present and/or explain their responses at a Post RFI Response Submission Meeting with representatives of Canada, in Ottawa.

Industry Engagement Questions are included with this RFI to provide Industry the opportunity to review and prepare written comments which may serve to facilitate this consultation process. The Rules of Engagement for this Industry Consultative Process can be found at Annex "B", Engagement Participation Form.

2. BACKGROUND

Natural Resources Canada (NRCan) has been managing satellite station facilities in collaboration with the private sector since 1972. NRCan's satellite station facilities are strategically located across Canada to ensure coverage of Canada's landmass and waters. These facilities include:

- Prince Albert Satellite Station (PASS)
- Gatineau Satellite Station (GSS)
- Inuvik Satellite Station Facility (ISSF)

In 2014, NRCan completed installation of an antenna (ICAN-1) at the ISSF. NRCan's ground station facility at Inuvik will be referenced as ICAN throughout this and supporting documents. Together the PASS, GSS and ICAN ground reception stations provide satellite imagery coverage of all areas of Canada exception some portions of the Baffin Island region.

The PASS, GSS and ICAN satellite stations have been completely revitalized with all new X/S-band antenna systems, data handling and scheduling, reporting and control systems. PASS is equipped with two antennas, GSS and ICAN each with one antenna. Each station will have S-band TT&C functionality implemented on one antenna system.

The entire system has been designed for a highly autonomous "lights-out" operation and will only require human intervention in the event of non-nominal situations (e.g. systems fault repair, satellite anomalies or other critical satellite control activities) and for systems preventive maintenance.

PASS will be the master station, with GSS and ICAN serving as autonomous remotely managed stations by PASS.

In the spring of 2014, NRCan completed purchase of 578 hectares of land at the ISSF. NRCan wishes to seek a business oriented Contractor to commercially develop the ISSF into a world class multi-antenna park with Canadian and international public and private sector clients.

There are two main aspects to the scope of work:

1) In Service Support (operations, maintenance and repair services) of NRCan's four antennas and control equipment at the PASS (Qty 2), GSS (Qty 1) and ICAN (Qty 1) sites
2) To support NRCan's plan for commercial development of the ISSF.

3. ADDITIONAL CONTENTS TO THE RFI

The following documents will form part of the RFI:

3.1 Draft Statement of Work at Annex "C", which includes the following attachments:

- Attachment 1 Requirements for the In-Service Support of NRCan Satellite Infrastructure
- Attachment 2 Requirements for Commercial Development of the ISSF
- Attachment 3 AD-1 - ICAN Earth Observation Ground Station Description
- Attachment 4 AD-2 - GSS Earth Observation Ground Station Description
- Attachment 5 AD-3 - PASS Earth Observation Ground Station Description
- Attachment 6 AD-4 - GSS Facility Description
- Attachment 7 AD-5 - PASS Facility Description
- Attachment 8 AD-6 - Inuvik Facility Description

3.2 Draft Evaluation Criteria at Annex "D".

4. REQUEST FOR INFORMATION (RFI)

"Respondents" to the RFI are defined as companies or consortia of companies with the capabilities to deliver the requirements identified in this document. Respondents wishing to participate in this consultative process must complete, sign and return the Engagement Participation Form, along with its Appendices, to the Procurement Authority identified in Section 14, below. Upon receipt of the Engagement Participation Form, a meeting time will be allocated to each registering Respondent, if requested by the Respondent. Should the Respondents

request a different date and/or time for their One-on-One Industry meeting, Respondents have to send a formal request to the Procurement Authority identified in section 14, below. If the requested meeting date and/or time by the respondent are not feasible, the Procurement Authority will then propose a new date and time agreeable to both Canada and the Respondent.

The information provided by Respondents may be used to refine the current requirement, the procurement strategy and/or the project cost envelope. The information gathered through the RFI may also be used to assist Canada in the development of the competitive "Request for Proposal (RFP)".

The Respondents are invited to submit a reply to the RFI that addresses each of the topics identified in Annex "A", Industry Engagement Questions.

4.1. Recommendations, Suggestions or Comments

Respondents are invited to provide general feedback and/or any recommendations, inputs or comments (including technical and/or costing information) that could assist Canada in the refinement of the requirement.

4.2. Government-Furnished Equipment (GFE)

For the purposes of this RFI, respondents do not need to consider any items or services identified in the Attachments as Government Furnished.

4.3. Contractual information and Procurement Process

Should Canada move forward with the procurement process (after closing of this Industry Consultative Process), the RFP will include the resulting contract, the mandatory and point rated evaluation criteria, certifications, Security Requirement Check List (SRCL), basis of payment and all other required documents. The RFP will be posted on the BuyandSell.gc.ca website.

4.3.1. Basis of Payment and Method of Payment

It is expected that the resulting contract will be based on a Firm All-Inclusive Monthly Rates for In-Service Support at the GSS, PASS and ICAN sites. The All-Inclusive Monthly Rates for the In-Service Support at the ICAN site will include any costs associated with hosting services at the ISSF, if applicable. It is also expected that Canada will do monthly payment. Non-routine work that may arise from time to time will be captured through a Task Authorization Process which will be subject to a ceiling price.

4.3.2. Green Procurement

Respondents are requested to identify and cost potential areas of development, manufacturing and/or project delivery that leverage environmentally friendly standards and/or processes.

4.4. Security Requirements

The security requirements for the NSI Project are still to be determined. It is expected that there will be a requirement up to SECRET level clearances for Contractor facilities and/or Personnel. The Respondents are requested to detail their current and planned capabilities and facilities, in terms of physical security and screened personnel, to address these requirements. Respondents are encouraged to familiarize themselves with potential security provisions. Details are available at: http://www.tpsgc-pwgsc.gc.ca/services/secinfo-eng.html.

5. REQUIREMENT DESCRIPTION

There are two aspects of work that must be considered:

1) The In-Service Support of the NRCan antenna and control systems at the PASS, GSS and ICAN sites and
2) To support NRCan's plan for commercial development of the ISSF.

The resulting contract is expected to start in FY 2015/16 for a period of eight (8) years. There would be two optional periods of three (3) years each, for a total period of fourteen (14) years.

5.1. ISS Requirement - Operations and Maintenance at PASS, GSS and ICAN

This portion of the resulting contract will be for operating and maintaining the GoC antenna systems, including control, monitoring and data capture systems.

Note due to the potential duration of the resulting contract there must be flexibility such that new facilities, antennas, infrastructure may be added or removed during the duration of the resulting contract.

In nominal cases the systems will be automated and intervention by the Contractor in non-nominal cases. The systems have been designed to self-monitor and send SMTP messages in the event of system problems. This does not preclude monitoring as required of the operations.

Facility maintenance is required for both PASS and ICAN. Facility maintenance is more encompassing in Inuvik. The ICAN facility includes video surveillance as well as a building management system that monitors the facility environment, including the diesel generator. The following attachments to the draft Statement of Work at Annex "C" describe the operations, requirements, facilities and equipment:

- Attachment 1 Requirements for the In-Service Support of NRCan Satellite Infrastructure
- Attachment 3 AD-1 - ICAN Earth Observation Ground Station Description
- Attachment 4 AD-2 - GSS Earth Observation Ground Station Description
- Attachment 5 AD-3 - PASS Earth Observation Ground Station Description
- Attachment 6 AD-4 - GSS Facility Description
- Attachment 7 AD-5 - PASS Facility Description
- Attachment 8 AD-6 - Inuvik Facility Description

5.2. Support expansion plan at the ISSF

In 2010, NRCan inaugurated the ISSF in Inuvik, Northwest Territories. Land for the development of the ISSF was purchased in three phases by the Government of Canada (GoC) and is administered by the CCMEO of NRCan. NRCan initially hosted two antennas with supporting infrastructure: the first belonging to the German Aerospace Centre (DLR), and the second, jointly owned by France's Centre national d'études spatiales (CNES) and SSC (formerly Swedish Space Corporation). In 2014, NRCan completed the installation of its own antenna, ICAN1 and its supporting infrastructure.

The ISSF location is accessible by road from Southern Canada and is near to an airport and modern town facilities; its high latitude provides frequent contacts with polar orbiting earth observation satellites.

The development of the ISSF should align and contribute to the following Canada's Northern Strategy, as detailed in the draft Statement of Work at Annex "C":

1) Exercising our Arctic sovereignty
2) Protecting our environmental heritage
3) Promoting social and economic development

5.3. Government Proposition

The government of Canada is planning to place a long term contract with a contractor to support expansion of the ISSF by seeking additional clients for antenna tracking services. It is combining this opportunity within the same contract for the operations and maintenance of its three (3) antenna tracking facilities at PASS, GSS and ICAN.

The government will fund the operations and maintenance resulting contract for its antennas at all three site but the contractor is to develop the ISSF site on a commercial basis. The government will retain ownership of the land and its own antennas and related equipment at all sites. The contractor will be given exclusivity to provide hosting services to clients wishing to establish Earth Observation infrastructure at Canada's Inuvik Satellite Station Facility. Exclusivity is defined as the right to provide hosting services to new clients at the ISSF without competition from other service providers.

The ISSF site is shown in Figure 5-1 below. There are three antenna locations currently used with a potential for another 12-15 locations. There is an existing road to the first three (3) antennas and room for it to be extended to a 4th and 5th antenna.

Plot A (purple dots in Figure 5-1) is a major new area for expansion showing potential antenna locations based on topography and minimizing mutual interference. The government may pay for the development of a main road and its extensions to service these locations.

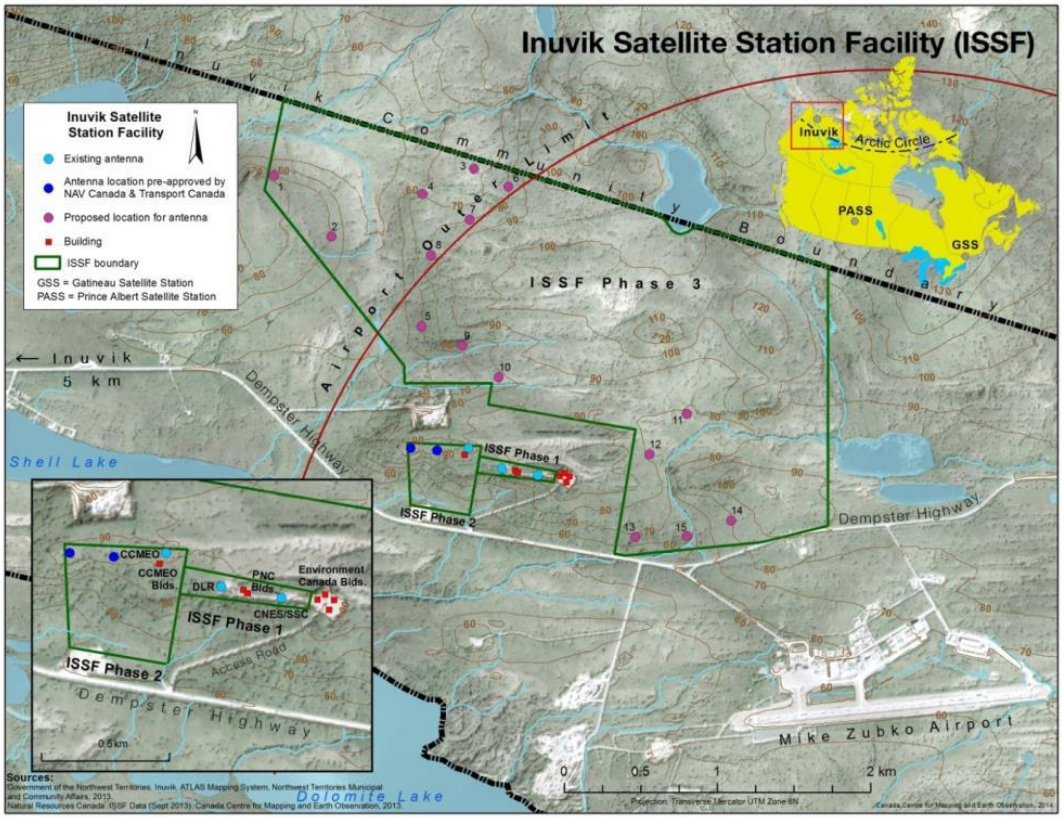

Figure 5-1: General Layout, ISSF and Surrounding Area

The Contractor may offer, at their own discretion, the following services to potential clients on a commercial basis:

- Providing marketing information on the ISSF, developing a plan for incremental growth with criteria for assignment of antenna locations, negotiating contracts for access, building and maintaining infrastructure including roads, power supplies, buildings, and communications. Collecting and paying local suppliers for power, communications and road maintenance.
- In the event that a client comes to an agreement with the government and leases land at the facility, the Contractor will have exclusive rights to provide service packages for installation of antenna pads, antennas and related equipment, and ongoing antenna operations and maintenance.
- The Contractor is expected to provide local capacity training and job creation to Inuvik residents.
- The government will retain its responsibility for the application of licenses as per the Remote Sensing Space Systems Act (RSSSA License) [1], issued by the Department of Foreign

[1] http://laws-lois.justice.gc.ca/eng/acts/R-5.4/

Canada

Affairs, Trade and Development (DFATD) and the *Radiocommunication Act* [2] issued by Industry Canada on behalf of ISSF clients.

Canada will manage the site using the Governance structure described in the draft Statement of Work at Annex "C".

5.4. Expected Timetable

Stage 1 2015-2017 - The resulting contract is expected to be in place for July 1, 2015, after a competitive process. The Contractor gains experience with the ISSF and plans for new installations. It markets the ISSF to clients. It is expected that the Contractor will identify at least 2 to 3 interested ISSF clients during this stage.

Stage 2 2017-2023 - Connection to the internet with high bandwidth fibre will allow for full data readout satellite services. The growth expected is 6 to 10 further clients at the ISSF.

Stage 3 2023-2026 - First contract option to renew for 3 years, if approved by Canada.

Stage 4 2026-2029 - Second contract option to renew for 3 years, if approved by Canada.

5.5. Government Expectations

The expectation is to choose a contractor who will: provide competent tracking satellite services the NRCan's PASS, GSS and ICAN sites, exploit the business opportunity to commercially develop the ISSF to provide satellite services to other companies and agencies, ensure the supply of critical government satellite data, and bring economic and social benefits to the North by developing the ISSF into a world class facility.

5.6. Inuvik Specific Requirements

The specific requirements detailed in Attachment 2 to the draft Statement of Work at Annex "C" must be followed for all work in the Inuvik area.

5.7. Canada's Maximum Funding and Additional Contractor Funding

Canada's maximum funding available for the contract resulting from the bid solicitation is $16M CAD (Applicable Taxes extra, as appropriate). Any cost in excess of the maximum funding will be construed as a Contractor's commitment of additional funding to the Contract. This disclosure does not commit Canada to pay the maximum funding available.

5.8. Exclusivity

The Contractor will be granted exclusive rights to provide hosting services to clients wishing to establish Earth Observation infrastructure at Canada's Inuvik Satellite Station Facility. Exclusivity is defined as the right to provide hosting services to new clients at the ISSF without competition from other service providers.

[2] http://laws-lois.justice.gc.ca/eng/acts/r-2/

6. REQUESTED INFORMATION

Respondents are invited to consult Industry Engagement Questions at Annex "A", Draft Statement of Work at Annex "C", including the attachments, and the Draft Evaluation Criteria at Annex "D", in order to provide their response(s) to the requested information.

To facilitate the review of the responses, Respondents are asked to address and present the requested information in the order in which the topics are presented.

7. NOTES TO INTERESTED RESPONDENTS

The RFI is not a bid solicitation and does not constitute a commitment, implied or otherwise, that the Government of Canada will take procurement action in this matter. The issuance of the RFI does not create an obligation for Canada to issue a subsequent RFP, and does not bind Canada legally or otherwise, to enter into any agreement or to accept any suggestions from Respondents. Canada reserves the right to accept or reject any or all comments received.

Further, Canada will not be responsible for any cost incurred by Respondents in furnishing responses.

A review team composed of representatives of Canada will review the responses on behalf of Canada. Canada may also use an independent consultant or any Government resources that it considers necessary to review response(s). Not all members of the review team will necessarily review all responses. If required, the independent consultant(s) will sign a non-disclosure agreement before they review any response. Canada will provide their information via an amendment to this RFI.

There will be no short listing of firms for purposes of undertaking any future work, as a result of this RFI. Similarly, participation in the RFI is not a condition or prerequisite for participation in any RFP(s).

7.1. Confidentiality

Respondents are advised that any information submitted to Canada in response to this RFI may be used by Canada in the finalization of a competitive RFP. However, the Government is not bound to accept any Expression of Interest or to consider it further in any associated documents such as an RFP.

All industry consultations will be documented and this information is subject to the Access to Information Act. Respondents should identify any submitted information that is to be considered as either company confidential or proprietary. Canada will not reveal any designated confidential or proprietary information to public and/or third parties, except for independent consultant(s) which may participate in RFI response review.

8. INDUSTRY CONSULTATION MEETINGS

8.1. Optional One-on-One Industry Meetings

The proposed One-on-One Meetings are not mandatory. If requested by a Respondent, a maximum of two (2) hours One-on-One Industry Meeting, with representatives of Canada, will be held at the date and time provided by the Procurement Authority. It is the responsibility of Respondents to confirm the date and time of their meeting, as well as their attendance.

These time-limited meetings will provide an opportunity for Respondents to seek clarification and to present technical input for the upcoming requirement. Respondents are asked to please refrain from using their One-on-One Industry Meeting as a forum for marketing purposes.

Following the submission of responses to Canada, Respondents may be invited to present their responses at a Post RFI Response Submission Meeting with representatives of Canada. The Post RFI Response Submission Meetings would occur at government facilities within the National Capital Region and would be held at a date and time agreeable to both Canada and the Respondents.

Registration for participation to this Industry Consultative Process or One-on-One Industry meeting is required on/or before **5 February 2015**.

Respondents are limited to send a maximum of four (4) representatives. Upon registration, a meeting time will be allocated to each registering Respondents on a first come first served basis. To register, please complete, sign and return the Engagement Participation Form along with its Appendices, attached at Annex "B", to the Procurement Authority identified in Section 14.

Participation at this consultative process is not required in order to submit a response to the RFI nor any follow-on RFP.

8.2. Location of the Optional One-on-One Industry Meetings

Optional One-on-One Industry Meetings would be held at the following address (note that meetings can be conducted by Teleconference):

- To be provided at time of registration (within the National Capital Region)

8.3. Additional Industry Consultation Meetings

Canada may request or consider Respondents' requests for additional one-on-one meetings, either in person or by teleconference. In person meetings will occur at government facilities within the National Capital Region. Meetings may be held at the Respondent's facilities at the sole discretion of Canada. In addition, Canada reserves the right to conduct such meetings beyond the closing date identified in this Notice or until further notice. To arrange a meeting, please contact the Procurement Authority.

All substantive and non-proprietary questions and answers discussed during these meetings will be noted and made available to all Respondents participating in the Industry Consultation Process. Questions may be edited, so that the proprietary nature of questions is eliminated.

9. DELIVERY ADDRESS AND RESPONSE FORMAT

Responses to the RFI questions must be sent to the Procurement Authority, identified in Section 14 below, by E-mail. It is the sole responsibility of Respondents to confirm whether their RFI Responses have been successfully received by Canada.

The electronic file formats of the responses must be in either Adobe Portable Document Format (PDF) ™ or in a file format that is readable by the 2003 Microsoft Office ™ Suite.

Provision of an electronic version is preferred in order to facilitate the distribution of the RFI responses to the NRCan project team.

10. CLOSING DATE

RFI Responses should be submitted on or before the following date and time:

The closing date of this Industry Consultative Process is **16 February 2015,** 17h00 EST.

RFI Responses received beyond the above-mentioned date may not be given further consideration.

11. RESPONSE EVALUATION AND INDUSTRY FOLLOW-UP

Following receipt of responses to this RFI, Canada will review responses received for the purpose of refining its way forward on this requirement. In order to maintain awareness within the bidding community for this requirement, PWGSC will publish a RFI findings document.

The RFI findings document may include, but is not limited to, the following information:

- the number of firms that participated
- the identification of firms submitting responses
- a collective assessment on the responses received including anticipated changes, if any. Proprietary information will not be disclosed.
- an estimated schedule for any resulting procurement, as applicable; and,
- next steps.

The RFI findings document will be distributed to Respondents that submitted responses to this RFI only. It is anticipated that the RFI findings document will be distributed within three (3) months after the closing date of the RFI.

12. ENQUIRIES

All enquiries and other communications related to this RFI must be directed exclusively to the Procurement Authority identified in Section 14. Respondents that intend on responding to this RFI are asked to advise the Procurement Authority of their intention to respond, in order that they may be notified of any changes to the notice on the PWGSC Buy and Sell website, which may occur during the posting period.

13. LANGUAGE

Responses and consultation meetings are to be provided / held in one of the two Official Languages of Canada (English or French).

14. PROCUREMENT AUTHORITY

All enquiries and other communications related to this RFI must be directed to the Procurement Authority as follows:

Adriana Crncan
Science Procurement Directorate
Services and Specialized Acquisitions Management Sector
Public Works and Government Services Canada (PWGSC)
11C1, Phase III, Place du Portage
11 Laurier Street,
Gatineau, Quebec, Canada

K1A 0S5

Telephone Number: 819-956-1353
Fax: 819-997-2229
E-mail address: adriana.crncan@tpsgc-pwgsc.gc.ca

Canada

ANNEX "A" – INDUSTRY ENGAGEMENT QUESTIONS

The issuance of this RFI does not bind Canada legally or otherwise, to enter into any agreement or to accept any suggestions from Respondents. Be advised that Canada reserves the right to accept or reject any or all comments received.

QUESTIONS TO INDUSTRY

1.0	**Available Budget**
Q1.1	Natural Resources Canada intends to set a budget limit for Bidders to comply with in the upcoming RFP. Internal evaluations have resulted in an estimated budget limit of $16M (excluding applicable taxes) for the potential 14-year Contract. Is the proposed budget reasonable as per the requirements described in the draft Statement of Work? If not, why not?
A1.1	
2.0	**Statement of Work**
Q2.1	NRCan will grant exclusivity[3] rights to the Contractor. Will exclusivity as specified in the draft Statement of Work provide sufficient opportunity and incentive for responding companies to profitably meet requirements for the provision of hosting services at the Inuvik Satellite Station Facility? If not, why not?
A2.1	
Q2.2	Are there any portions of the draft Statement of Work that need more clarity and/or detail? If so, please note the sections and how the wording is unclear and state why more clarity and/or detail is required.
A2.2	
Q2.3	Are there any portions of the draft Statement of Work that are significant cost drivers? If so, please note the sections, state why and recommend how to improve the requirements to reduce cost?
A2.3	
3.0	**Transition Period**
Q3.1	A number of activities, for example training, will be undertaken as the new Contract comes into effect. Are the transition timelines for the transfer of In Service Support services for the NRCan satellite infrastructure reasonable? If not, why not?
A3.1	

[3] Exclusivity is defined as the right to provide specified hosting services to new clients at the ISSF without competition from other service providers.

Canada

4.0	Evaluation Criteria
Q4.1	Given the complexity if the RFP and the long term nature of the resulting Contract are the (draft) evaluation criteria reasonable, understandable and fair? If not, why not?
A4.1	

Canada

ANNEX "B" – ENGAGEMENT PARTICIPATION FORM (1/3)

In order to participate to this Industry Consultative Process, Respondents must complete, sign and return the following Participation Form, along with its appendices to the Procurement Authority identified in section 14, above.

Participant Name	**Company Name**

Participant Title	**Business Address**

Preferred language of communication

English ☐ French ☐

Are you requesting a One-on-One Industry Meeting

		Number of Participant(s)
Yes		
No		

Additional Participant; name and title

#	Name	Title
1		
2		
3		

By signing this document, the individual represents that he/she has full authority to bind the company identified below and that the individual and the company agree to be bound by all the terms and conditions contained in Annex "B" – Engagement Participation Form and its appendices.

_____ _____

Signature Date

(I have the authority to bind the Company)

_____ _____

Name (Print) Title or Position (Print)

Canada

Appendix 1 to Annex "B" – Engagement Participation Form (2/3)

Rules of Engagement

An overriding principle of the Industry Consultative Process is that it be conducted with the utmost of fairness and equity between all parties. No one entity shall not receive nor be perceived to have received any unusual or unfair advantage over the others.

The Industry Consultative Process begins following the publication on Buy and Sell website of the Notice for RFI and concludes with the dissemination of the RFI Findings Document to participant or on the date indicated on the Buy and Sell website, whichever occurs first. The Industry Engagement Process will consist of the following events:

- Buy and Sell Posting of the Notice for RFI Package Release;
- Optional One-on-One Industry Meetings;
- Submission of RFI Responses;
- Post RFI Response Submission Meetings, if required; and,
- Release of RFI Findings Report to participants only.

At any point within the Industry Consultative Process, the above listed Industry Engagement events or their scheduling may change. Except for changes brought on an unforeseen events or adverse weather, a minimum five (5) calendar day notice will be provided to participants of any planned change. Optional One-on-One Industry Meeting will be held at a location within the National Capital Region.

Following the release of the Request for Information, all written information provided by Canada with respect to this industry engagement will be provided only to those entities that have signed the Rules of Engagement Terms and Conditions identified below.

Rules of Engagement Terms and Conditions

a) Participants wishing to participate in this Industry Consultative Process, as well as to attend optional One-on-One Industry Meetings must register on/or before the date indicated at Section 8.1 - Optional One-on-One Industry Meetings;

b) Participants are expected to discuss their views concerning the requirement and to provide positive resolutions to the issues in question. Each participant shall be provided equal opportunity for information exchange, and in the submission of questions;

c) Participants will NOT reveal or discuss any information to the MEDIA/NEWSPAPERS regarding this requirement during this Industry Consultative Process. If participants receive a question from the Media, participants are to direct the Media to contact the PWGSC Media Relations Office at 819-956-2313;

d) Participants are to direct inquiries and comments only to authorized representatives of Canada, as directed in notices given by the Procurement Authority from time to time. Any communication to unauthorized representatives of Canada may be subject to full disclosure by Canada to all Participants;

e) The number of persons from any one Participant (company, consortia, bidding team, joint venture) is limited to four (4) persons for the One-on-One Industry Meetings and/or the Post RFI Response Submission Meetings;

f) Media cannot participate in this Industry Consultative Process;

g) Canada is not obligated to issue any RFP, or to negotiate any contract for any of the requirements or phases to be identified during this Industry Consultative Process;

Canada

h) Throughout the entire Industry Consultative Process, all questions from industry, exchanges of information and all of the industry feedback shall be provided in writing to the contracting Authority. In accordance with and subject to the *Access to Information Act, R.S., 1985, c. A-1*, and any other legislative or legal requirement, all information which is provided by a Participant and which is clearly marked as "Proprietary" will not be released or disclosed;

i) Proceedings from the optional One-on-One Industry Meetings will be recorded. Questions and answers raised from these meetings may be summarized and provided to all Participants. In order to establish better communications between Canada and Industry, and also to increase the accuracy of information gathered during the One-on-One Industry Meetings, Respondents will be requested to submit the list of questions posed during the meeting to the Procurement Officer no later than five (5) business days after the meeting;

j) If Canada does release an RFP, the terms and conditions will be subject to Canada's absolute discretion;

k) Canada will not reimburse any Participant for any cost incurred in participating in this Industry Consultative Process;

l) Participation is this Industry Consultative Process will not be a mandatory requirement for any subsequent RFP. An entity will not be precluded from submitting a proposal under any subsequent RFP on account of they not being a Participant;

m) Failure of an entity to agree to and sign the Engagement Participation Form will result in exclusion of the entity from participation in the Industry Consultative Process, exclusion of the entity from participation in the optional One-on-One Industry Meetings, as well as exclusion of the entity from the provision of updates to the RFI documentation;

n) A dispute resolution process to manage impasses throughout this Industry Consultative Process must be adhered to in accordance with Appendix 2 of Annex "B" – Engagement Participation Form, below. All requests to use the dispute resolution process must be directed to the Procurement Authority who will make the appropriate arrangements;

o) At any point within this process, a Participant may provide notice to the Procurement Authority that they no longer wish to participate in the Industry Consultative Process. Upon the Procurement Authority's receipt of such notice, the Participant will not be scheduled for participation in any future event(s);

p) If required, the Post RFI Response Submission Meetings will be held with only those Participants that have submitted a complete response to the RFI;

q) Participation in the optional One-on-One Industry Meetings, and, or the Post RFI Response Submission Meetings is conditional on the Participant's formal acceptance of all of the above Rules of Engagement. This Engagement Participation Form must be signed by a duly authorized officer of the Participant in this respect; and,

r) The RFI Findings Report will be distributed to all Participants including any which may have previously indicated that they no longer wish to participate in the Industry Consultative Process.

_____ _____

Signature
(I have the authority to bind the Company)

Date

_____ _____

Name (Print)

Title or Position (Print)

_____

Company (Print)

Canada

Appendix 2 to Annex "B" – Engagement Participation Form (3/3)

Dispute Resolution Process

1. By informal discussion and good faith negotiation, each of the parties shall make all reasonable efforts to resolve any dispute, controversy or claim arising out of or in any way connected with this Industry Engagement Process.

2. Any dispute between the Parties of any nature arising out of or in connection with this Industry Engagement Process shall be resolved by the following process:

   a) Any such dispute shall first be referred to the Participant's Manager and the PWGSC Manager managing the Industry Engagement Process. The parties will have 3 Business Days in which to resolve the dispute.

   b) In the event the representatives of the Parties specified Article 2.a. above are unable to resolve the dispute, it shall be referred to the DND DGIMPD Portfolio Manager and the PWGSC Senior Director of the Division responsible for managing the Industry Engagement Process. The parties will have 3 Business Days to resolve the dispute.

   c) In the event the representatives of the Parties specified in Article 2.b above are unable to resolve the dispute, it shall be referred to the Participant's Senior Representative responsible for this project and the PWGSC Director General, who will have 3 Business Days to resolve the dispute.

   d) In the event the representatives of the Parties specified in Article 2.c. above are unable to resolve the dispute, it shall be referred to the Participant's CEO and the PWGSC Assistant Deputy Minister, Acquisitions Branch who will have 5 Business Days to resolve the dispute.

   e) In the event the representatives of the Parties specified in Article 2.d. above are unable to resolve the dispute, the Procurement Authority shall within 5 Business Days render a written decision which decision shall include a detailed description of the dispute and the reasons supporting the Procurement Authority's decision. The Procurement Authority shall deliver a signed copy thereof to the Participant.

_____ _____

Signature
(I have the authority to bind the Company)

Date

_____ _____

Name (Print)

Title or Position (Print)

_____

Company (Print)

Canada

ADDITIONAL CONTENT

-

ANNEX “C”

AND

ANNEX “D”

Canada

1 INTRODUCTION

The Canada Centre for Mapping and Earth Observation (CCMEO) of Natural Resources Canada (NRCan) has a requirement for In-Service Support (ISS) of its revitalized satellite infrastructure at the Prince Albert Satellite Station (PASS), the Gatineau Satellite Station (GSS) and the Inuvik Satellite Station (ICAN) and for commercial development services at its expanded Inuvik Satellite Station Facility (ISSF).

The Contractor must provide the following services:

(1) Provide performance based operations, maintenance and repair services for its new satellite tracking antennas and associated control and data handling system thereby ensuring supply of critical government satellite data from these facilities, and

(2) Leverage the business opportunity to expand the ISSF into a world class facility that would bring economic and social benefits to northern Canadians.

The requirements and scope of work are detailed in two separate documents to ensure clarity: Attachment 1 describes the requirements for In Service Support of NRCan's revitalized satellite infrastructure at the PASS, GSS and ICAN sites and Attachment 2 describes the requirements for commercial development at the ISSF. These and all other applicable documents are listed in Section 3 below.

2 DEFINITIONS

Automated/Automation - A system that is designed and programmed to implement procedures or processes that do not require operator intervention under nominal conditions.

Client – person(s) or organization(s) using the hosting services provided by the Contractor. Contractual arrangements for hosting services will be between the Contactor and the client, not NRCan and the client.

Exclusivity - the right to provide hosting services to new clients at the ISSF without competition from other service providers.

Hosting - the provision of services to clients wishing to establish Earth Observation infrastructure at Canada's Inuvik Satellite Station Facility.

The Project – comprises In Service Support of the NRCan satellite infrastructure at PASS, GSS and ICAN and commercial development at the ISSF.

Lights-Out (Lights-Out Operations) - "Lights-out" is the term being used for an operational model whereby system operations, including scheduling, reception, demodulation, and transmission of the data over an Ethernet based network, are accomplished without human intervention. A "lights-out" system will be fault tolerant and automated to a point where the minor issues that are frequently present are resolved automatically. A "lights out" system will incorporate mechanisms to notify NRCan and Contractor staff of system status and problems.

Nominal Operations - Nominal operations refer to operations when the system is fully functional and meeting all functional requirements without operator intervention.

3 ACRONYMS AND ABBREVIATIONS

The following table lists acronyms and abbreviations used in this Statement of Work, its attachments and associated reference documents.

ACRONYM / ABBREVIATION	DEFINITION
AMS	Archive Management System
AOS	Acquisition Of Signal
BSA	Booth Street Archive (NRCan Ottawa)
CSA	Canadian Space Agency
CCEO	Canada Centre for Earth Observation (a Division of CCMEO)
CCMEO	Canada Centre for Mapping and Earth Observation (a Branch of Natural Resources Canada)
CNES	*National Center for Space Studies (of France)* - *Centre national d'études spatiales*
COTS	Commercial Off The Shelf
CSA	Canadian Space Agency
DAF	Data Acquisition Facility
DAS	Direct Archive System (MDA)
DEU	Digital Equipment Unit (Datron antenna control unit)
D/C	Down Converter
DFATD	Department of Foreign Affairs, Trade and Development
DLR	German Aerospace Center - *Deutsches Zentrum für Luft - und Raumfahrt*
DRF	Data Reception Facility
EO	Earth Observation
EODMS	Earth Observation Data Management System (co-located with BSA)
EODS	Earth Observation Data Services
FRED	Framed Raw Expanded Data (an MDA-designed data format specification)
FTP	File Transfer Protocol
GB	Gigabyte (1 000 000 000 bytes)
Gb	Gigabit (1 000 000 000 bits)
GPS	Global Position System
GSS	Gatineau Satellite Station
GSS13m1	GSS 13metre antenna #1
GUI	Graphical User Interface
HSM	Hierarchical Storage Management
ICAN	NRCan's satellite ground station at the ISSF
ICAN1	ICAN antenna #1

ACRONYM / ABBREVIATION	DEFINITION
IF	Intermediate Frequency
IRIG	InterRange Instrumentation Group
ISO	Greek – means “the same”
ISSF	Inuvik Satellite Station Facility
kbps	kilo-bits per second
LAN	Local Area Network
LNA	Low Noise Amplifier
LO	Local Oscillator
LOS	Loss of Signal (from satellite)
MB	Megabyte (1 000 000 bytes)
Mb	Megabit (1 000 000 bits)
Mbps	Megabits per second
MON-A-CO	Monitoring and Control Unit (SED)
NRCan	Natural Resources Canada
PASS	Prince Albert Satellite Station
PASS13m1	PASS 13metre antenna #1
PASS13m2	PASS 13metre antenna #2 (no TT&C)
QA	Quality Assurance
QPSK	Quadrature Phase-Shift Keyed
RACC	Reception, Archive and Control Computer (MDA)
RAID	Redundant Array of Inexpensive Disks
RF	Radio Frequency
RM	Reception Manager
-NSI	NRCan Satellite Infrastructure (formerly known as EODS)
RSSSA	*Remote Sensing Space Systems Act*
RT	Real-Time
RV	Reception Viewer (MDA)
SAR	Synthetic Aperture Radar
S-Band	2.200 – 2.300 GHz
SSC	Swedish Space Corporation
SOA	Satellite Operating Agency
SOP	Standard Operating Procedures
SOW	Statement of Work
SPA	System Participant Agreement
TB	Terabyte (1 000 000 000 000 bytes)
TBD	To Be Determined
TCG	Time Code Generator
TCR	Time Code Reader

ACRONYM / ABBREVIATION	DEFINITION
TT&C	Telemetry Transmit and Control
U/C	Up-Converter
UTC	Universal Time Coordinated
UTP	Unshielded Twisted Pair
VEC	State Vector
WAN	Wide Area Network
WWW	World Wide Web
X-Band	8.025 – 8.400 GHz

4 BACKGROUND

Natural Resources Canada (NRCan) has been managing satellite ground station facilities in collaboration with the private sector since 1972. NRCan's satellite ground station facilities are strategically located across Canada to ensure coverage of Canada's landmass and waters. These facilities include:

- PASS (established 1972)
- GSS (established 1986)
- ISSF (established 2010)

Together, NRCan's antennas at these three stations provide satellite reception coverage of all areas of Canada, with the exception of a portion of the Baffin Island area. In addition, coverage extends into the continental United States and over all three oceans (Pacific, Atlantic and Arctic).

Coverage provided by NRCan's satellite ground station receiving stations is shown in Figure 1 below:

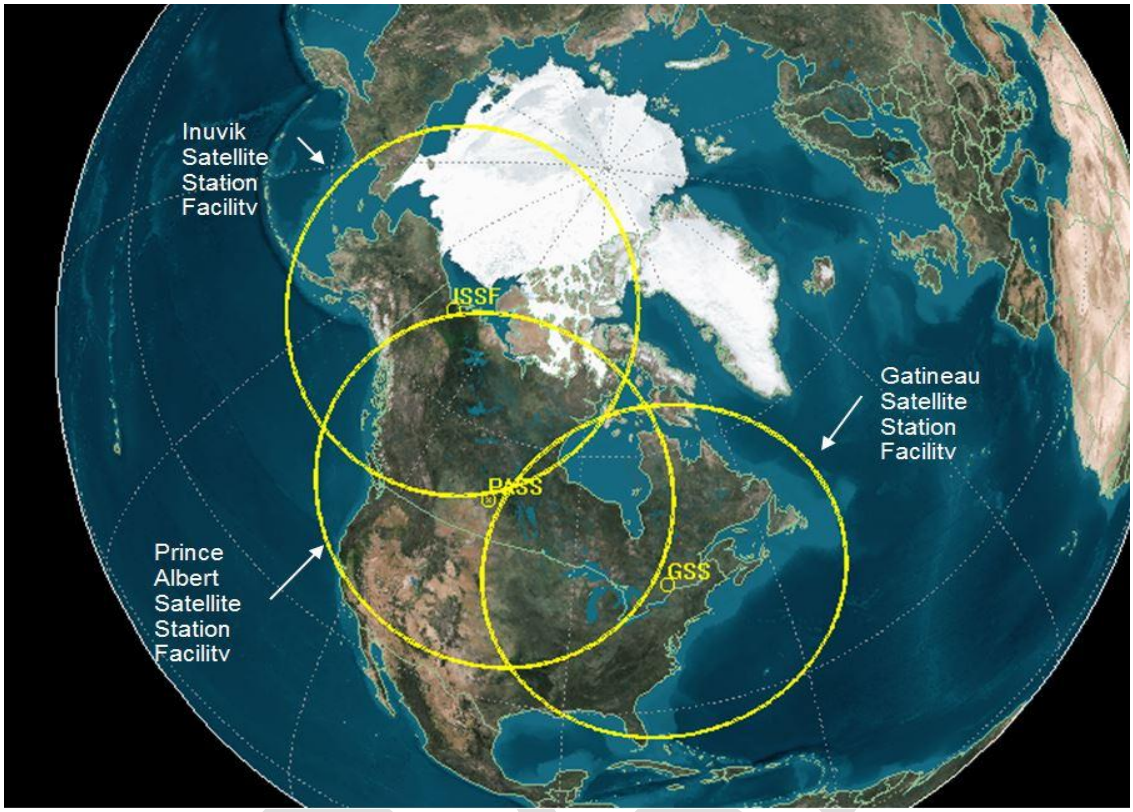

Figure 1. Coverage provided by NRCan's satellite stations

Over the past 5 years, the PASS and the GSS have been completely revitalized with all new X/S-band antenna systems, data handling and scheduling, reporting and control systems. The PASS is equipped with two antennas, the GSS with one antenna. A new antenna – ICAN1 - with supporting equipment and systems has been installed at ICAN. All of the NRCan ground stations have S-band TT&C functionality implemented on one antenna system.

The entire system has been designed for a highly autonomous "lights-out" operation and will only require human intervention in the event of non-nominal situations (e.g. systems fault repair, satellite anomalies or other critical satellite control activities) and for systems preventive maintenance.

PASS will be the master station, with the GSS and ICAN serving as autonomous remotely managed stations by PASS.

In addition, NRCan has procured a large parcel of land at the ISSF. NRCan envisions a sustainable antenna park with at least 12 more antennas added to the ISSF over the next 14 years. To this end, NRCan wishes to seek a business oriented contractor to expand the ISSF into a world class facility by providing hosting services to Canadian and international public and private sector clients.

4.1 GOVERNMENT OF CANADA OBJECTIVES

NRCan seeks to expand the ISSF in alignment with Canada's Northern Strategy and Canada's Economic Action Plan. The expansion of the ISSF will contribute to the following Government of Canada objectives:

4.1.1 Promoting social and economic development in the North

In the immediate future, expansion of the ISSF will result in improved communications to Inuvik and the surrounding area. The need for satellite data providers to have access to a fast communication system to link their data to the world has served as a catalyst for the installation of the Mackenzie Valley Fibre Link (MVFL)[1] that will connect the town of Inuvik and many communities in the NWT via high speed optic-fibre enabled network. This new communications link will provide increased opportunities to grow and diversify businesses, boost employment opportunities, and enhance government service delivery.

In the short term, establishing clients at the ISSF presents opportunities for local employment the construction of roads, antenna pads, and other infrastructure such as support buildings. It will require installation of equipment and systems – including electrical, IT, heating and cooling, water and sewage, security and weather monitoring.

In the longer term, the location of both an Aurora College campus and the Aurora Research Institute in Inuvik, presents opportunities for developing skills related to the operations and maintenance, and data reception and management processes of a world class Earth Observation facility. Possible training opportunities range from satellite station design layout to processing satellite signals for local applications such as ice or energy infrastructure monitoring, to maintaining sophisticated system hardware and software.

4.1.2 Protecting our environmental heritage

Several major resource projects are planned for the Yukon, Northwest Territories (NWT) and Nunavut. Data received from the many satellites tracked at the ISSF can be used as baseline environmental information that can be updated as resource projects progress. Similarly, protected areas such as northern National Parks, marine protected areas, bird sanctuaries and other protected areas can be monitored.

4.1.3 Exercising our Arctic sovereignty

The Canadian RADARSAT satellite series provide regular surveillance of the Arctic for monitoring shipping and tracking changes to the land. The ISSF provides increased reception and Telemetry, Tracking & Control (TT&C) capabilities that will complement other NRCan and Department of National Defence (DND) Polar Epsilon receiving stations in southern Canada. Data received from other satellites tracked at the ISSF could provide additional monitoring.

4.2 GOVERNANCE

Nothing contained in this Contract shall create the relationship of principal and agent, employer and employee, partnership or joint venture between the Parties. However, given the complexity

[1] http://news.exec.gov.nt.ca/mackenzie-valley-fibre-line-contract-signed/

and length of time of the Contract a governance structure will be required to ensure that all stakeholders have a forum to discuss issues arising from the Contract.

4.2.1 Management Board

The Management Board will be composed of representatives of NRCan – the Project Authority – and other government stakeholders. The Management Board will formulate the vision, goals and strategy for the expansion of the ISSF, GSS and PASS facilities, upon which antennas and infrastructure may be added or removed throughout the life of the Contract. The intent in forming a Management Board is for decisions to be made on a consensus basis. If decision cannot be reached by consensus NRCan retains the authorities enabled as the Project Authority. If the decision is out-of-scope of the contractual relationship, NRCan retains full decision-making authority and accountability unless otherwise indicated in the Board decision record. A Record of Decision will be generated after each meeting. Meetings will be held at least quarterly.

The Management Board will approve the annual work plan of its supporting committee – the Technical Committee, review and approve the annual financial report approved by the Finance Committee. The Management Board will also carefully consider and implement wherever possible the recommendations of the ISSF Multi-Stakeholder Steering Committee related to the ISSF site.

4.2.2 Technical Advisory Committee

The Technical **Advisory** Committee will be composed of representatives (likely different representatives than on the Management Board) of NRCan and the Contractor. This Committee will be responsible for implementing Management Committee decisions and for researching and recommending future areas for consideration. This Committee will also provide oversight and direction to the In-Service Support Committee.

The Technical Advisory Committee may form issue-specific and/or time-limited working groups to explore in more detail topics of mutual interest and may invite additional experts, partners, and/or stakeholders to these working group meetings. This would include representation from stakeholders such as the Canadian Space Agency, the Department of National Defence, Environment Canada and others as required.

Recommendations will be made on a consensus basis. If a unanimous recommendation cannot be reached, risks and benefits and cost implications must be articulated and brought forward to the Management Board. It is suggested that the Technical Advisory Committee meet formally on a quarterly basis.

4.2.3 In-Service Support (ISS) Advisory Committee

The In-Service Support (ISS) Advisory Committee will be composed of representatives (likely different representatives than on the Management Board and/or the Technical Advisory Committee) of NRCan and the Contractor. This Committee will be responsible for the ongoing In-Service Support of NRCan's satellite infrastructure at the ICAN, the PASS and the GSS, as outlined in the Contract. The ISS Advisory Committee will deal with ongoing, operational/support challenges, plan future works and monitor and evaluate completed work. Recommendations will be made on a consensus basis. If a unanimous recommendation cannot be reached, risks and benefits and cost implications

must be articulated and brought forward to the Technical Advisory Committee. It is suggested that this Committee meets formally on a monthly basis.

4.2.4 Finance Advisory Committee

The Finance Advisory Committee will be composed of representatives (representatives (likely different representatives than on the Management Board) of NRCan and the Contractor. The Contractor will be responsible for forecasting, tracking and reporting on all financial aspects relating to contractual obligations and will produce quarterly financial reports related to Hosting services at the ISSF and an Annual Financial Report, to be recommended by the Finance Advisory Committee for approval by the Management Board and inclusion in the Annual Report.

4.2.5 ISSF Multi-Stakeholder Steering Committee

The ISSF Multi-Stakeholder Steering Committee**,** a critical component of the governance structure – will focus exclusively on the expansion of the ISSF. This Committee will advise the Management Board on current and emerging challenges and opportunities associated with the ongoing management and future planning of the ISSF. The approach taken by this Committee will be one of community engagement – it will provide an open forum for identification, discussion and resolution on issues and potential actions to be taken. Its recommendations will be made to the Management Board. It is recommended that the Steering Committee meets monthly via teleconference and once a year, holds an Annual General Meeting.

It will be important to keep lines of communication between the Multi-Stakeholder Steering Committee and the Management Board and it's supporting committees open and transparent. To that end, NRCan will provide mechanisms to ensure timely dissemination of meeting notices, materials, records and supporting documents in such a way that they are accessible by stakeholders and community members.

Figure 2 below illustrates the governance structure.

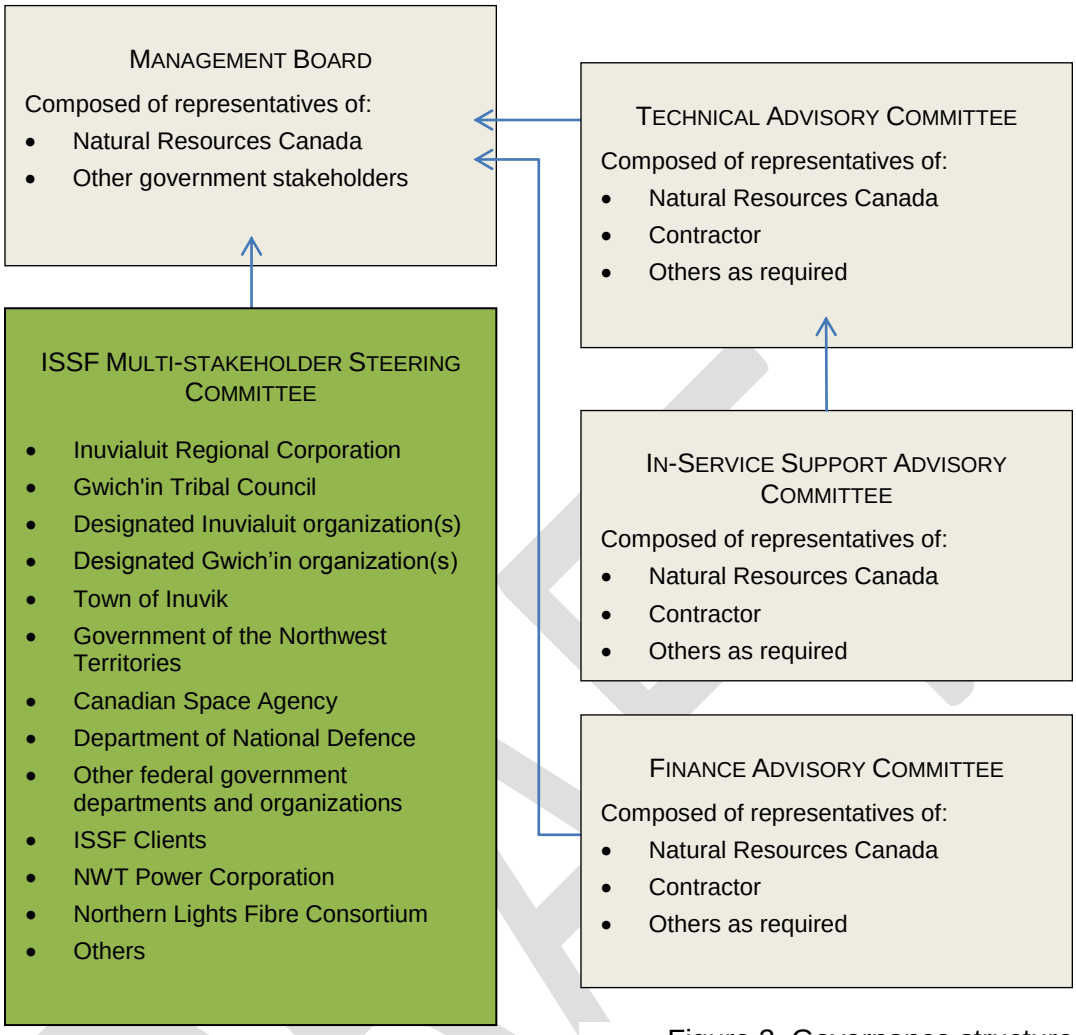

Figure 2. Governance structure

5 APPLICABLE DOCUMENTS

The following documents are necessary for this Statement of Work:

Attachment 1	Requirements for the In-Service Support of NRCan Satellite Infrastructure
Attachment 2	Requirements for Commercial Development at the ISSF
Attachment 3	AD-1 ICAN Earth Observation Ground Station Description
Attachment 4	AD-2 GSS Earth Observation Ground Station Description
Attachment 5	AD-3 PASS Earth Observation Ground Station Description
Attachment 6	AD-4 GSS Facility Description
Attachment 7	AD-5 PASS Facility Description
Attachment 8	AD-6 Inuvik Facility Description

Note: Attachments 1 and 3 - 8 relate to the In-Service Support of the NRCan Ground Stations

6 LOCATION OF WORK

The work will be performed at NRCan's satellite station facilities located at the PASS, GSS and ICAN sites, CCMEO offices in Ottawa, and the Contractor's place of business. Meetings with the Project Authority will take place at locations as agreed to by NRCan and the Contractor.

7 MEETINGS

The Contractor must be able to meet regularly with the Project Authority. Regular meeting schedules will be determined in the finalized Work Plan and Tasks and Deliverables Schedule as per the deliverables outlines in Section 5 - Specific Reporting Deliverables of Attachment 2 – Requirements for Commercial Development at the ISSF.

8 LANGUAGE OF WORK

All work must be undertaken in accordance with the *Official Languages Act* as applicable. The *Official Languages Act* can be found at: http://laws-lois.justice.gc.ca/eng/acts/O-3.01/. All official

1 IN SERVICE SUPPORT PROJECT OVERVIEW

1.1 INTRODUCTION

This document outlines the requirements for the portion of the Staement of Work pertaining to In Service Support (ISS) - the operation, maintenance and repair of identified equipment - at the following sites: Prince Albert Satellite Station (PASS), Gatineau Satellite Station (GSS) and Inuvik Satellite Station (ICAN).

1.2 SCOPE OF IN SERVICE SUPPORT (ISS)

The scope of In Service Support (ISS) requirements includes:

(a) Reception of earth observation data;

(b) Recording of earth observation data;

(c) Telemetry Tracking and Command (TT&C) of polar orbitting satellites;

(d) System back-ups;

(e) Maintenance of systems operated in the course of routine operations at the PASS, GSS, and ICAN sites; and

(f) Provision of facility maintenance as identified at the PASS, GSS, and ICAN sites.

1.3 TASK DESCRIPTIONS

The In Service Support (ISS) requirement consists of five (5) key tasks. They are:

(a) Task 1 – Reception;

(b) Task 2 – TT&C;

(c) Task 3 – Reporting;

(d) Task 4 – Equipment Maintenance; and

(e) Task 5 – Facility Maintenance.

1.4 OBJECTIVE

This document describes:

- A high level overview of the NRCan ground stations, and
- The In-Service Support requirements.

1.5 BACKGROUND AND DESCRIPTION

NRCan's Canada Centre for Mapping and Earth Observation (CCMEO) ground segments operating at the three stations has been designed for a nominal highly autonomous "lights-out" operation and will only require human intervention in the event of non-nominal situations (e.g. systems fault repair, satellite anomalies or other critical satellite control activities) and for systems preventive maintenance. This will be the model for existing and future missions.

PASS will be the master station, with GSS and ICAN serving as autonomous remotely managed stations by PASS.

A description of the NRCan ground segment outlined in Figure 1 may be found in documents AD-1, AD-2 and AD-3.

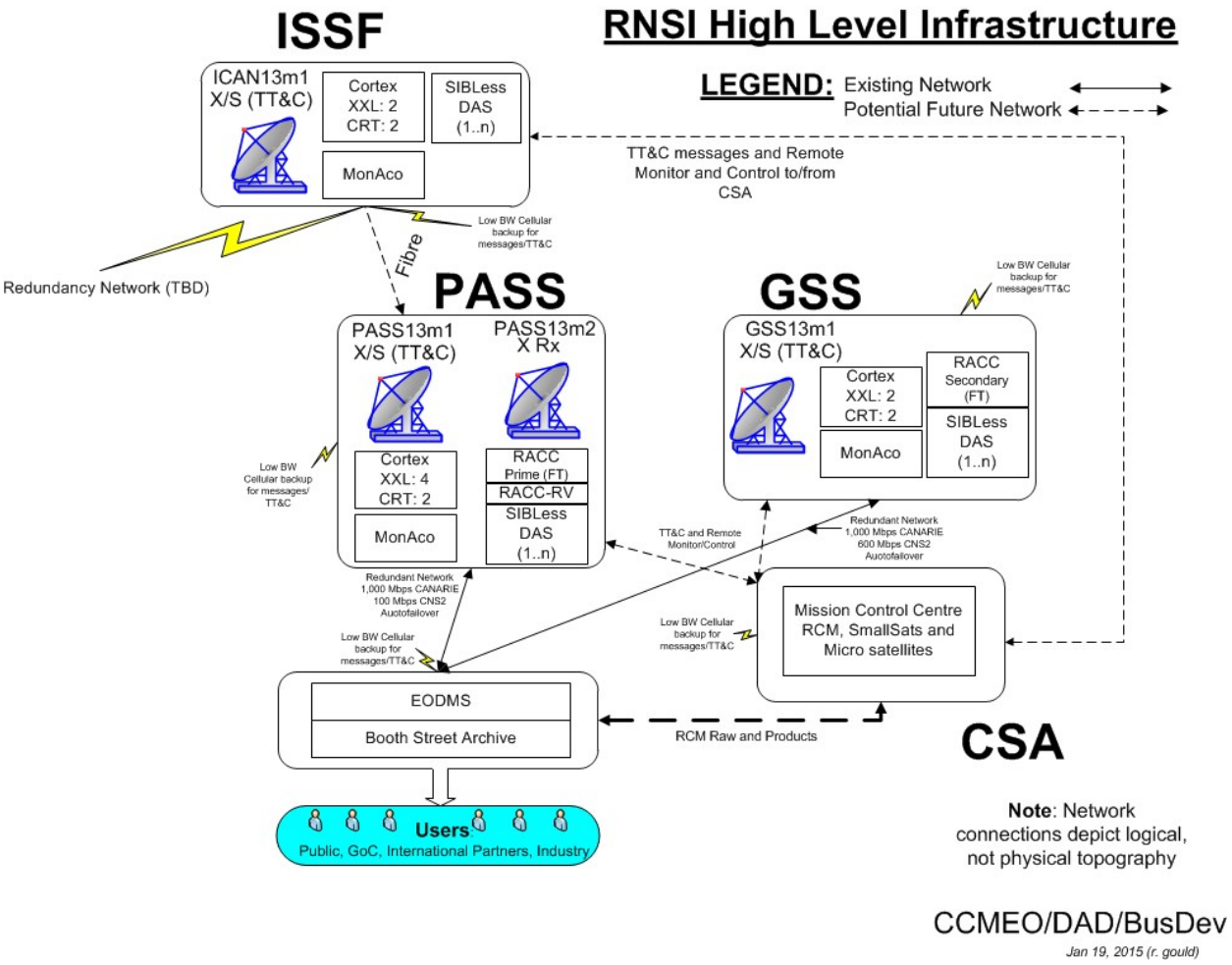

Figure 1: High Level System Diagram

1.6 EXPECTED VOLUME OF SATELLITE PASSES

Table 1 below provides the expected maximum number of passes at each of the NRCan facilities. These volumes have been determined based on the type of satellites that NRCan typically service. On a year to year or facility basis, the total number of passes can vary.

	GSS	PASS	ICAN	Total
# of Antennas	1	2	1	4
# of passes per day	13	30	20	63
# of passes per year	4745	10950	7300	22995

Table 1 - Expected volume of passes at each of the NRCan facilities

2 APPLICABLE DOCUMENTS

2.1 DOCUMENTED OPERATIONAL PROCEDURES

Copies of all existing procedures used in the operation of the systems, equipment and physical facilities at the following sites: PASS, GSS and ICAN may be found at: ftp://ftp.ccrs.nrcan.gc.ca/dad/iss.

3 GENERAL REQUIREMENTS

A number of requirements are common to PASS, GSS, and ICAN. These are outlined in the sections below.

3.1 SERVICES

The Contractor must provide the services defined in this SOW.

3.1.1 "Lights-out" Operation

The Contractor must proactively ensure continued operation of automated equipment and systems as designed for "lights-out" operation.

3.1.2 Simultaneous X-Band and S-Band

The Contractor must operate and maintain the systems such that they are capable of performing S-Band operations simultaneously with X-Band receive operations without performance degradation.

3.1.3 Conformance with Remote Sensing Space Systems Act

The Contractor must perform the operations in conformance with the *Remote Sensing Space Systems Act* (RSSSA) and the *Remote Sensing Space Systems Regulations*. These documents can be found (respectively) at:

- http://laws-lois.justice.gc.ca/eng/regulations/SOR-2007-66/FullText.html

3.1.4 http://laws-lois.justice.gc.ca/eng/regulations/SOR-2007-66/page-1.html **Conformance with Radiocommunication Act**

The Contractor must ensure that it does not unduly cause unwanted Radio Frequency (RF) interference or damage to terrestrial installations or satellites in the operation of all antenna and related RF equipment and must comply with *Radiocommunication Act* in the operation all antenna and related RF equipment. The Act and associated regulations can be found at: http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-484/page-1.html

3.1.5 Occupational Health and Safety

The Contractor is responsible for the health, safety and security of all persons present on the site(s) at its behest and must adhere to the Canadian Labour Code and the appropriate legal framework defined by various levels of Government including those entities acting under the authority of such Governments.

3.1.6 IT Integrity and Security

The Contractor must not compromise the integrity and security of the Government of Canada Information Technology network. The Contractor must adhere to the Treasury Board of Canada Secretariat policy on the Use of Electronic Networks. This policy can be found at: http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=27122&section=text.

3.1.7 Network Responsibilities

The Contractor must be responsible for the day-to-day operation, maintenance and troubleshooting of the station Local Area Networks (LANs). Any changes or enhancements to the satellite stations LANs must be done in collaboration with the Project Authority.

Shared Services Canada (SSC) will be responsible for the Wide Area Network (WAN) connecting all three satellite stations to Ottawa.

The Contractor is responsible for reporting WAN outage to the Project Authority.

3.1.8 E-Mail Use

The Contractor must use generic e-mail accounts for operations purpose, e.g. pass_ops, gss_ops, inuvik_ops e-mail accounts. These generic e-mail accounts will be supplied by NRCan.

3.1.9 Use of Supplied Assets

Use of NRCan supplied infrastructure, equipment, networks, systems and services etc. is solely for the requirements of this Contract.

3.1.10 Asset Disposal

In regards to the disposal of NRCan assets that becomes obsolete, the Contractor must coordinate this activity with the Project Authority, who will initiate the appropriate arrangements

with PWGSC Crown Assets Distribution for disposal. The cost of disposal is the responsibility of the Government of Canada.

3.1.11 Spares

All spares that are available on-site at PASS, GSS and ICAN will be inventoried and made available to the Contractor by NRCan at the commencement of the Contract. The Contractor is expected to run all operations in a safe and responsible manner duly adhering to the Standard Operating Procedures wherever applicable. The Contractor may use any spare item only when it is absolutely necessary and other efforts to repair and reuse are not plausible. Usage of spare items is to be reported to the Project Authority in a mutually agreeable mode. Adequate justification supporting the use of the spare must be provided. Whenever the replacement of any component, part, etc., is attributable to negligence or disregard to the established ways of operation, the Contractor assumes full responsibility to take appropriate corrective measures as quickly as possible.

3.1.12 Consumables

The Contractor must supply all consumables necessary to provide the technical operations services as well as for the facility custodial services e.g. wire, connectors, electronic components, cleaning supplies, light bulbs. Consumables on-site at contract start date are available to the Contractor with the requirement that the Contractor must replenish the items with equivalence of quality and quantity. Any and all consumables being made available on-site by NRCan will be inventoried prior to the Contract start date. The Project Authority will supply this list to the Contractor prior to the Contract start date.

3.1.13 Technical Support

The Contractor must provide technical support to NRCan for the implementation and maintenance of replacement equipment or software of same or similar functions e.g. equipment changed for reasons of life cycle, and for NRCan initiated system changes, enhancements, or configuration changes. The estimated support for this requirement is 500 hours per year for all three facilities. In general, this technical support will be required during core business hours.

3.1.14 Task Authorization

For certain services, including maintenance beyond Level-1, the Project Authority will authorize the Contractor to perform those services using the Task Authorization process.

In the event of unforeseen occurrences, such as natural disasters or emergencies, i.e. floods or forest fires, the Contractor must provide services to NRCan as requested via the Task Authorization process. These services must be authorized in advance by the Project Authority and could include supporting additional reception and/or TT&C activities e.g. to ensure that crucial data is received/sent with associated production and delivery timelines.

3.1.15 Contract Liaison

The Contractor must provide a single point of contact to NRCan who will be responsible to ensure the provision of all services under the Contract and for all operational communication with the Project Authority.

3.1.16 Training

All Contractor resources must participate in and complete training outlined in Table 2 shown in Section 7.1 below. This training will be provided by the Government of Canada and will be completed prior to the Contractor assuming responsibility for operations. It is anticipated that this training will begin within the first month of Contract award. The Contractor must provide mentoring to any new staff or sub-contractors engaged during the Contract.

3.1.17 ISS Procedures and Processes

The Contractor must, when it determines it needs to, create new procedures or processes or update existing procedures or processes, comply with the following requirements:

(a) Deliver this documentation in both official languages to NRCan; and

(b) Develop the same procedures or processes (e.g. scripts, software) at each of the stations for common functions.

(c) Scripts and programs may be internally commented in either official language.

(d) The Project Authority will review documents within two weeks of receipt of the document.

(e) Existing documentation from hardware and software suppliers is available only as provided by the supplier, typically in English.

3.1.18 Procedure Format

In regards to document creation, the Contractor must use a standard format which will be approved by the Project Authority.

3.1.19 Procedure Execution

The Contractor must ensure they use only the latest NRCan approved versions of all documents. Version control will be the responsibility of NRCan. Latest versions will be made accessible to the Contractor.

3.1.20 Facility Additions

Any additions to facilities must be coordinated with and approved by the Project Authority and must be compliant with existing Government of Canada and applicable Provincial and Territorial regulations, standards, and policies.

3.1.21 Facility Co-Occupants

The Contractor must not interfere, delay, or prevent ongoing operations of any facility (building and/or site) co-occupants for which NRCan may designate space at PASS, GSS and ICAN.

4 PRINCE ALBERT SATELLITE STATION REQUIREMENTS

4.1 BASE STATION

It is expected that only one site will be needed to remotely monitor operations and manually intervene using the remote control capabilities of the systems provided in the event of non-nominal operations for all sites. Currently PASS operations will remotely monitor GSS and ICAN operations and manually intervene using the remote control capabilities of the systems provided in the event of non-nominal GSS or ICAN operations. As backup to PASS in this regard, GSS will also be configured to remotely monitor PASS and ICAN operations and manually intervene using the remote control capabilities of the systems provided in the event of non-nominal PASS or ICAN operations.

Any change to the baseline will need to be approved by the Project Authority.

4.2 COVERAGE

The Contractor must supply satellite receiving and TT&C services to cover the Prince Albert satellite station reception mask down to 2.5 degrees elevation at latitude 53.212N and longitude 105.926W.

4.3 EQUIPMENT

The Contractor must use the NRCan provided equipment as baseline for the stations operations. All enhancements, additions and changes must be approved by the Project Authority. NRCan will maintain an inventory of its equipment as described in Appendix A of AD-3 – PASS Earth Observation Ground Station Description. The Contractor must report any changes to the Project Authority as per the Reporting requirements of the Contract specified in Section 10 below.

4.4 NRCAN RESPONSIBILITIES

NRCan is responsible for:

(a) Maintenance of the building structure, access road, and parking lot;

(b) Maintenance and fuel supply of diesel generator;

(c) Maintenance of the Heating Ventilation Air Conditioning (HVAC) systems;

(d) Maintenance of the electrical system;

(e) Maintenance of the building security system;

(f) Maintenance of the water system including all plumbing and septic systems;

(g) Natural Gas utility, via Saskatchewan Energy Corporation;

(h) Electrical power utility, via Saskatchewan Power Corporation;

(i) Standby fire protection services, via the Buckland Fire Department;

(j) Radio frequency licenses;

(k) RSSA licenses;

(l) Telephones, facsimile lines, communication lines and switchboard, which are to be used solely in the performance of the contract;

(m) Monthly inspection of fire extinguishers;

(n) Maintenance and semi-annual inspection of the FM-200 fire suppression systems;

(o) Maintenance and monthly inspection of the emergency lighting units;

(p) Maintenance and monthly inspection of fire protection alarms;

(q) Potable water testing;

(r) Providing the initial office furniture e.g. desks, chairs, to allow the Contractor to perform the work;

(s) Designating three enclosed furnished offices within the main building, for exclusive use by government staff;

(t) Designating sufficient space for the Contractor to perform duties under this SOW; and

(u) Designating space within the building and site for use by other co-occupants.

5 GATINEAU SATELLITE STATION REQUIREMENTS

5.1 COVERAGE

The Contractor must supply satellite receiving and TT&C services to cover the Gatineau satellite station reception mask down to 2.5 degrees elevation at latitude 45.548N and longitude 75.806W.

5.2 EQUIPMENT

The Contractor must use the NRCan provided equipment as baseline for the stations operations. All enhancements, additions and changes must be approved by the Project Authority. NRCan will maintain an inventory of its equipment as per Appendix A of AD-2 - GSS Earth Observation Ground Station Description. The Contractor must report any changes to the Project Authority as per the Reporting requirements of the Contract specified in Section 10 below.

5.3 NRCAN RESPONSIBILITIES

NRCan is responsible for:

(a) Maintenance of the building structure, access road, and parking lot;

(b) Maintenance and fuel supply of diesel generator;

(c) Maintenance of the HVAC systems;

(d) Maintenance of the electrical system;

(e) Maintenance of the building security system;

(f) Maintenance of the water system including all plumbing, the 5,500 gallon potable water tank and septic system;

(g) Electrical power, via Quebec Hydro;

(h) Standby fire protection services, via the Cantley Fire Department;

(i) Radio frequency licenses;

(j) RSSA licenses;

(k) Telephones, facsimile lines, communication lines and switchboard, which are to be used solely in the performance of the contract;

(l) Monthly inspection of fire extinguishers;

(m) Maintenance and semi-annual inspection of the FM-200 fire suppression systems;

(n) Maintenance and monthly inspection of the emergency lighting units;

(o) Maintenance and monthly inspection of fire protection alarms;

(p) Potable water testing;

(q) Providing the initial office furniture e.g. desks, chairs, to allow the Contractor to perform the work;

(r) Designating two enclosed furnished offices within the main building, for exclusive use by government staff;

(s) Building Custodial Services and Grounds Maintenance;

(t) Designating sufficient space for the Contractor to perform duties under this SOW; and

(v) Designating space within the building and site for use by other co-occupants.

6 INUVIK CANADA SATELLITE STATION REQUIREMENTS

6.1 COVERAGE

The Contractor must supply satellite receiving and TT&C services to cover the Inuvik Canada satellite station (ICAN) reception mask down to 2.5 degrees elevation at latitude at 68.319 N and longitude 133.549 W.

6.2 EQUIPMENT

The Contractor must use the NRCan provided equipment as baseline for the stations operations. All enhancements, additions and changes must approved by the Project Authority. NRCan will maintain an inventory of its equipment as per Annex A of AD-1 - ICAN Earth Observation Ground Station Description. The Contractor must report any changes to the Project Authority as per the Reporting requirements of the Contract specified in Section 10 below.

6.3 NRCAN RESPONSIBILITIES

NRCan is responsible for:

(a) Radio frequency licenses;

(b) RSSA licenses;

(c) Electrical power, via Northwest Territories Power Corporation;

(d) Communication lines which are to be used solely in the performance of the Contract;

(e) Provision of the initial office furniture e.g. desk, chairs, to allow the Contractor to perform the work; and

(f) Designation of sufficient space for the Contractor to perform duties under this SOW.

7 TRAINING REQUIREMENTS

7.1 INITIAL OPERATION AND MAINTENANCE (O & M) TRAINING

All Contractor resources must participate in and complete training outlined in Table 2 below. This training will be provided by the Government of Canada and will be completed prior to the Contractor assuming responsibility for operations. It is anticipated that this training will begin within the first month after Contract award.

Subject	Audience	Duration (days)	Location	Comments
General Overview of Ground Segment	All Contractor resources	1	PASS	Covers the overall architecture of NRCan ground stations
Antenna Operations	All Contractor resources	2	PASS	Covers antenna operation and basic maintenance
Monitor and Control Operations	All Contractor resources	2	PASS	Covers Monitor and Control Operations and basic maintenance
RACC	All Contractor resources	1	PASS	Covers RACC operations and basic maintenance

Table 2. Training Requirements for Contractor resources

The above training will be provided by NRCan and will be accompanied by a full set of printed training materials as well as the vendor System Operations Manuals and the vendor System Maintenance Manuals.

Once this initial training is complete, the Contractor must assume full responsibilities for meeting the requirements of the Contract.

7.2 INITIAL OPERATOR FAMILIARIZATION

During the initial two-week period after handoff of operations to the Contractor, NRCan will provide personnel with NRCan's satellite station system operations experience to familiarize the Contractor resources. The goal is to achieve a smooth transition from NRCan to the Contractor. Familiarization support will be provided during core business hours (8 hours per day), weekdays, for the initial two-week operational period. The NRCan personnel will answer questions about the correct operations of the RNSI Systems and provide advice on how to accomplish operations tasks. NRCan personnel are provided to the Contractor for advice only. Full responsibility for operations remains with the Contractor from the point at which the Contractor assumes full responsibilities for meeting the requirements of the Contract.

The Contractor is responsible for providing mentoring to any new Contractor staff and/or sub-contractors engaged during the Contract period.

NRCan will provide familiarization for new mission equipment introduced by NRCan during the Contract period.

8 TASK 1 – RECEPTION

8.1 SATELLITE TRANSMISSIONS

The Contractor must provide reception services, which could potentially cover up to the number of passes identified in Table 1 of Section 1.6, which shall be considered as the Baseline Requirement.

Based on current expectations for existing and planned satellite missions, the Contractor must provide reception services for all of the satellite transmissions identified in:

(a) Table 3 - Prince Albert Satellite Station X-Band Reception Requirements & Metrics,

(b) Table 4 – Gatineau Satellite Station X-Band Reception Requirements & Metrics, and

(c) Table 5 - Inuvik Canada Satellite Station X-Band Reception Requirements & Metrics.

Tables 3, 4, and 5 describe some of the expected missions to be supported during the Contract. However, missions are subject to change. Satellites may reach their end of useful life and/or fail prematurely, operations could be discontinued, new or substitute missions could be added. In most cases, it is expected that this will not change the requirements for reception services. If such an event was to occur, the Contract may need to be amended.

8.2 RECEPTION SERVICES

Reception services include, but are not limited to:

(a) Setting up, in a nominally automated manner, of the reception equipment in preparation for the planned reception of a satellite pass;

(b) Tracking of the satellite;

(c) Actual data reception and associated preprocessing of data, as scheduled in the ground segment systems;

(d) Preprocessing of data files for long term archive and short term storage;

(e) Delivery of data files over the Wide Area Network (WAN) to the NRCan Archive.

In regards to article 8.2 (e) the Contractor will not be in default of meeting the requirement in the event of WAN link unavailability between the satellite stations and the NRCan Archive, provided that the Contractor notifies Shared Service Canada (SSC) and the Project Authority within one hour of the reception (See Section 10.1).

8.3 AUTOMATED REPORTING

The Contractor must ensure that automated post-pass reporting from RACC is made available for delivery. It should be noted that, in nominal and non-nominal receptions, the reports will be automatically generated and delivered.

RECEPTION PERFORMANCE METRICS

8.3.1 Performance Metrics

Refer to Tables 3, 4 and 5 for required performance metrics.

8.3.2 Exclusions

The following are not are not considered as data reception losses incurred by the Contractor:

(a) Satellite downlink unavailability e.g. downlink not scheduled, data not present on downlink;

(b) Scheduling errors e.g. missing reception schedules, inaccurate reception schedules; and

(c) Outages due to satellite occultation and multi-pathing.

(d) Outages due to extreme climate conditions. Each station is equipped with a weather station which readings are logged and may be used to verify weather conditions.

(e) Unavailability due to extreme climate conditions.

8.3.3 Short Term Storage

The Contractor must ensure short term storage of all data received at each station, which is an inherent design feature of the systems.

Table 3. Prince Albert Satellite Station X-Band Reception Requirements & Metrics

Satellite / Sensor	Reception Mode	Projected Reception Volume Passes Per 365-day period (Maximum)	Reception Performance % Received versus Accepted (Measured Quarterly)	Data Quality Minimum/Pass =Ratio of NumBadBlocks /(NumBlocks) (Measured as Quarterly Average)	Data File Format/ Delivery	Data File Delivery Destination
RADARSAT-2	Pass-through & Store and Forward	2,970	Not to exceed 36 minutes data loss per Quarter	<1*10E-07	FRED /FTP	DAS
LANDSAT-8	Realtime & Playback	1,080	95	<1*10E-07	L8 Mission Data /FTP	DAS
SENTINEL-1A,B (or equivalent, commencing 2015)	Realtime	2,593 /satellite	95	<1*10E-07	L0/FTP	DAS
SENTINEL-2A,B (or equivalent, commencing 2016)	Realtime	1,390 /satellite (Descending passes only)	95	<1*10E-07	L0/FTP	DAS
RCM 1,2,3 (Commencing 2018)	Realtime Playback	1,533 /satellite	95	<1*10E-07	FRED/FTP	DAS

Table 4. Gatineau Satellite Station X-Band Reception Requirements & Metrics

Satellite / Sensor	Reception Mode	Projected Reception Volume Passes Per 365-day period (Maximum)	Reception Performance % Received versus Accepted (Measured Quarterly))	Data Quality Minimum/Pass =Ratio of NumBadBlocks /(NumBlocks) (Measured as Quarterly Average)	Data File Format/ Delivery	Data File Delivery Destination
RADARSAT-2	Pass-through & Store and Forward	1,800	Not to exceed 36 minutes data loss per Quarter	<1*10E-07	FRED/FTP	DAS
LANDSAT-8	Realtime & Playback	720	95	<1*10E-07	L8 Mission Data /FTP	DAS
SENTINEL-1A,B (or equivalent, commencing 2015)	Realtime	2,135 /satellite	95	<1*10E-07	L0/FTP	DAS
SENTINEL-2A,B (or equivalent, commencing 2016)	Realtime	951 /satellite (Descending passes only)	95	<1*10E-07	L0/FTP	DAS
RCM 1,2,3 (Commencing 2018)	Realtime Playback	1,000 /satellite	95	<1*10E-07	FRED/FTP	DAS

Table 5. Inuvik Canada Satellite Station X-Band Reception Requirements & Metrics

Satellite / Sensor	Reception Mode	Projected Reception Volume Passes Per 365-day period (Maximum)	Reception Performance % Received versus Accepted (Measured Quarterly)	Data Quality Minimum/Pass =Ratio of NumBadBlocks /(NumBlocks) (Measured as Quarterly Average)	Data File Format/ Delivery	Data File Delivery Destination
RADARSAT-2	Pass-through & Store and Forward	2,850	Not to exceed 36 minutes data loss per Quarter	<1*10E-07	FRED /FTP	DAS
LANDSAT-8	Realtime & Playback	1,200	95	<1*10E-07	L8 Mission Data /FTP	DAS
SENTINEL-1A,B (or equivalent, commencing 2015)	Realtime	4,362 /satellite	95	<1*10E-07	L0/FTP	DAS
SENTINEL-2A,B (or equivalent, commencing 2016)	Realtime	1,903 /satellite (Descending passes only)	95	<1*10E-07	L0/FTP	DAS
RCM 1,2,3 (Commencing 2018)	Realtime Playback	3,350 /satellite	95	<1*10E-07	FRED/FTP	DAS

9 TASK 2 – TT&C

9.1 SATELLITE TRANSMISSIONS

The Contractor must provide TT&C services, which could potentially cover up to the number of passes as identified in Table 1 of Section 1.5, which is considered as the Baseline Requirement.

Based on current expectations for existing and planned satellite missions, the Contractor must provide S-band TT&C services for all of the satellite transmissions identified in:

(a) Table 6 - Prince Albert Satellite Station TT&C Requirements & Metrics,

(b) Table 7 - Gatineau Satellite Station TT&C Requirements & Metrics, and

(c) Table 8 - Inuvik Canada Satellite Station TT&C Requirements & Metrics.

Tables 6, 7, and 8 describe some of the expected missions to be supported during the Contract. However, missions are subject to change. Satellites may reach their end of useful life and/or fail prematurely, operations could be discontinued, new or substitute missions could be added. In most cases, it is expected that this will not change the requirements for reception services. If such an event was to occur, the Contract may need to be amended.

9.2 TT&C SERVICES

TT&C services include, but are not limited to:

(a) Setting up, in a nominally automated manner, of the equipment in preparation for the planned satellite pass;

(b) Tracking of the satellite;

(c) Delivery of telemetry files over the Wide Area Network (WAN) to the Canadian Space Agency;

(d) Uplink of commands forwarded by Satellite Operating Agency(s);

(e) Satellite payload and vehicle Launch Early Orbit Phase (LEOP) operations support, if required, will be via the Task Authorization process.; and

(f) Operations support, if required, will be via the Task Authorization process.

It should be noted that TT&C data flow will be autonomous.

In regards to article 9.2(d), it is currently anticipated that SOAs will include the Canadian Space Agency (CSA) and possibly MDA GeoSpatial Systems Inc. (MDA-GSI) for RADARSAT-2.

9.3 AUTOMATED REPORTING

The Contractor must ensure that automated post-pass reporting from Reception Archiving Catalogue Controller (RACC) is made available for delivery. It should be noted that, in nominal and non-nominal receptions, the reports will be automatically generated and delivered.

9.4 PERFORMANCE METRICS

9.4.1 Performance Metrics

Refer to Tables 6, 7 and 8 for required performance metrics.

9.4.2 Exclusions

The following are not are not considered as data reception losses incurred by the Contractor:

(a) Satellite link unavailability e.g. link not scheduled, data not present on link;

(b) Scheduling errors e.g. missing schedules, inaccurate schedules;

(c) Outages due to satellite occultation and multi-pathing;

(d) Outages due to extreme climate conditions. Each station is equipped with a weather station which readings are logged and may be used to verify weather conditions; and

(e) Unavailability due to extreme climate conditions.

Table 6. Prince Albert Satellite Station TT&C Requirements & Metrics

Satellite	Contact Volume, Projected Passes Per 365-day period	Overall Operational Performance % (Measured Quarterly)
RADARSAT-2	2000 (concurrent with X-Band)	99
SciSAT-1	1000	99
NeoSAT	1000	99
TerraSAR-X	10	99
TanDEM-X	10	99
GRACE	50	99
RCM 1,2,3	400 / satellite (concurrent with X-Band)	99

Table 7. Gatineau Satellite Station TT&C Requirements & Metrics

Satellite	Contact Volume, Projected Passes Per 365-day period	Overall Operational Performance % (Measured Quarterly)
RADARSAT-2	1000 (concurrent with X-Band)	99
SciSAT-1	1000	99
NeoSAT	1000	99
TerraSAR-X	10	99
TanDEM-X	10	99
GRACE	50	99
RCM 1,2,3	400 / satellite (concurrent with X-Band)	99

Table 8. Inuvik Canada Satellite Station TT&C Requirements & Metrics

Satellite	Contact Volume, Projected Passes Per 365-day period	Overall Operational Performance % (Measured Quarterly)
RADARSAT-2	1000 (concurrent with X-Band)	99
SciSAT-1	500	99
NeoSAT	500	99
TerraSAR-X	4	99
TanDEM-X	4	99
GRACE	20	99
RCM 1,2,3	800 / satellite (concurrent with X-Band)	99

10 TASK 3 - REPORTING

10.1 SPECIAL SITUATIONS

The Contractor must provide written notification to the Project Authority, with follow-up by direct land line phone call or alternately by cell-phone (if outside of Monday - Friday 09:00 - 17:00 normal hours), within one hour of any major systems or operational anomalies that will prevent the Contractor from delivering on the requirements specified under articles 8.1, 8.2, 9.1 and 9.2.

10.2 ABILITY TO DELIVER

The Contractor must report by e-mail to the Project Authority, all problems that will prevent the Contractor from delivering on Tasks 1 through 5, within 48 hours of the event.

10.3 MONTHLY OPERATION REPORTS

Monthly operations reports must be produced for all three stations describing all activities performed at the stations and must be made available within 5 business days of the end of each month. These reports must include statistics for all data reception activities for each station, a description of all non-nominal events and actions taken to resolve them, a summary of all preventive maintenance conducted, and plans for the subsequent month.

Monthly operations reports must be submitted in both official languages.

10.4 RECEPTION UNAVAILABILITY REPORTS

The Contractor must generate and deliver Reception Unavailability Report(s) to the applicable Satellite Operating Agency using the RACC system. Reception Unavailability Report(s) must be provided within one hour of generation.

10.5 QUARTERLY ANTENNA AND RF SYSTEM QUALITY DEMONSTRATION REPORT

The Contractor must generate, and provide to the Project Authority, a quarterly system quality demonstration report containing the following information:

(a) Reception G/T test Data Channel calculations and results for S-Band LHCP for each Spacecraft frequency in Operation on each antenna.

(b) Reception G/T test Data Channel calculations and results for S-Band RHCP for each Spacecraft frequency in Operation on each antenna.

(c) Reception G/T test Data Channel calculations and results for X-Band LHCP for each Spacecraft frequency in Operation on each antenna.

(d) Reception G/T test Data Channel calculations and results for X-Band RHCP for each Spacecraft frequency in Operation on each antenna.

(e) Eb/N0 waterfall calculations and plots for full system loopback from LNA through demodulator/Bit Synchronizer for each S-Band LHCP spacecraft frequency in Operation on each antenna.

(f) Eb/N0 waterfall calculations and plots for full system loopback from LNA through demodulator/Bit Synchronizer for each S-Band RHCP spacecraft frequency in Operation on each antenna.

(g) Eb/N0 waterfall calculations and plots for full system loopback from LNA through demodulator/Bit Synchronizer for each X-Band LHCP spacecraft frequency in Operation on each antenna.

(h) Eb/N0 waterfall calculations and plots for full system loopback from LNA through demodulator/Bit Synchronizer for each X-Band RHCP spacecraft frequency in Operation on each antenna.

(i) Tests and calculations demonstrating actual EIRP transmit levels for each S-Band LHCP spacecraft frequency in Operation on each antenna.

(j) Tests and calculations demonstrating actual EIRP transmit levels for each S-Band RHCP spacecraft frequency in Operation on each antenna.

11 TASK 4 - EQUIPMENT MAINTENANCE

A list of all equipment, equipment spares, test equipment and tools, systems and systems software at each station can be found in the following reference documents.

(a) AD-1 EODS-REF-001 - ICAN Earth Observation Ground Station Description

(b) AD-2 EODS-REF-002 - GSS Earth Observation Ground Station Description

(c) AD-3 EODS-REF-003 - PASS Earth Observation Ground Station Description

11.1 SYSTEMS & EQUIPMENT (INCLUDING LAN) MAINTENANCE

The Contractor must provide Level 1 preventative maintenance and repair for all identified systems and equipment.

Level-1 preventative maintenance and repair includes, but is not limited to:

- Servicing and minor adjustments
- Periodic inspections and measurements
- Fault identification and isolation
- Service restoration
- Removal and replacement of boards, power supplies and other major sub-units (typically does not include component replacement)
- Periodic cleaning or replacement (as applicable) of unit exteriors, vents, fans, and filters
- Installation of software updates
- Installation, moving, and removal of cables including power cables up to 220 VAC
- As above for diesel generator and UPS systems at ICAN

11.1.1 Preventive maintenance

Preventive maintenance is required on all systems and equipment in accordance with the Vendor/Manufacturer recommended preventive maintenance regime. All preventive maintenance performed by the Contractor including that sub-contracted by the Contractor to Vendors/Manufacturers must be documented in a preventive maintenance database, created and maintained by the Contractor, which must be readily accessible to the Project Authority.

For system software, maintenance and backups must be undertaken in accordance with software suppliers' recommended best practices. All procedures and a log of their use must be documented by the Contractor and be readily accessible to the Project Authority.

All NRCan furnished test equipment and tools must be maintained by the Contractor in accordance with Vendor/Manufacturer guidelines. Where appropriate, the Contractor must have test equipment recalibrated by authorized service providers. The Contractor must maintain a log of test equipment recalibration and that log must be readily accessible to the Project Authority.

11.1.2 Repair

In the event of non-nominal system or equipment operation, the Project Authority should be notified of the non-nominal situation and the cause of the failure must be promptly diagnosed and repair undertaken to at least Level-1 corrective maintenance in order to avoid impact on operations.

11.2 MAINTENANCE LOGS

The Contractor must maintain maintenance logs and an action request system which are online and accessible via an interactive internet site created and maintained by the Contractor.

The Contractor must provide the Project Authority with access to the maintenance logs and action request system.

The logs must provide details on both what and when maintenance was performed.

The format of these maintenance logs is at the discretion of the Contractor, but must clearly communicate the information contained in the logs.

The Contractor must perform the following maintenance:

(a) Backups;

(b) Restores;

(c) System management of disk space;

(d) System administration;

(f) Troubleshooting;

(g) Fault isolation;

(h) Repair;

(i) Deployment of software updates;

(j) In the event of repair higher than Level-1, assist the equipment or systems Manufacturers/Vendors and/or NRCan in restoring the equipment or system to operational status; and

(k) Fan cleaning.

12 TASK 5 - FACILITY MAINTENANCE

12.1 HEALTH AND SAFETY

Health and safety of its employees and sub-contractors is the responsibility of the Contractor. There are no known outstanding health and safety issues on record for the Gatineau Satellite Station, Inuvik Canada Satellite Station or the Prince Albert Satellite Station. Canada is responsible for providing and upgrading fixed site health and safety equipment e.g. fixed ladders, safety rails. The Contractor is responsible for providing personal protective equipment e.g. safety boots, safety gloves, safety hats, safety goggles, safety harnesses for its staff. Further information on the GSS, PASS and ICAN physical facilities may be found in AD-4, AD-5 & AD-6.

12.2 PASS AND ICAN CUSTODIAL SERVICES

The Contractor must provide the following custodial services to PASS and ICAN, including space designated exclusive to NRCan at PASS and ICAN. The Contractor must provide these services using Contractor furnished supplies, appliances, equipment and tools. The Contractor must maintain a log of all maintenance performed and make this information accessible to the Project Authority.

GSS custodial services are not included in this Contract.

12.2.1 Services

The Contractor must supply, but not limited to, the following building custodial services:

12.2.1.1 Space Cleaning

(a) Sweeping/dust mopping of non-carpeted areas. A properly swept/dust mopped floor, raised operations floor, and/or stairway, must be free of all visible dust, dirt, lint and debris, including areas behind doors, under desks, under tables and other furniture except permanently installed equipment such as computer racks.

(b) Vacuuming of carpets, baseboards, air and return air duct covers. New spots and stains must be removed with a spot remover approved for the type of carpet involved. A properly vacuumed carpet must have stains and spots removed and must be free of all visible dust, dirt, lint and debris including areas behind doors, under desks, under tables and other furniture, with the exception of permanently installed equipment such as computer racks.

(c) Emptying of trash containers and recycling containers. Boxes, cans, bottles and other items placed adjacent to trash containers and marked “TRASH” must also be removed and disposed of. Proper emptying of trash containers and recycling containers must not be allowed to overflow and in the case of trash containers the content shall not be allowed to decay resulting in foul odour.

(d) Using disinfectants, the cleaning of restroom sanitary fixtures such as sinks, toilets, counter tops, and associated fixtures. A properly cleaned restroom must be free of all visible stains, debris and foul odour.

(e) Using disinfectants, the cleaning of kitchen areas including appliances, sinks, countertops and associated fixtures. A properly cleaned kitchen must be free of all visible stains, debris and foul odor.

(f) Dusting of all furniture, chairs, partitions, and sills. Walls and doors must be wiped clean as needed e.g. visible stains removed. If present, white boards, bulletin boards, pictures, and other wall fixtures are to be dusted and cleaned. Proper dusting and cleaning of these items must result in these items being free of visible dust and stains.

(g) Vacuuming and cleaning of the area underneath the raised operations Floor (PASS only).

12.2.1.2 Floor Care

Damp mopping of non-carpeted areas. A properly damped mopped floor, raised operations floor, and/or stairway, is free of all visible dust, dirt, lint, streaks, standing water, and debris,

including areas behind doors, under desks, under tables and other furniture, with the exception of permanently installed equipment such as computer racks.

12.2.1.3 Additional Services

(a) Replacement of burnt-out light bulbs, florescent and halogen tubes. Proper replacement and disposal of burnt-out light bulbs, florescent and halogen tubes must be done promptly (within 24-hours) and with equivalent devices.

(b) Replenishing of bottled drinking water. Proper replenishment of bottled drinking water must be done so as to avoid unavailability.

(c) Replenishing of toilet paper, paper towels, and soap for the restrooms. Proper replenishment of toilet paper, paper towels, and soap must be done so as to avoid unavailability.

(d) Replenishing of paper towels and soap for the kitchen. Proper replenishment of paper towels and soap must be done so as to avoid unavailability.

(e) Garbage disposal and material recycling removal from the site. Proper garbage disposal and material recycling removal must be done as to avoid overflow of holding bins and in the case of garbage to avoid decomposition and foul odor. In addition, the Contractor must properly dispose or recycle waste material e.g. batteries, compact fluorescent Lamps, other electronics, in accordance with the applicable Government of Canada, Provincial and Territorial regulatory guidelines.

(f) Stripping of old wax off of floors and the application of new wax to floors. Proper stripping of old wax and application of new wax must be done do as to neat clean and lustrous finish without soiled, stain or other marks visible. e.g. approximately once a year.

12.3 GROUNDS MAINTENANCE

The Contractor must provide grounds maintenance services using Contractor furnished supplies, appliances, equipment and tools.

12.3.1 Services

The Contractor must supply, but not limited to, the following ground maintenance services:

12.3.1.1 Grass Cutting (PASS only)

The Contractor must mow all grass to look well-manicured, with a neat and professional appearance at all times, maintaining grass height between 2 and 4 inches, uniform in appearance. The Contractor must pick up debris, natural and manmade, prior to mowing any area. The Contractor must remove or mulch grass clippings when visible after mowing, before leaving work area.

12.3.1.2 Shrubbery Maintenance (PASS only)

The Contractor must prune/trim shrubs and other plants to maintain their natural growth characteristics and to enhance the beauty and health of the plant.

12.3.1.3 Roadway and Fire Break (PASS Only)

The Contractor must perform vegetation trimming along the roadway sides and annual tillage of the natural sand fire break along the fence for vegetation control at PASS.

12.3.1.4 Roadway Access

The Contractor must ensure roadway access by keeping the road clear of vegetation, fallen trees or any other thing that would prevent or restrict access.

12.3.1.5 Snow Clearing and Sanding/Salting

The Contractor must provide snow clearing and sanding (or other proper method) for access roadway and parking areas, sidewalks, building entrances, emergency exits and trails to the reception antennas. The Contractor must provide these services using Contractor furnished supplies, appliances, equipment and tools. In the case of ICAN, should the access road increase over the course of this Contract, any substantial increase in this effort will be negotiated.

The Contractor must commence clearing away snow before it exceeds 10 centimeters in height. Accumulations of less than 10 centimeters of snow must be cleared away within 12-hours of precipitation.

The Contractor must take care in clearing and removal of snow such that it does not block building entrances, emergency exits, and access to air conditioning condensers, antennas, utility & diesel generator installations, postal boxes or other site fixtures as applicable.

In the case of ICAN, should the length of the access road increase over the course of this Contract, compensation for substantial increase in this effort will be negotiated.

The Contractor must, when icing conditions prevail, spread a mixture of sand and/or salt as applicable to local conditions on all roadway parking areas, sidewalks and trails which provide access to all building entrances, emergency exits, antenna structures, postal box and other site fixtures, as applicable.

12.4 ADDITIONAL NRCAN ICAN SPECIFIC FACILITY REQUIREMENTS

The Contractor must provide:

(a) Maintenance of the building structure;

(b) Maintenance of diesel generator including monthly exercise routine

(c) Fuel supply for diesel generator including monthly inspection of tank and all pipes and valves for leakage, and monthly recording of fuel levels; Contractor must be present for all fuel deliveries, ensure applicable regulations are followed, and log all deliveries

(e) Monthly inspection of fuel spill kit to verify complete and ready for use plus yearly inventory of the contents of the spill kit

(f) Maintenance of the HVAC systems including monthly inspection of coolant loops for leaks and monthly recording of levels in glycol fill tank;

(g) Maintenance of the electrical system;

(h) Maintenance of the building security system;

(i) Maintenance of the water system including all plumbing, the potable water tank and the sewage tank system;

(j) Fire protection services, via the Inuvik Fire Department;

(k) Monthly inspection of fire extinguishers;

(l) Monthly inspection of first aid kits to verify complete and ready for use plus annual inventory of contents

(m) Maintenance and semi-annual inspection of the fire suppression systems;

(n) Maintenance and monthly inspection of the emergency lighting units;

(o) Maintenance and monthly inspection of fire protection alarms;

(p) Testing of on-site potable water reservoir;

(q) Training of staff in accordance with Inuvik Emergency Response Plan including:

- Basic spill response training
- Emergency Plan awareness
- Fill Procedures review
- Transportation of Dangerous Goods
- Workplace Hazardous Materials Information Systems (WHMIS)
- Fire Extinguisher Training
- Standard Operating Procedures review

13 SERVICE LEVEL SUPPORT AND RESPONSE TIME REQUIREMENTS

This section describes the priority levels and response times required for different levels of operational system anomalies for X-band Reception and S-band TT&C mission operations.

13.1 PRIORITY LEVELS

Priority	Definition
Severity 1 - Urgent	Problem or outage affecting X and S-Band customers critical functions including the antenna with no workaround until fix. Loss of passes.
Severity 2 - High	Problem affecting X-Band or S-Band subsystem with workaround available until repairs are completed. Degradation of performance.
Severity 3 - Service Request	NRCan request requiring intervention.

13.2 RESPONSE TIME

Response time is the time taken from incident to start of repair.

13.3 RESOLUTION TIME

Resolution time is the time taken from start of repair to restoration of the service.

Where the resolution is dependent on the services of an external service provider (e.g.: beyond Level-1 repair), the resolution by an external provider will not be unreasonably delayed, but the timeliness of the external provider's response cannot be guaranteed.

13.4 SERVICE LEVELS

Core Business Hours (Eight hours/day, weekdays)

Measure	Urgent	High	Service Request
Resolution Time	2 hours	3 business days	7 business days
Percentage of resolution times met	95%	95%	95%

After Hours

Measure	Urgent	High	Service Request
Response Time	1 hour	Next business day	Next business day
Resolution Time	4 hours	3 business days	7 business days
Percentage of resolution times met	95%	95%	95%

APPENDIX 1 – LIST OF TABLES

documentation – reports as identified - required for this Contract must be submitted in both official languages.

9 DEPARTMENTAL SUPPORT

NRCan will provide leadership and decision making authority on the Management Board. NRCan will also provide technical expertise on the Technical Advisory Committee, the ISS Advisory Committee and the Finance Advisory Committee. NRCan will provide leadership and may provide logistical and Secretariat support to the ISSF Multi-Stakeholder Steering Committee. The Project Authority and/or delegate(s) will provide support as required throughout the project.

10 PERFORMANCE MONITORING

10.1 OBJECTIVES

As the Project includes a number of complexities, performance monitoring will be managed via the Governance Structure described in Section 4 above. The objectives of the Governance committees will be to ensure that the requirements outlined in Attachment 1 and 2 are met.

10.2 ACCEPTANCE

Meeting records, including records of decision of the Governance Committees will serve as records of requirements being met.

10.3 PROBLEM IDENTIFICATION AND RESOLUTION

The Management Board – described in Section 4.2.1 above will be the mechanism for problem identification and resolution. The Management Board will consider recommendations from the other governance committees in its decision making. The Management Board will seek to make decisions on a consensus basis. If decision cannot be reached by consensus NRCan retains the authorities enabled as the Project Authority.

1 COMMERCIAL DEVELOPMENT OF THE ISSF

This document outlines the requirements for the portion of the Statement of Work pertaining to expansion of the ISSF into a world class facility.

1.1 SCOPE

Hosting services are defined as the provision of services to new clients wishing to establish Earth Observation infrastructure at the ISSF. Hosting services at the ISSF will include numerous activities such as; developing client sites, constructing and installing necessary infrastructure, equipment and support buildings, and providing a defined service level of local operations and maintenance support to clients once they are established there.

NRCan considers that there are three main features of hosting services at the ISSF:

(a) Client development which will include acquiring new clients for the ISSF and developing business relationship with existing clients of the ISSF.

(b) Establishment at the ISSF which includes providing service packages to clients related to site leasing from NRCan and licensing as per the RSSSA and the RF License, providing technical and engineering expertise and contracting for the installation of antennas, construction of supporting infrastructure such as road segments, antenna pads and service buildings, connections to utilities and emergency power hookups.

(c) Ongoing service support to clients such as local Level One maintenance for clients' on site equipment, maintaining and monitoring a 24 hour emergency repair hot-line with access to bonded and fully insured contractors who have been vetted for good pricing and good work that is up to code, maintenance of outdoor areas (such as snow removal, landscaping) of client sites on the ISSF, and site upgrades as required.

The Contractor will be granted exclusivity for the provision of hosting services at the ISSF.

Exclusivity entails the right to provide hosting services to new clients at the ISSF without competition from other service providers.

The Contractor will not be granted exclusivity in the provision of communications networks due to client's potential security requirements.

Existing clients at the ISSF will not be subject to the Contractor's right to exclusivity. This should not preclude the Contractor from offering competitive service packages to those clients

Priority will be given to installation of Earth Observation and other Polar Orbiting satellite reception systems and related infrastructure at the ISSF. Proposals regarding installations to support work that is ancillary[1] to remote sensing may be considered on a case by case basis. NRCan reserves the right to make the final determination in this regard at its sole discretion.

[1] Examples of ancillary work would typically include: processing and distribution of data and execution of other activities such as research and academic activities that do not amount to performance of Controlled Activities as defined by the RSSSA.

Should commercial development at the PASS and GSS sites be contemplated in the future, it will be carried out under similar, if not, identical terms to those set out for the ISSF in the present document.

1.2 BACKGROUND

In 2010, NRCan inaugurated the ISSF in Inuvik, Northwest Territories. Development of the ISSF was part of the NSI – a major project which also included replacing the antennas at the PASS and at the GSS.

Land for the development of the ISSF was purchased in three phases by the Government of Canada (GoC) and is administered by the CCMEO. At Phase 1 of the ISSF, NRCan initially hosted two antennas with supporting infrastructure: the first belonging to the German Aerospace Centre (DLR), and the second, jointly owned by France's Centre national d'études spatiales (CNES) and SSC (formerly Swedish Space Corporation). In 2014, NRCan completed the installation of its own antenna, ICAN1 and its supporting infrastructure on the Phase 2 site of the ISSF.

In the spring of 2014, NRCan completed purchase of 578 hectares of land (Phase 3 of the ISSF) from the Town of Inuvik thereby increasing the total size of the ISSF substantially.

The ISSF site is shown in Figure 1 below. The purple dots show **potential** antenna locations based on topography and minimization of mutual interference.

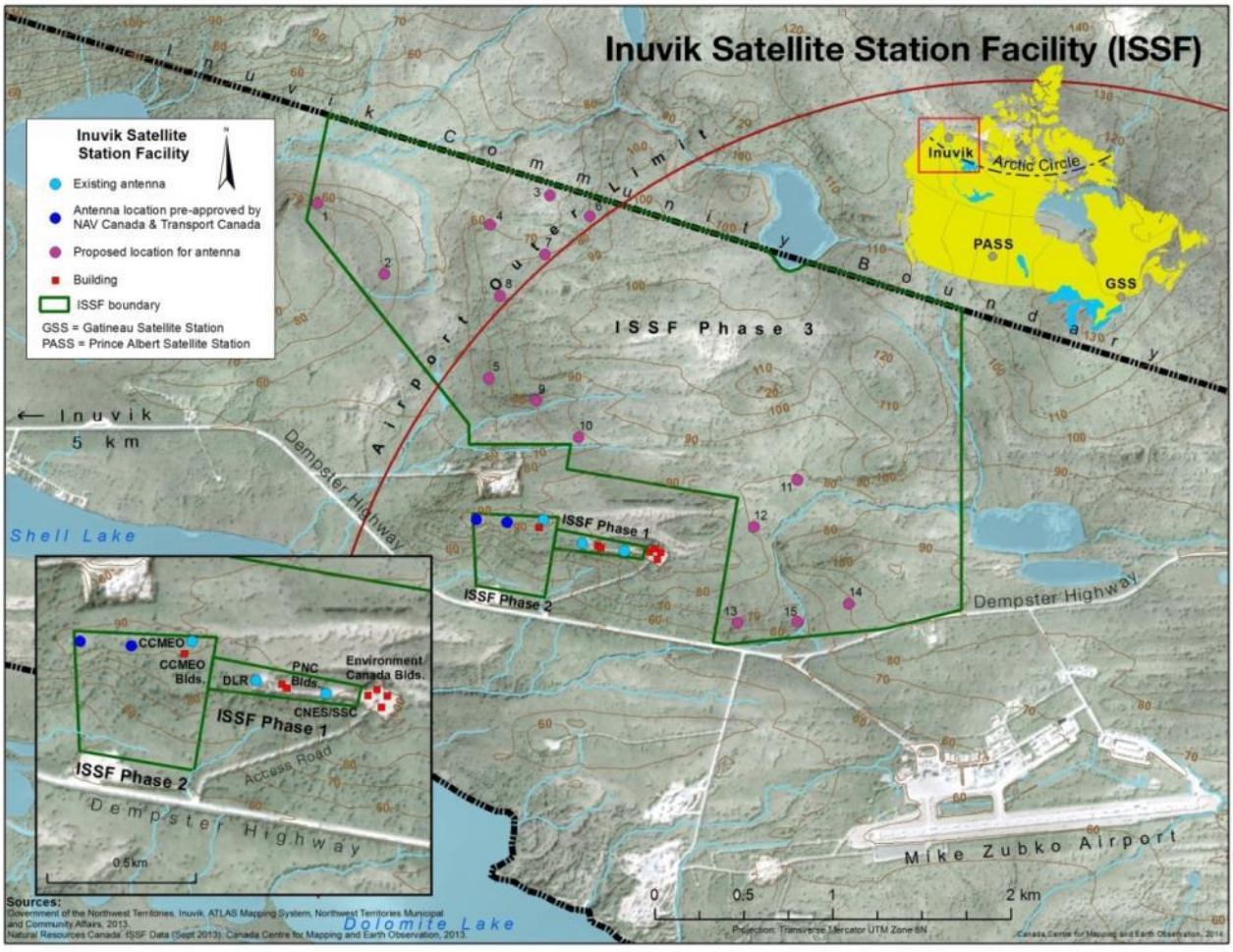

Figure 1. Inuvik Satellite Station Facility site

1.2.1 ISSF Advantages

The location of the ISSF is advantageous for a number of reasons. Its 68° N latitude provides frequent contact with polar orbiting Earth Observation satellites while its western North American location provides coverage of the Earth's surface not available through satellite station facilities in northern Europe. The 578 hectare Phase 3 addition to the ISSF site is characterized by gently rolling topography suitable for the installation of at least 12 additional antenna sites.

Transportation to the ISSF is effectively served by both road and air throughout the year. The Dempster Highway is part of Canada's road network providing access to southern Canada through the Yukon, British Columbia and Alberta. It is open year-round except for brief periods during the November freeze and April thaw. The ISSF is located near by the Inuvik Mike Zubko Airport. The town of Inuvik is located approximately 10 km from the ISSF via the Dempster Highway.

Both Inuvik and the Northwest Territories offer a qualified work force with experience in the construction and installation of antenna infrastructure, construction of support buildings, installation of complex electrical, heating and cooling, and plumbing systems in the northern environment. Inuvik also offers a campus location of the Aurora College, a post-secondary institute specializing in training of skilled trades' people.

It is expected that the ISSF will be served by the soon to be constructed Mackenzie Valley Fibre Link (MVFL). The MVFL, a state-of-the art fibre telecommunications network, will enable space agencies worldwide to have high speed access to the ISSF. As per the Government of Northwest Territories, the construction of the MVFL will be completed in 2016[2].

Canada will fund the construction of a main road to an entrance point of the ISSF Phase 3 site between 2015 and 2016. Construction of this road will be done under a separate contract to this one.

2 GENERAL REQUIREMENTS

This section lists the general requirements based on NRCan ownership of the land contained within the ISSF. It is important to note that NRCan will have individual lease agreements with the Contractor's ISSF clients. As well NRCan is the licensee for both RSSSA and RF Licenses on behalf of the client.

2.1 ESTABLISHING AT THE ISSF

The Contractor is required to commercially develop the ISSF and work with its ISSF clients as outlined below:

(a) The Contractor will make available the updated ISSF Site Plan to potential clients. The ISSF Site Plan must be maintained in order to provide the most current and accurate information at any time, and must be provided to NRCan upon request.

[2] http://news.exec.gov.nt.ca/mackenzie-valley-fibre-line-contract-signed/

(b) The client may select a specific lot to lease at the ISSF from the locations identified on the ISSF Site Plan.

i. NRCan and the Contactor will review requests from clients for installation of infrastructure in areas not identified on the ISSF Site Plan to confirm agreement with the overall operation of the ISSF. In no event shall the highest point of the antenna exceed 105 metres above sea level under ordinary circumstances to ensure compliance with the *Inuvik Airport Zoning Regulations*[3].

ii. A client who wishes to establish on a specific lot at the ISSF but is not yet ready to install its antenna and supporting infrastructure may - with the agreement of NRCan - reserve the lot for a fixed period of time upon payment of a non-refundable reservation fee based on the land lease rate and the duration of the requested reservation as determined by NRCan's Real Property Division. Reservation fees will be reviewed annually and revised as per fair market value of land lease rates. If the client does not develop the reserved lot within the agreed upon reservation time period, upon providing due notice to the client, NRCan may lease the lot to another client.

(c) The Contractor is responsible for the health, safety and security of all persons present on the site at its behest and must adhere to the Canadian Labour Code as the appropriate legal framework defined by various levels of Government including those entities acting under the authority of such Governments.

(d) The Contractor is responsible for obtaining Engineering Approval. The Contractor must ensure the civil works are designed, sealed, inspected and approved by a duly recognized engineer in Canada.

(e) The Contractor is responsible for conforming to Building Codes. The Contractor must ensure that all civil and electrical work is done by workers duly registered or licensed with the responsible authorities and according to all applicable local building and electrical codes.

2.2 LEASING

Canada will retain ownership of the ISSF land, and the authority to lease sites at the ISSF under the *Federal Real Property and Federal Immovables Act*[4].

As the owner of the ISSF land, NRCan will be Lessor and will sign the Lease Agreement with the client in such capacity. However, the Contractor will be required to facilitate the process between new ISSF clients and NRCan. Facilitation of the leasing process must include communication liaison, and the provision of guidelines and advice to the clients.

NRCan will work closely with the Contractor and its client to ensure that the leasing process is completed efficiently. A sample lease agreement can be viewed in Attachment 9 of this document.

[3] The Inuvik Airport Zoning Regulations may be found at http://laws-lois.justice.gc.ca/PDF/SOR-81-707.pdf
[4] http://laws-lois.justice.gc.ca/eng/acts/f-8.4/

At any time, NRCan may prospectively exclude some sites that are yet to be chosen by clients from the scope of this Contract if Government of Canada priorities require it to do so. Examples of such extenuating circumstances could include meeting national security or other defense requirements.

2.3 LICENSING

Conducting remote sensing activities at the ISSF requires two separate licenses: one under the *Remote Sensing Space Systems Act* (RSSSA License) [5], issued by the Department of Foreign Affairs, Trade and Development (DFATD) where Controlled Activities [6] are proposed to be performed and the second under the *Radiocommunication Act* [7] (RF License) issued by Industry Canada. As the sole licensee for both licenses, NRCan currently applies, and will continue to apply under normal circumstances, for both licenses on behalf of ISSF clients. It is important to note that prior to having these authorizations, no activities can be performed at the ISSF

Upon provision of all required information pertaining to each sensor / satellite that a client wishes to operate, NRCan in consultation with other GoC departments will ascertain the admissibility of the client's request. Some of the key considerations include the type of data that the satellite will sense, the ownership and operation of the satellite, the nature of Controlled Activities proposed to be performed, etc.

All clients operating in the ISSF must enter into a System Participant Agreement (SPA) with NRCan to regulate performance of Controlled Activities in order to ensure compliance with the RSSSA. In consultation with DFATD, NRCan will negotiate and finalize a SPA with each client. It should be noted that whenever the client proposes changes to previously authorized Controlled Activities, NRCan will work with DFATD both to secure the required authorizations and, in parallel, work with the client to amend the existing SPA to accommodate the proposed changes. NRCan will recover from the client(s) any fees required by DFATD or Industry Canada for the obtaining of the RSSSA and RF licenses respectively.

The issuance of the RSSSA and RF licenses is at the discretion of the Ministers of Foreign Affairs and Industry Canada, respectively. In the recent past, the time taken to obtain authorizations for operating at the ISSF have ranged from two to twelve months depending on the complexities associated with each request.

Guidance in, and preparation for, the NRCan application for the RSSSA License and the RF License on behalf of its client will be facilitated by the Contactor. Facilitation of the licensing processes must include communication liaison with NRCan.

NRCan will work closely with the Contractor and its client to ensure that the licensing processes are completed efficiently.

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[5] http://laws-lois.justice.gc.ca/eng/acts/R-5.4/

[6] Controlled Activities (as per Sub subsection 8(6) of the RSSSA) are defined as: any of the following activities in the operation of a remote sensing space system:

(*a*) formulating or giving a command to a remote sensing satellite of the system;
(*b*) receiving raw data from a remote sensing satellite of the system;
(*c*) storing, processing or distributing raw data from the system;
(*d*) establishing or using:
(i) cryptography in communications with a remote sensing satellite of the system, or
(ii) information assurance measures for the system.

[7] http://laws-lois.justice.gc.ca/eng/acts/r-2/

In addition, NRCan will work with the clients and the Contractor to obtain all other required licenses and permits that are obligatory under any extant regulatory[8] framework that binds the client.

For greater certainty, it is the Contractor's responsibility to communicate the licensing and permitting requirements to its ISSF clients as soon as possible in its client development process.

A sample SPA can be viewed in Attachment 10 of this document. Attachment 11 contains documents NRCan has designed to expedite the licensing processes.

Clients operating in the ISSF who do not perform Controlled Activities shall be required to enter into an appropriate agreement with NRCan, to be negotiated and finalized prior to commencement of operations.

3 SPECIFIC REQUIREMENTS

NRCan requires that the Contractor develops a number of plans for the commercial development of the ISSF. These plans will form the basis of an overarching Work Plan. NRCan will work with the Contractor to reach agreement on the final version of the Work Plan and a Task and Deliverables Schedule for the Project within the framework of the negotiated Terms and Conditions of the Contract.

The Contractor will be required to implement the plans within the framework of the finalized Work Plan and the Task and Deliverables Schedule. Adherence to the plans will be enforced via the Governance model outlined in Annex A.

All plans proposed/developed by the Contactor are subject to the acceptance of the Project Authority.

Over time, the plans, the Work Plan and Task and Deliverables Schedule may change. It is the responsibility of the Contractor to maintain and update the plans, the Work Plan and the Task and Deliverables Schedule as required.

3.1 BENEFITS TO CANADA

(a) The Contractor must include a "Benefits to Canada" aspect to all plans and subsequent implementation. Some examples of Benefits to Canada can be found in Section 4 of Annex A – Statement of Work.

(b) The Contractor must develop methods by which such benefits could be demonstrated. For example, benefits could fall into categories such as socio-economic development in the North or scientific research and innovation. Demonstrable benefits could be shown using Statistics Canada or NWT Bureau of Statistics data that demonstrate increased economic activity or increased educational levels in Inuvik and the NWT related to expansion of the ISSF or case studies of the use of EO data in northern research and operational applications.

[8] Regulatory shall include all appropriate authorities who typically are from various levels of Government as well as those who act under the authority of various Governments such as NAV Canada, Environmental Impact Screening Committee of the Inuvialuit Region (EISC).

3.2 PROJECT TEAM(S)

(a) The Contractor must describe the key members and structure of the Project Team(s) associated with each of the required Plans of the Project as described in the Sections below. The Contractor must outline the roles, responsibilities and relevant, quantifiable experience and qualifications of those tasked with carrying out the work required in Stages One and Two of this Project.

3.3 BUSINESS PLAN

(a) The Contractor must develop, maintain and update as required a Business Plan for Stages One (the first two years of the Contract) and Two (the following 6-year Contract period) of Project. This Plan should include:

i. An Executive Summary

ii. The Company Description
    1. Experience
    2. Stability of the Company
    3. Financials

iii. Market Analysis
    1. Target clients
    2. Market Research

iv. Strategy and Implementation
    1. Marketing Strategy
    2. Client development strategy
    3. Services development strategy

v. Management and Human Resources
    1. Roles and responsibilities of key personnel
    2. Reporting relationships

vi. Finances
    1. Financial analysis
    2. Description of assumptions

vii. Risk Analysis and mitigation

(b) The Contractor must implement the approved Business Plan.

3.4 HOSTING PLAN

(a) The Contractor must develop, maintain and update as required a Hosting Plan including project planning for the installation of:

i. Access road sections

ii. Antenna pads

iii. Antennas

iv. Supporting infrastructure and equipment

v. Power supply including emergency power back-up

vi. Communications links

vii. Service buildings

(b) The Hosting Plan must include:

i. An outline the provision and oversight of a local maintenance crew providing Level One support for ISSF clients.

ii. Developing and managing contracts, with preference given to local contractors where available.

iii. Options for site upgrades, preventative maintenance, and demonstrate access to a roster of licensed, bonded and fully insured, preferably local, sub-contractors who have been vetted for quality of work and competitive pricing.

The Contractor should describe any assumptions made in the development of the Hosting Plan.

(c) The Contractor must implement the approved Hosting Plan.

3.5 ISSF SITE PLAN

(a) The Contractor must develop, maintain and update as required an ISSF Site Plan identifying allowable locations of, but not limited to:

i. Access road sections

ii. Antenna pads

iii. Supporting infrastructure and equipment

iv. Connectivity to power and communication infrastructure

v. Service buildings (for example research, operations, maintenance, and storage)

vi. The ISSF Site Plan must define and describe the criteria for assigning antenna locations to clients of the ISSF.

(b) The Contractor must implement the approved ISSF Plan.

3.6 LOCAL ECONOMIC PLAN

The Contractor must develop, maintain and update as required a Local Economic Development Plan demonstrating adherence to Inuvik Specific Requirements described as follows:

i. Work Opportunities

Beneficiaries and citizens of the land claim region encompassed by the Project must be involved wherever possible, in providing personnel and support services associated with this work, and must be provided with on-the-job training wherever possible.

Representation of both Inuvialuit and Gwich'in businesses and citizens is required on a best effort basis. Documentary proof of first consideration must be provided.

ii. Consideration and Respect

The Contractor must consider and respect aboriginal culture, wildlife and land ownership when working within the Inuvialuit Settlement Region and within the Gwich'in Settlement Area.

iii. Mobilization Report

a. The mobilization report must be submitted to the Project Authority upon mobilization and must elaborate on logistics pertaining to Inuvialuit and Gwich'in citizens, including training. It should also include, but is not limited to, the following:
    i. any deviation from the Contractor's initial proposal clearly identified;
    ii. a summary of logistical considerations for the work to be performed;
    iii. list of Inuvialuit and Gwich'in Citizens hired, list of Inuvialuit and Gwich'in businesses and services involved in the Project;
    iv. list of all personnel on the job.

b. Documentation must be provided to prove employment of Inuvialuit and Gwich'in Citizens, and to prove involvement of Inuvialuit and Gwich'in businesses and services.

c. Documentation must be provided to prove training of Inuvialuit and Gwich'in citizens employed in the Project.

d. The mobilization report must be submitted within one (1) week of mobilization.

iv. Demobilization Report

a. The demobilization report must be submitted to the Project Authority and must include, but is not limited to, the following:

   i. training questionnaires

   ii. demobilization date;

   iii. detailed logistics pertaining to Inuvialuit and Gwich'in Citizens;

b. Training questionnaires must be completed by all Inuvialuit and Gwich'in citizens employed in this Project.

c. The demobilization report must be provided within two (2) weeks of demobilization from the field.

v. Inuvialuit Involvement Report and Gwich'in Involvement Report

Two reports bound separately (and in pdf format). One report is required for Inuvialuit involvement and one report for Gwich'in involvement. Each report must list and outline the extent and dollar value of Inuvialuit and Gwich'in involvement in providing personnel, benefits, services, training and equipment and a comparison to the Contractor's initial proposal with an explanation for any deviation. Include all concerns which may interest the Inuvialuit Regional Corporation and the Gwich'in Tribal Council. The reports should be extensive in detail and should include all occurrences of communication with the Inuvialuit Regional Corporation and Gwich'in Tribal Council. The Inuvialuit Involvement Report will be made available to the Inuvialuit Regional Corporation. The Gwich'in Involvement Report will be made available to the Gwich'in Tribal Council.

a. The Inuvialuit Involvement Report and Gwich'in Involvement Report must be provided within two (2) weeks of demobilization.

vi. Communications

The Contractor must ensure that any organization or local authorities such as the town office, which may have an interest in the Project are contacted and made aware of the Project and its scope, requirements, time frame, etc. These organizations and local authorities must include and are not limited to:

- Inuvialuit Regional Corporation;
- Gwich'in Tribal Council;
- Designated Inuvialuit Organization(s);
- Designated Gwich'in Organization(s);
- Town of Inuvik

vii. Training

The Contractor must ensure training is provided wherever possible for Inuvialuit and Gwich'in Citizens hired for the work in Inuvik. This may include, but not limited to, relevant on-the-job training, safety and security. All training must be documented in the report as indicated in this document.

3.7 ENGAGEMENT PLAN

(a) The Contractor must develop, maintain and update as required an Engagement Plan describing processes to inform and gather feedback from stakeholders in a fair and transparent manner. This Plan should include consideration of, but not limited to:

- Inuvialuit Regional Corporation;
- Gwich'in Tribal Council;
- Designated Inuvialuit organization(s);
- Designated Gwich'in organization(s);
- Town of Inuvik
- Aurora College and the Aurora Research Institute
- Government of the Northwest Territories
- NWT Power Corporation
- Northern Lights Fibre Consortium
- GoC departments and organizations
- Clients of the ISSF

(b) The Contractor must implement the approved Engagement Plan.

4 REQUIREMENT STAGES

4.1 STAGE 1 (2015-2017)

After award of Contract, the Contractor will be responsible for the commercial development of the ISSF site (see Figure 1). During this first two-year stage the Contractor will gain experience with the ISSF site and begin to accomplish the work as per required Plans (Sections 3.2 – 3.7), the Work Plan and the Task and Deliverables Schedule signed off by the Project Authority. It is expected that the Contractor will identify at least 2 to 3 interested ISSF clients during this stage.

4.2 STAGE 2 (2017-2023)

During the second six-year stage connection to the MVFL is expected to be operational which will allow for optimal data transfer from the ISSF globally. NRCan expects the addition of at least 6 to 10 clients for the ISSF site during this stage. The Contractor is expected to have accomplished most of the Work Plan as per the Tasks and Deliverables Schedule as signed off by the Project Authority.

5 MILESTONES AND DELIVERABLES

The Contractor must produce all deliverables as per the final version of the Work Plan and the Task and Deliverables Schedule, which will be developed within the Contract Terms and Conditions during Year 1 of the Contract and signed off by the Project Authority.

All documentation must be provided in electronic format (Microsoft Word) for e-mail transmission to the Project Authority.

5.1 SPECIFIC REPORTING DELIVERABLES

Milestone #	Deliverable(s)	Delivery Date
Stage 1 (Year 1)	A first draft Work Plan including draft versions of the Plans as described in Sections 3.2 - 3.7 above, and a first draft and Deliverables Schedule. This must include a schedule of regular meeting times for all of the governance committees.	September 30, 2015
	Scheduling, organization and delivery of first meeting with the Management Board to present draft Work Plan and Tasks and Deliverables Schedule for review by the Project Authority.	October 15, 2015
	Incorporation of feedback into draft Work Plan and Task and Deliverables Schedule for sign-off on the draft Work Plan by Project Authority.	November 15, 2015
	Final Work Plan Task and Deliverables Schedule including revised Plans as described in Sections 3.2 - 3.7 above.	January 1, 2016
	Scheduling, organization and delivery of second meeting of the Management Board for presentation of finalized Work Plan and Tasks and Deliverables Schedule.	January 30, 2016
	Presentation of finalized Work Plan and Tasks and Deliverables Schedule to the ISSF Multi-Stakeholder Steering Committee.	January 30, 2016
	Finalization and sign-off of Work Plan and Tasks and Deliverables Schedule by the Project Authority. Note: Sign-off cannot occur without engagement of the Multi-Stakeholder Steering Committee and the inclusion of any agreed upon Steering Committee recommendations into the Work Plan.	March 31, 2016
Stage 1 (Year 2)	Delivery on requirements for the second year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2017
Stage 2 (Year 1)	Delivery on requirements for the third year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2018
Stage 2 (Year 2)	Delivery on requirements for the fourth year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2019
Stage 2 (Year 3)	Delivery on requirements for the fifth year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2020

Stage 2 (Year 4)	Delivery on requirements for the sixth year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2021
Stage 2 (Year 5)	Delivery on requirements for the seventh year of the Contract as defined by the Work Plan and Tasks and Deliverables Schedule.	March 31, 2022

5.2 ANNUAL DELIVERABLES FOR LENGTH OF CONTRACT (STAGE 1 AND 2)

The Contractor must deliver requirements on an annual basis for Stage Two covering ongoing activities such as:

(a) Annual Reports detailing progress in meeting requirements of the Contract, as outlined in the Final Work Plan and defined in the Task and Deliverables Schedule. Annual Reports must be presented at the ISSF Multi-Stakeholder Steering Committee Annual General Meeting.

(b) Scheduling, organization and delivery of:

i. Regular Management Board meetings,

ii. Regular supporting Committee (Technical, Operations and Finance) meetings

(c) Production and dissemination of necessary documentation, meeting materials and Meeting Records in an accessible, transparent manner.

(d) Quarterly reports on management of relationships with the local community and other ISSF stakeholders and clients, including those described in Inuvik Specific Requirements of Section 3.6. These quarterly reports will be reviewed by the ISSF Multi-Stakeholder Steering Committee.

(e) Quarterly reports describing financial investment and spending in the local economy. These quarterly reports must be presented to the Finance Committee.

Attachment 3 to Annex "C"

AD-1

ICAN Earth Observation Ground Station Description

Canada Centre for Earth Observation
CANADA CENTRE for MAPPING AND EARTH OBSERVATION
Natural Resources Canada (NRCan)

Doc. No.:	EODS-REF-001
Version:	4
Revision:	3
Status:	FINAL DRAFT
Date:	15 December, 2015

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CHANGE LOG

ISSUE	DATE	PAGE (S)	DESCRIPTION	Initials
0.0		All	First Release for review.	
1.9		all	Major Rewrite	
3.0	April/May 2014	All	Major Rewrite for RFI	
4.0	Dec 2014	All	Final Update for Draft RFP	AMR
4.1	16 Dec 2014	Multiple	Final Update for Draft RFP, incl. Figure 3 addition	TF
4.2	17 Dec 2014	App. A	Added details of building infrastructure systems	AMR
4.2	18 Dec 2014	App. A	Updated MONACO Servers Model No.	TF
4.2	30 Dec 2014	4, 5	Updated Acronyms & Abbreviations list	TF
4.2	31 Dec 2014	7	Corrected typo	TF
4.3	15 January 2015	All	Formatting, removed Geomatics Canada 'Snail' logo, updated corporate identity	CV

TABLE OF CONTENTS

ACRONYMS & ABBREVIATIONS

AMS	Archive Management System
AOS	Acquisition Of Signal
BSA	Booth Street Archive (NRCan Ottawa)
CSA	Canadian Space Agency
CCEO	Canada Centre for Earth Observation (a Division of CCMEO)
CCMEO	Canada Centre for Mapping and Earth Observation (Natural Resources Canada – NRCan)
COTS	Commercial Off The Shelf
CSA	Canadian Space Agency
DAF	Data Acquisition Facility
DAS	Direct Archive System (MDA)
DEU	Digital Equipment Unit (Datron antenna control unit)
D/C	Down Converter
DRF	Data Reception Facility
EO	Earth Observation
EODMS	Earth Observation Data Management System (co-located with BSA)
EODS	Earth Observation Data Services
FRED	Framed Raw Expanded Data (an MDA-designed data format specification)
FTP	File Transfer Protocol
GB	Gigabyte (1 000 000 000 bytes)
Gb	Gigabit (1 000 000 000 bits)
GPS	Global Position System
GSS	Gatineau Satellite Station
GSS13m1	GSS 13metre antenna #1
GUI	Graphical User Interface
HSM	Hierarchical Storage Management
ICAN	ISSF Canadian station
ICAN1	ICAN antenna #1
IF	Intermediate Frequency
IRIG	InterRange Instrumentation Group
ISO	Greek – means “the same”
ISSF	Inuvik Satellite Station Facility
kbps	kilo-bits per second
LAN	Local Area Network
LNA	Low Noise Amplifier
LO	Local Oscillator
LOS	Loss of Signal (from satellite)

MB	Megabyte (1 000 000 bytes)
Mb	Megabit (1 000 000 bits)
Mbps	Megabits per second
MDA	MacDonald Dettwiler and Associates
MON-A-CO	Monitoring and Control Unit (SED)
NRCan	Natural Resources Canada
PASS	Prince Albert Satellite Station
PASS13m1	PASS 13metre antenna #1
PASS13m2	PASS 13metre antenna #2 (no TT&C)
QA	Quality Assurance
QPSK	Quadrature Phase-Shift Keyed
RACC	Reception, Archive and Control Computer (MDA)
RAID	Redundant Array of Inexpensive Disks
RF	Radio Frequency
RM	Reception Manager
RNSI	Revitalized NRCan Satellite Infrastructure (formerly known as EODS)
RT	Real-Time
RV	Reception Viewer (MDA)
SAR	Synthetic Aperture Radar
SED	SED Systems Limited
S-Band	2.200 – 2.300 GHz
SOA	Satellite Operating Agency
SOP	Standard Operating Procedures
SOW	Statement of Work
TB	Terabyte (1 000 000 000 000 bytes)
TBD	To Be Determined
TCG	Time Code Generator
TCR	Time Code Reader
TT&C	Telemetry Transmit and Control
U/C	Up-Converter
UTC	Universal Time Coordinated
UTP	Unshielded Twisted Pair
VEC	State Vector
WAN	Wide Area Network
WWW	World Wide Web
X-Band	8.025 – 8.400 GHz

1 PURPOSE AND SCOPE

1.1 Purpose

The purpose is to provide the descriptive information for the systems located at the ISSF Canadian Station (ICAN) and a listing of the equipment and systems for which the Contractor is responsible to provide In Service Support for their maintenance and operation.

1.2 Scope

This document provides a general description of the NRCan ground stations infrastructure and the principle operational processes that occur within it.

This document describes the systems and equipment at the ISSF Canadian Station (ICAN) used for reception of satellite remote sensing data and satellite and Telemetry Transmit and Control (TT&C) operations.

This document includes a list of the NRCan furnished equipment and systems at the ISSF Canadian Station (ICAN). See Appendix A.

This document does not give any detailed information about the building structures, plumbing, electrical systems, and civil works etc., which comprise the facility or building itself, except for the NRCan furnished *facility* related equipment and systems identified in Appendix A.

2 BACKGROUND

2.1 Background

The NRCan Earth Observation Ground Stations Infrastructure is a national service that provides Earth Observation data to Programs in the Earth Sciences Sector (ESS) of NRCan, Satellite Operating Agencies (SOAs) including the Canadian Space Agency (CSA) and Other Government Departments (OGDs), as well as to the Private Sector and other users.

Data reception, dissemination and TT&C services are provided through NRCan's three satellite stations at Prince Albert, Inuvik, and Gatineau, utilizing systems contained therein.

The suite of satellites received at the stations includes the American LANDSAT-8 and the Canadian RADARSAT-2. In the future the stations will receive the Canadian RADARSAT Constellation Missions data and potentially the European Copernicus SENTINEL series. Additionally each station will be used for TT&C for Satellite Operating Agency(s) (SOAs) e.g. CSA the NEOSSat, SciSat missions and other SOA missions via the CSA, and in the future RADARSAT Constellation Missions.

2.1.1 GSS, ICAN, and PASS

GSS, ICAN, and PASS are responsible for the day-to-day operations and maintenance of the satellite stations and their short-term buffer of earth observation data. These responsibilities include:

- Reception and processing of the data required by NRCan’s internal and external clients
- TT&C mission contacts required by NRCan’s external clients (e.g. CSA)
- Timely transfer of data to the NRCan Booth Street Archive (BSA).

2.2 Operations Overview

Following implementation of new systems and infrastructure, NRCan has deployed new systems whose design goal was intentionally directed to allow autonomous and lights out operation for the vast majority of the system data collections and reporting activities. The design also implemented remote reporting notifications of system status where feasible. Deployed systems also included integration of automatic redundancy for some equipment and networks.

While each of the three NRCan ground stations retain their own equipment monitoring and control, the intended operational oversight has been implemented whereas PASS is the central operations point for all four antennas located at the three site using integrated remote monitoring and control.

The primary services of the NRCan Earth Observation Ground Stations Infrastructure have been divided into four main processes. The four main processes are:

- Reception (ICAN, PASS, GSS)
- TT&C (ICAN, PASS, GSS)
- Archiving (BSA)
- Cataloguing (BSA)

There is of course a large amount of interaction between the various processes. This is illustrated in the following figures:

- Figure 1: Block Diagram – Overview
- Figure 2: Block Diagram – Operations

It should be noted that these figures represent a high level view of the on-going NRCan Earth Observation Ground Stations Infrastructure operation.

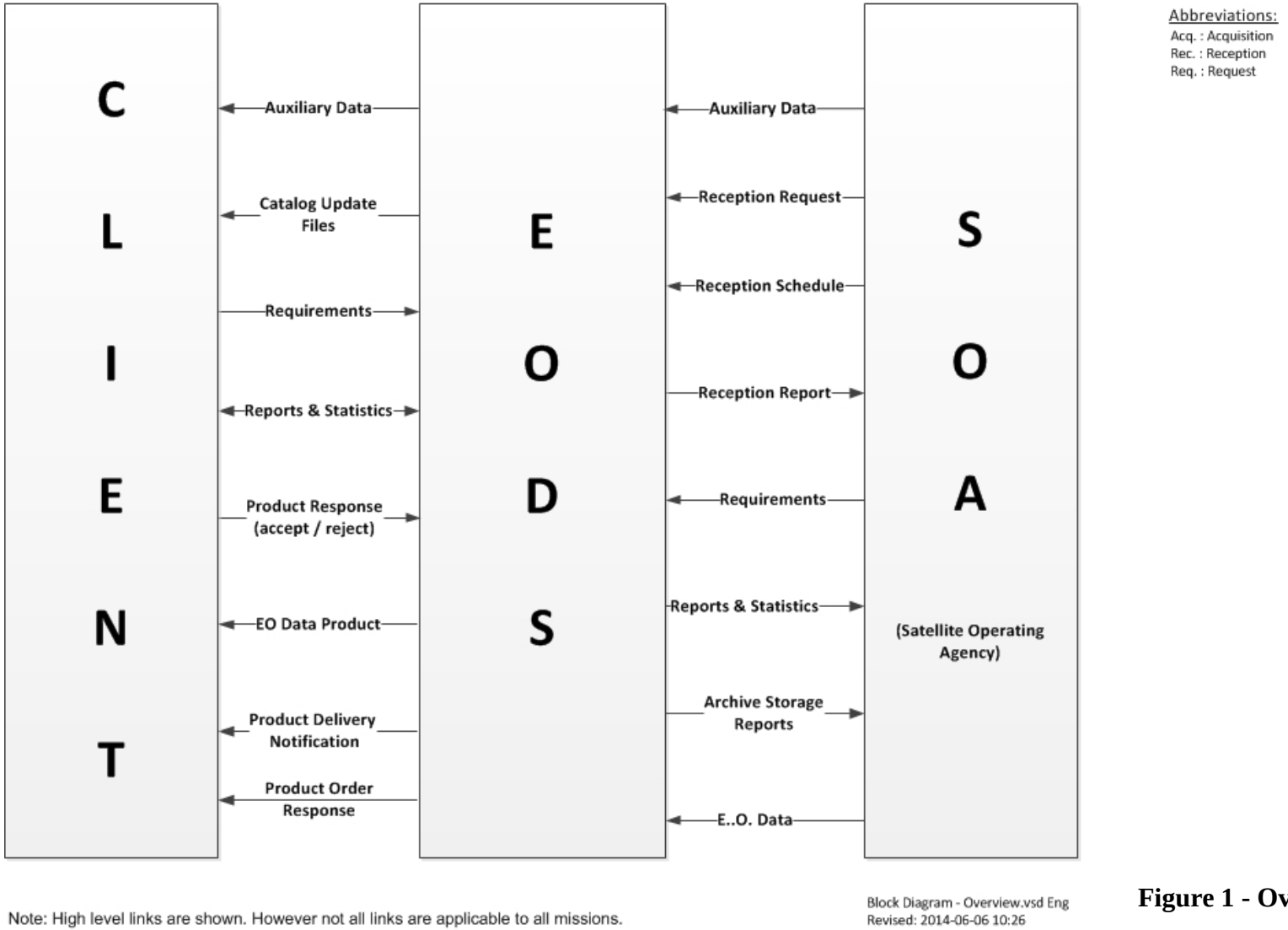

Figure 1 - Overview

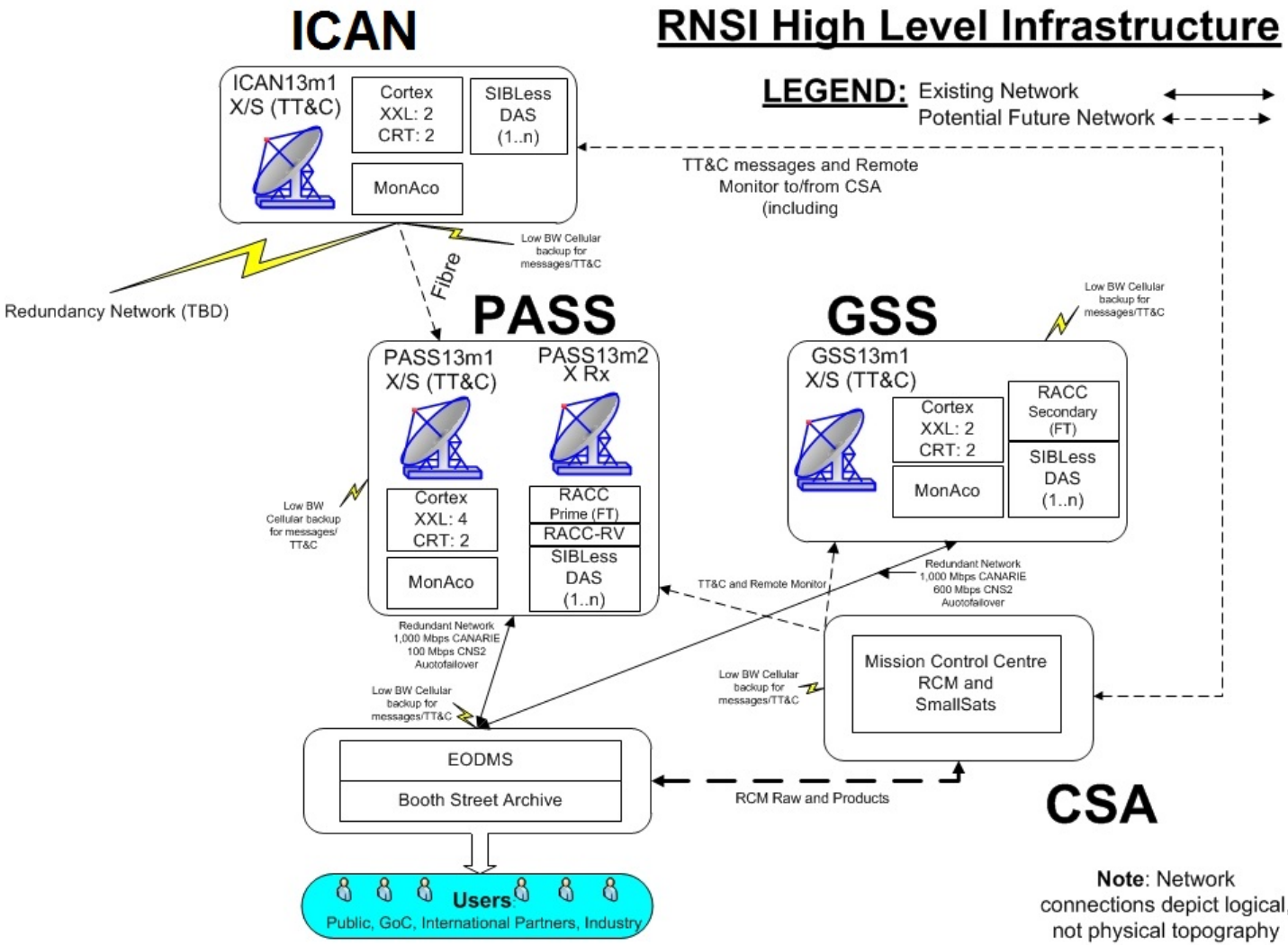

Figure 2: Operations

CCMEO/DAD/BusDev

May 15, 2014 (rg)

2.2.1 Reception

Reception is mostly performed by the reception stations and consists primarily of:

- PASS obtaining reception schedules and control files from SOA for provision to the three reception stations;
- PASS performing the scheduling and tasking of reception activities to all three reception stations;
- PASS reporting on reception status for all three reception stations;
- The reception of earth observation data by each of the four antenna systems;
- Conversion of raw EO data to a format suitable for storage and transmission via WAN;
- The near real-time transfer of recently received data from the station to the NRCan Booth Street Central Archive;
- The provision and support of the systems and subsystems needed to receive and deliver this data
- Retaining a 90 day cyclic buffer of all data collected

2.2.2 TT&C

TT&C is mostly performed by the stations and consists primarily of:

- PASS obtaining TT&C schedules and control files from SOA for provision to the three stations;
- PASS performing the scheduling and tasking of TT&C activities to all three stations. The SOA e.g. CSA is responsible for sending the Control commands to the stations;
- The SOA is responsible for the sending the Control commands to the stations; retrieving the Telemetry and Tracking data from the stations and monitoring the real-time TT&C status;
- PASS reporting on TT&C status for all three stations;
- The provision and support of the systems and subsystems needed to receive this data
- Retaining a 90 day cyclic buffer of all data collected and transmitted

2.2.3 Archiving

Archiving is performed by the NRCan BSA and consists primarily of the following activities:

- Accepting data from the GSS, ICAN, and PASS reception stations for long term archiving
- Provision of long term archive data to the for use in product generation;
- Provision of access to archive data for clients;
- Long term storage of EO data
- Periodic testing of archived data to ensure its' viability
- Migration of long term archive to newer mediums as technology and time progresses
- the provision and support of the subsystems needed to store and archive EO data

2.2.4 Cataloguing

Cataloguing is performed either by BSA and consists primarily of the following activities:

- provision of catalogue update files (CUF) and associated "quick look" imagery to SOA and NRCan EODMS, which maintains the catalogues used by NRCan clients when ordering products
- the provision and support of the subsystems needed to produce the CUF files and associated imagery

3 SYSTEMS

A high level block diagram illustrating the equipment and systems at the Inuvik Canadian Station (ICAN) are depicted in Figure 3 and are described in Sections 3.1 through 3.5.

3.1 Antenna and RF Systems

3.1.1 Systems and Subsystems

The antenna and RF system at the ISSF Canadian Station (ICAN) consist of those systems and subsystems between the satellite and the output of the demodulators. The principle systems in this chain are:

- Antenna complete with:
  - Reflector, sub-reflector and feed
  - Drive motors, motor controllers and servos
  - RF up and down converters
- Inter-facility link cabling with:
  - Power cabling
  - Signal cabling
  - Control cabling
- Tracking receivers
- Antenna control units (DEU)
- IF switch units
- Cortex XXL HDR Demodulators and Cortex CRT Systems
- UpConvertors
- DownConvertors
- Decimator Remote Spectrum Display units
- 100Watt S-Band High Power Amplifiers
- Test Loop Translator

3.1.2 Redundancy

Most units are provided with “self-contained” redundancy such that Mon-A-Co control software will detect hardware failures and integrate alternate units for operation.

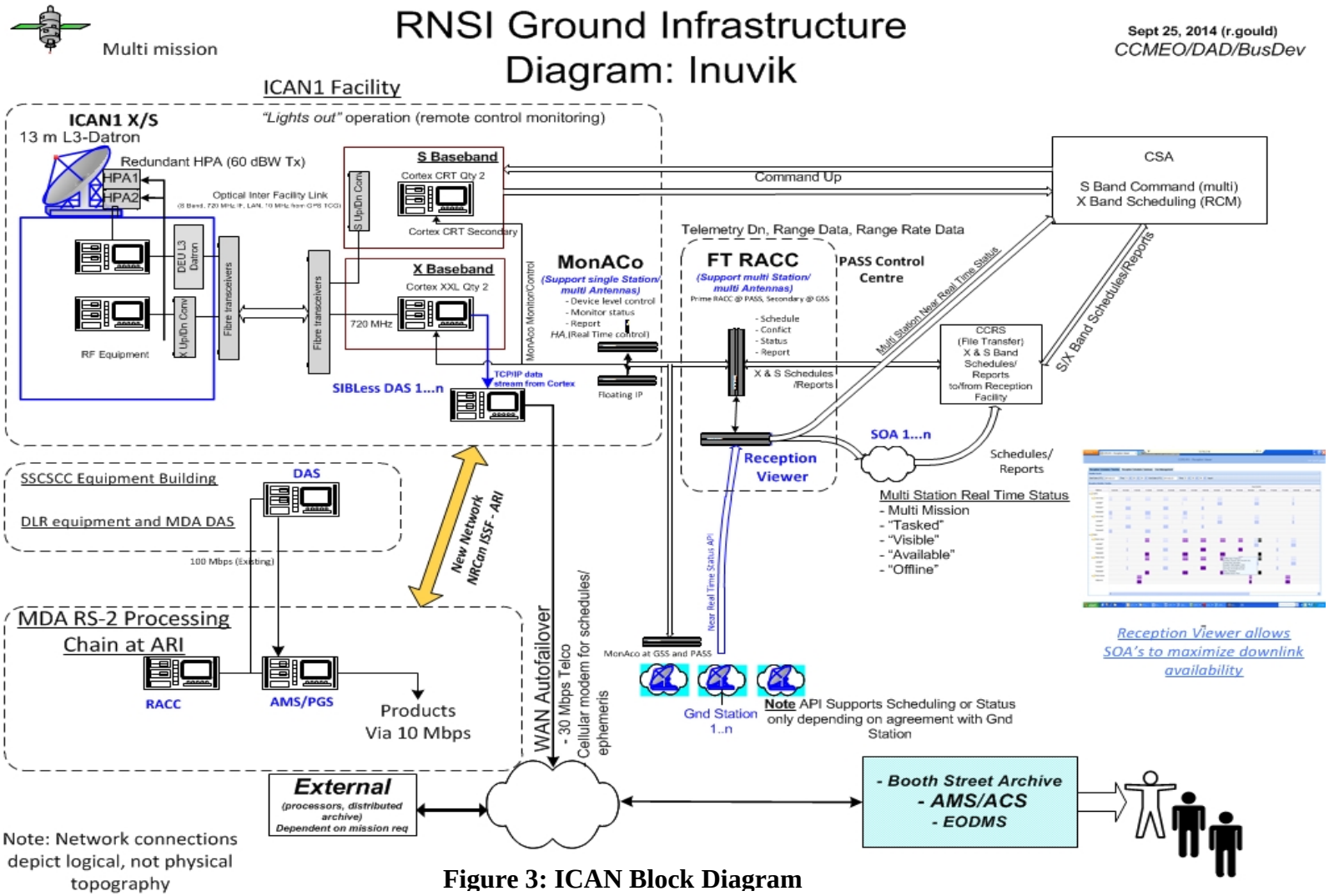

Figure 3: ICAN Block Diagram

3.1.3 General Configuration

The Inuvik Satellite Station is equipped with one 13 metre Cassegrain type tracking antenna systems made by L3-Datron. This antenna is equipped with a dichroic sub-reflector which permits the use of X-Band for both tracking and data reception. This 13 Metre antenna also retains S-Band uplink and downlink capabilities and may be used for tracking, uplink commanding, ranging, and telemetry reception.

3.1.4 13-Metre Antenna Systems

3.1.4.1 Antenna Drive

The antennas are provided with dual-drive elevation over azimuth over tilt pedestals, which provide the high slew rates, and pointing precision needed to track earth observation satellites in low earth orbit.

3.1.4.2 Tracking

Satellites are tracked from either from the start of schedule data to end of scheduled data collection or horizon to horizon. The system will typically start in the “program track” mode based on the calculated satellite position as provided by Digital Equipment Units (DEU) located in the antenna pedestals. When signal levels are sufficient, tracking automatically switches to “auto track” (monopulse tracking) on S-band (where available) and will then switch to X-band when the X-band data carrier is received. These operations are pre-programmed and automatic. If the monopulse track system(s) should fail, tracking will automatically continue in the program track mode.

3.1.4.3 Antenna Tilt Mechanism

Both 13 metre antennas are equipped with a fixed seven degree elevation tilt mechanism which can be moved to any azimuth position. This mechanism tilts the reflector / sub-reflector / drive mechanism. This allows the antennas to successfully track a satellite passing directly over the station without limitations due to “key-holing”.

Determination of the requirement for tracking at zenith, and operation of the tilt mechanism, is automatic.

3.1.4.4 Tracking Receivers

Each antenna has a tracking receivers can be used for X-Band or S-Band tracking as available.

The X-Band receivers are fixed frequency (720MHz). The S-Band receivers are variable frequency (2200 – 2300 MHz). The DEU controls and configures the tracking receivers.

3.1.4.5 Operations Console

The local control console for the 13-metre antenna system is located in the control room at the Inuvik Satellite Station.

3.1.5 X-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 720 Mhz range and is used to patch IF channels between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.6 S-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 70 Mhz range and is used to patch IF channels between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.7 X-Band Demodulators with bit synchronizers for 13 m Antenna Systems (HDR)

The station is equipped with two Cortex HDR XXL demodulators. Each HDR contains circuitry to perform demodulation, bit synchronization, and decoding functions. Each HDR is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding). Each HDR will accept up to two IF inputs.

Each HDR has RAID capability to store up to 1TB internally of data collected from satellite missions.

Each HDR outputs decoded data streams over TCP sockets to DAS systems.

3.1.8 S-Band Command, Range, and Telemetry units for one 13 m Antenna System (CRT)

The station is equipped with two Cortex CRT Command, Ranging, and Telemetry units. Each CRT contains circuitry to perform demodulation, bit synchronization, decoding, command encoding, and Range/Range rate functions. Each CRT is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding/etc). Each CRT will accept up to two IF inputs.

3.1.9 S-Band UpConvertors and Downconvertors

The S-Band system utilizes interface to the antenna at S-Band frequencies for uplink and downlink. The CRT operates at an IF Frequency of 70MHz. The up and down convertors, located in the operations building translate the signals between the IF and S-Band frequencies.

3.1.10 Test Loop Translator

A test loop translator is locating in the antenna pedestal to allow loopback testing from simulated uplink command signals.

3.1.11 S-Band Test Generator

A CW selectable frequency generator is provided in the S-Band rack in the operations room and is used for test purposes.

3.1.11.1 Boresite System

Complete checkout of the auto-track system is provided using a signal source located on a tower several kilometers from the site. Space and utility services on the tower is rented by NRCan from private companies.

The boresight test system includes two DC powered RF synthesizers, one at 8200 MHz and the other at 2250 MHz. The RF outputs of the synthesizers are combined together and fed through a

coaxial cable to the wideband feed-horn. A DC power supply is provided for each RF synthesizer.

The RF synthesizers will be able to be turned on or off by a telephone and /or web based remote power switch made by Remote Power Switch.

3.2 Processing Systems and Control Systems

3.2.1 Mon-A-Co (MNC)

The Monitor And Control (Mon-A-Co) system is the main controller internal to each station. The Mon-A-Co controls one or more antenna systems at a station. For example at PASS the Mon-A-Co controls both PASS13m1 and PASS13m2. The main Mon-A-Co interfaces are to the FT-RACC, antenna controllers and the Cortex units. Cortex XXL units are used for X Band data demodulation and data capture. Cortex Command Ranging and Telemetry (CRT) units are used for TT&C. In the case of the CRT units, the Mon-A-Co provides configuration and basic control/monitoring. The Canadian Space Agency (CSA) interface directly to the CRT units for retrieving telemetry data and sending command data.

The Mon-A-Co™ software executes on a pair of server computers in a redundant configuration where one of the servers is online and the second server operates as hot-standby. Mon-A-Co™ provides monitor and control of the antenna subsystem and the baseband equipment. It uses the MySQL database management system for persistent storage of data and CORBA and TCP sockets for communications between the different software components. The Graphical User Interface (GUI) software can execute on either the same computer as the server software or on a remote computer or both. The Mon-A-Co™ software is designed to operate autonomously, and only requires operator involvement during installation and configuration and to resolve anomalous conditions such as device failures. Mon-A-Co™ raises events and alarms whenever a condition exceeds pre-defined parameters. These parameters are defined during the installation and configuration of the system. The raised events and alarms are presented on the GUI and forwarded to the set of defined recipients using either SNMP or SMTP or both. In addition to raising events and alarms Mon-A-Co™ will automatically take action to try and resolve device failures by switching in redundant equipment. If redundant equipment is not available for a given failure Mon-A-Co™ will gracefully degrade activities and command and control functionality by continuing to support operations that do not require the failed devices. The Mon-A-Co™ GUI is used to define system parameters, view current system status and command and control individual devices and generally operate Mon-A-Co™ .

In addition to the common functionality that all Mon-A-Co™ systems share, the Mon-A-Co™ system being delivered is enhanced with a request interface for handling satellite tracking and data capture requests. The requests can be provided programmatically or through the Mon-A-

Co™ GUI. The GUI provides windows to view the current list of pending requests, edit/replace existing requests, add new requests and delete requests.

3.2.2 Direct Archive System (DAS)

The Direct Archive System (DAS) captures demodulated X Band reception data via Transmission Control Protocol/Internet Protocol (TCP/IP) from the Cortex XXL units. The DAS at each station are tasked by the FT-RACC located at PASS. The DAS units reformat the data into standard formats based on specific missions. For example for RADARSAT-2 the DAS units create standard FRED datasets and for LANDSAT-8 the DAS units create Mission Data files. This allows for operability with external systems for decryption (for RADARSAT-2 only) and processing.

The DAS systems were designed and built by MDA. The DAS Systems were installed for the direct-to-disk recording of RADARSAT-1, RADARSAT-2, and ENVISAT ASAR satellite data. The input to the DAS is serial over TCP sockets. The output of the DAS is segment-based FRED formatted data. Outputs of the DAS system include FRED segments consists of a data file and a header file, RFC Buffer files (RAW) and, Level-0 data files . The output files can be archived or can be used as input to processing systems to generate user products.

There are two (2) DAS systems at the station. Each system consists of a COTS personal computer with a RAID, two (2) processors, and a 1000Mbps NIC

3.3 Station Networks and Systems

The station currently has a 30 Mbps link to the NRCan WAN via a territorial (NWT Telecom) network. In Summer of 2016, a Gigabit connection to the WAN is planned by NRCan.

Routers are used for network isolation, network security and routing over a WAN to NRCan Ottawa.

The majority of the LAN network is copper UTP based.

The local and wide area network is running TCP/IP.

3.3.1 Weather Station

Weather stations are provided at each station. These allow the operations to understand what local weather

3.3.2 WebCams

Nine HTTP accessible webcam systems are located throughout the station, 4 inside and three outside, to provide views of the principle systems and areas of the station.

3.4 VOIP

Each station will be capable of voice communication over phone, with Voice over IP (VoIP) as backup using VoIP equipment. Equipment will be installed in antennas and operations buildings.

APPENDIX A – ICAN EQUIPMENT LIST AND MAINTENANCE REQUIREMENTS

ICAN *Station* Equipment and Systems Maintenance Requirements

System	Equipment/Sub-Systems	Manufacturer/Model	Qty	Exceptions Hardware	Exceptions Software
13 Metre RF Antenna Systems	Antenna System, inclusive of servo, and all related sub-systems	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	DEU	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	HPA	WV Communications 100W	1	Nil	Nil
13 Metre RF Antenna Systems	TLT	MU-DEL Model 44449	1	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (X-Band)	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (S-Band)	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	Overall antenna system flood lighting, HVAC systems, Electrical systems, Associated interconnections, PPA systems, Air Dryers, Emergency systems, and all related	Datron/Related	N/A	N/A	N/A
13 Metre RF Antenna Systems	Boresight Test Signal Transmitter	Datron	1	Nil	Nil
Mon-A-Co	MNC Server A	Dell Power Edge R320	1	Nil	NRCan Responsibility
Mon-A-Co	MNC Server B	Dell Power Edge R320	1	Nil	NRCan Responsibility

Mon-A-Co	High Data Rate Receiver	Zodiac Cortex HDR XXL	2	Nil	Nil
Mon-A-Co	Command Ranging and Telemetry Unit	Zodiac Cortex CRT	2	Nil	Nil
Mon-A-Co	MNC GUI Ops PC	DELL Optiplex 790	1	Nil	Nil
Mon-A-Co	16X16 Matrix Switch	USC 12661-001	2	Nil	Nil
Mon-A-Co	GPS receiver	End Run 3019-5114-000	1	Nil	Nil
Mon-A-Co	Keyboard/Monitor/Mouse Drawer	BSI RMK-928	1	Nil	Nil
Mon-A-Co	LAN Switch (X-Band Rack)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
Mon-A-Co	LAN Switch (S-Band Rack)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
Mon-A-Co	LAN Switch (Antennas)	MOXA EDS-G308-2SFP	1	Nil	Nil
Mon-A-Co	Network Based Spectrum Analyzer	SED Decimator	1	Nil	Nil
Mon-A-Co	Signal Generator	Rhode & Schwartz SGS100A	1	Nil	Nil
Mon-A-Co	S-Band Up Convertor	GEOSYNC UTR-200240	2	Nil	Nil
Mon-A-Co	S-Band Down Convertor	GEOSYNC DTR-200240	2	Nil	Nil
Mon-A-Co	Rack Fan Tray Unit	Kooltronics 122502-1	2	Nil	Nil
Mon-A-Co	1 PPS Fiber Transmit Unit	LuxLink DTR-7201-7	1	Nil	Nil
Mon-A-Co	1 PPS Fiber Receiver Unit	LuxLink DR-7201	1	Nil	Nil
Mon-A-Co	Transmitter, Distribution, Optical, 10MHz	PTF-1208A/ SED 130887-1	1	Nil	Nil
Mon-A-Co	Receiver, Distribution, Optical, 10MHz	PTF-1209A/ SED 130887-2	1	Nil	Nil
Mon-A-Co	Mini MCU	SED P/N 126421-4	5	Nil	Nil
Mon-A-Co	EMI Rack FILTERS	SED 38117ASSY124028-3	4	Nil	Nil
Mon-A-Co	IF/RF Switchplates	SED	1	Nil	Nil
Mon-A-Co	Fibre Optic IFL (X-Band)	Miteq OCC-1	1	Nil	Nil
Mon-A-Co	Fibre Optic IFL (S-Band)	Miteq OCC-1	1	Nil	Nil

Mon-A-Co	Signal Distribution Unit IRIG-B	PTF-1206A/ SED 127457-2	1	Nil	Nil
Mon-A-Co	Distribution 10MHz (S-Band)	PTF-1206A/ SED 130856-4	1	Nil	Nil
Mon-A-Co	1PPS Distribution unit (S-Band)	PTF-1206A/ SED 130856-9	1	Nil	
Direct Archive Systems (DAS)	DAS Computer (IDAS1)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
Direct Archive Systems (DAS)	DAS Computer (IDAS2)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
Station Network	CISCO (Main Network)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
Station Network	CISCO (MDA Rack)	Cisco WS-C2960S-24TS-S	1+spare	Nil	Nil
Station Network	CISCO (Operations Room)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
General Station Equipment	Avigilon 5 Camera Server	Dell	2	Nil	Nil
General Station Equipment	Avigilon 5 Camera GUI Client	Dell			
General Station Equipment	Exterior Camera with Pan/Tilt/Zoom	Panasonic WV-SW395	5	Nil	NRCan Responsibility
General Station Equipment	Interior Camera	Panasonic WV-SF336		Nil	NRCan Responsibility

General Station Equipment	Weather Station	Colombia Weather Systems "Orion Weather Station"	1	Nil	Nil
General Station Equipment	Weather Station Server	Colombia Weather Systems "Weather MicroServer"	1	Nil	NRCan Responsibility
General Station Equipment	Weather Station Display	Colombia Weather Systems "Weather Display"	1	Nil	NRCan Responsibility
General Station Equipment	Staging Computer	DELL Poweredge R710 Server	1	Nil	Nil
General Station Equipment	Staging Computer RAID	DELL MD1000 RAID	1	Nil	Nil

ICAN *Facility* Related Equipment & Systems Maintenance Requirements

System	Equipment/Sub-Systems	Manufacturer/Model	Qty	Exceptions Hardware	Exceptions Software
Power System	Diesel Generator Enclosure	Silhouette Steel Ltd. 500 KW Arctic	1	Nil	Nil
Power System	Diesel Generator	Kohler 500REOZJ	1	Nil	Nil
Power System	Diesel Generator Controller	Kohler Decision Maker 550	1	Nil	Nil
					Nil
					Nil
Power System	UPS	Eaton Powerware 9390 300 kW	1	Nil	Nil
Power System	Battery Cabinet	Eaton Powerware 9390 IBC	1	Nil	Nil
Power System	Maintenance Bypass Module	Eaton Powerware 9390 MBM	1	Nil	Nil

Power System	Transfer Switch	Eaton ATC-300	1	Nil	Nil
					Nil
Building Automation System (BAS)	System	Siemens PXCM	2 (primary and backup)	Nil	Nil
					Nil
Heating,, Ventilation, Air Conditioning (HVAC)	Chillers	Motivar MPC-FC 1500-SC	2 (lead/lag config.)	Nil	Nil
HVAC	Coolant Pumps	Armstrong 4380-1.5x1.5x6-7.5	4	Nil	Nil
HVAC	Pump Drives	Taco SmartDRIVE VP Variable Speed Drives	4	Nil	Nil
HVAC	In Row Coolers	Schneider Electric / APC ACRC-100	5	Nil	Nil
HVAC	Fan Coil Unit	Williams Horizontal Fan Coil LH400	1	Nil	Nil
HVAC	Unit Heater	Reznoir EGW	2	Nil	Nil
HVAC	Glycol Fill Tank	Axiom MF200	1	Nil	Nil
HVAC	Duct Heater, 1 kW	Thermolec ZON	2	Nil	Nil
Building Security System	Automatic Voice/Pager Dialer System	USP Model AD-2000	1	Nil	Nil
Building Security System	Alarm System Controller	MAXSYS PC4020 V3.5	1	Nil	Nil
Building Security System	Motion Detector	DSC Security Products BV-602 PIR	3	Nil	Nil
Building Fire Alarm System	Fire Alarm Control Panel	Simplex 4010ES	1	Nil	Nil
Building Fire	Smoke Detector	Simplex 4098-9714	4	Nil	Nil

Alarm System					
Building Fire Alarm System					
Building Fire Suppression System	Fire Extinguisher	2A:10BC	2	Nil	Nil
	Fire Suppression Aerosol Generator	Stat-X 2500 E	9	Nil	Nil
	Fire Suppression Releasing Panel	Potter PFC Series	1	Nil	Nil
	Fire Alarm Manual Pull Station	Simplex 4099-9001	2	Nil	Nil
Building Emergency Lighting System	Emergency Light Battery Unit with Two Lights	AimLite EBST	3	Nil	Nil
	Dual Head Remote Unit	AimLite RMMD	11	Nil	Nil
	Self Test Module	AimLite RTD	3	Nil	Nil

Attachment 5 to Annex "C"

AD-2

Gatineau Satellite Station (GSS)
Earth Observation Ground Station Description

Canada Centre for Earth Observation
CANADA CENTRE for MAPPING AND EARTH OBSERVATION
Natural Resources Canada (NRCan)

Doc. No.:	EODS-REF-002
Version:	4
Revision:	2
Status:	DRAFT
Date:	January 15, 2015

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CHANGE LOG

ISSUE	DATE	PAGE (S)	DESCRIPTION	Initials
0.0		All	First Release for review.	
1.9		all	Major Rewrite	
3.0	April/May 2014	All	Major Rewrite for RFI	
4.0	November/December 2014	Multiple	Updating	
4.1	16 Dec 2014	Multiple	Final Update for draft RFP, incl. addition of Figure 3 GSS Block Diagram	
4.2	15 January 2015	All	Formatting, removed Geomatics Canada 'Snail' logo, updated corporate identity	CV

REVIEWS AND APPROVALS

Reviewed and Recommended by:

_____ _____

_____ _____

Approved by:

_____ _____

TABLE OF CONTENTS

ACRONYMS & ABBREVIATIONS

AMS	Archive Management System
AOS	Acquisition Of Signal
BSA	Booth Street Archive (NRCan Ottawa)
CSA	Canadian Space Agency
CCEO	Canada Centre for Earth Observation (a Division of CCMEO)
CCMEO	Canada Centre for Mapping and Earth Observation (a Branch of the Earth Science Sector of Natural Resources Canada)
CIS	Canadian Ice Service (Environment Canada)
COTS	Commercial Off The Shelf
CSA	Canadian Space Agency
DAF	Data Acquisition Facility
DAS	Direct Archive System (MDA)
DEU	Digital Equipment Unit (DATRON antenna control unit)
D/C	Down Converter
DRF	Data Reception Facility
EO	Earth Observation
EODMS	Earth Observation Data Management System (co-located with BSA)
EODS	Earth Observation Data Services
ESS	Earth Science Sector (a sector of Natural Resources Canada)
FRED	Framed Raw Expanded Data (an MDA-designed data format specification)
FTP	File Transfer Protocol
GB	Gigabyte (1 000 000 000 bytes)
Gb	Gigabit (1 000 000 000 bits)
GPS	Global Position System
GRS	Ground Receiving System
GSS	Gatineau Satellite Station
GUI	Graphical User Interface
HSM	Hierarchical Storage Management
ICAN	Inuvik Canadian station of ISSF
IF	Intermediate Frequency
IRIG	InterRange Instrumentation Group
ISO	Greek – means “the same”
ISSF	Inuvik Satellite Station Facility
kbps	kilo-bits per second
LAN	Local Area Network
LNA	Low Noise Amplifier

LO	Local Oscillator
LOS	Loss of Signal (from satellite)
MB	Megabyte (1 000 000 bytes)
Mb	Megabit (1 000 000 bits)
Mbps	Megabits per second
MDA	MacDonald Dettwiler and Associates
MON-A-CO	Monitoring and Control unit (SED)
NRCan	Natural Resources Canada
PASS	Prince Albert Satellite Station
PB	Play Back
Pn	Pseudo Random
QA	Quality Assurance
QL	Quick-Look
QPSK	Quadrature Phase-Shift Keyed
RACC	Reception, Archive and Control Computer (MDA)
RAID	Redundant Array of Inexpensive Disks
RF	Radio Frequency
RM	Reception Manager (DAFControl)
RNSI	Revitalized NRCan Satellite Infrastructure
RT	Real-Time
RV	Reception Viewer (MDA)
SAR	Synthetic Aperture Radar
SED	SED Systems Ltd.
S-Band	2.200 – 2.300 GHz
SOA	Satellite Operating Agency
SOP	Standard Operating Procedures
SOW	Statement of Work
TB	Terabyte (1 000 000 000 000 bytes)
TBD	To Be Determined
TCG	Time Code Generator
TCR	Time Code Reader
TT&C	Telemetry Transmit and Control
U/C	Up-Converter
UTC	Universal Time Coordinated
UTP	Unshielded Twisted Pair
VEC	State Vector
WAN	Wide Area Network

WWW	World Wide Web
X-Band	8.025 – 8.400 GHz

1 PURPOSE AND SCOPE

1.1 Purpose

The purpose is to provide the descriptive information for the systems located at the Gatineau Satellite Station (GSS) and a listing of the equipment and systems for which the Contractor is responsible to provide In Service Support for their maintenance and operation.

1.2 Scope

This document provides a general description of the NRCan ground stations infrastructure and the principle operational processes that occur within it.

This document describes the systems and equipment at the Gatineau Satellite Station used for reception of satellite remote sensing data and satellite and Telemetry Transmit and Control (TT&C) operations.

This document includes a list of the NRCan furnished equipment and systems at the Gatienau Satellite Station (Appendix A).

This document does not give any detailed information about the building structures, plumbing, electrical systems, and civil works etc., which comprise the facility or building itself.

2 BACKGROUND

2.1 NRCan Earth Observation Ground Stations Infrastructure - Background

The NRCan Earth Observation Ground Stations Infrastructure is a national service that provides Earth Observation data to Programs in the Earth Sciences Sector (ESS) of NRCan, Satellite Operating Agencies (SOAs) including the Canadian Space Agency (CSA) and Other Government Departments (OGDs), as well as to the Private Sector and other users.

Data reception, dissemination and TT&C services are provided through NRCan's three satellite stations at Prince Albert, Inuvik, and Gatineau utilizing systems contained therein.

The suite of satellites received at the stations includes the American LANDSAT-8 and the Canadian RADARSAT-2. In the future the stations will receive the Canadian RADARSAT Constellation Missions and potentially and the European Copernicus SENTINEL series. Additionally each station will be used for TT&C for Satellite Operating Agency(s) e.g. CSA NEOSSat, SciSat missions and other SOA missions via the CSA, and in the future the RADARSAT Constellation Missions.

2.1.1 GSS, ICAN, and PASS

GSS, ICAN, and PASS are responsible for the day-to-day operations and maintenance of the satellite stations and their short-term buffer of earth observation data. These responsibilities include:

- Reception and processing of the data required by NRCan’s internal and external clients
- TT&C mission contacts required by NRCan’s external clients (e.g. CSA)
- Timely transfer of data to the NRCan Booth Street Archive (BSA).

2.2 Operations Overview

Following implementation of new systems and infrastructure, NRCan has deployed new systems whose design goal was intentionally directed to allow autonomous and lights out operation for the vast majority of the system data collections and reporting activities. The design also implemented remote reporting notifications of system status where feasible. Deployed systems also included integration of automatic redundancy for some equipment and networks.

While each of the three NRCan ground stations retain their own equipment monitoring and control, the intended operational oversight has been implemented where PASS is the central operations point for all four antennas located at the three site using integrated remote monitoring and control.

The primary services of the NRCan Earth Observation Ground Stations Infrastructure have been divided into four main processes. The four main processes are:

- Reception (ICAN, PASS, GSS)
- TT&C (ICAN, PASS, GSS)
- Archiving (BSA)
- Cataloguing (BSA)

There is of course a large amount of interaction between the various processes. This is illustrated in the following figures:

- Figure 1: Block Diagram – Overview
- Figure 2: Block Diagram – Operations

It should be noted that these figures represent a high level view of the on-going NRCan Earth Observation Ground Stations Infrastructure operation.

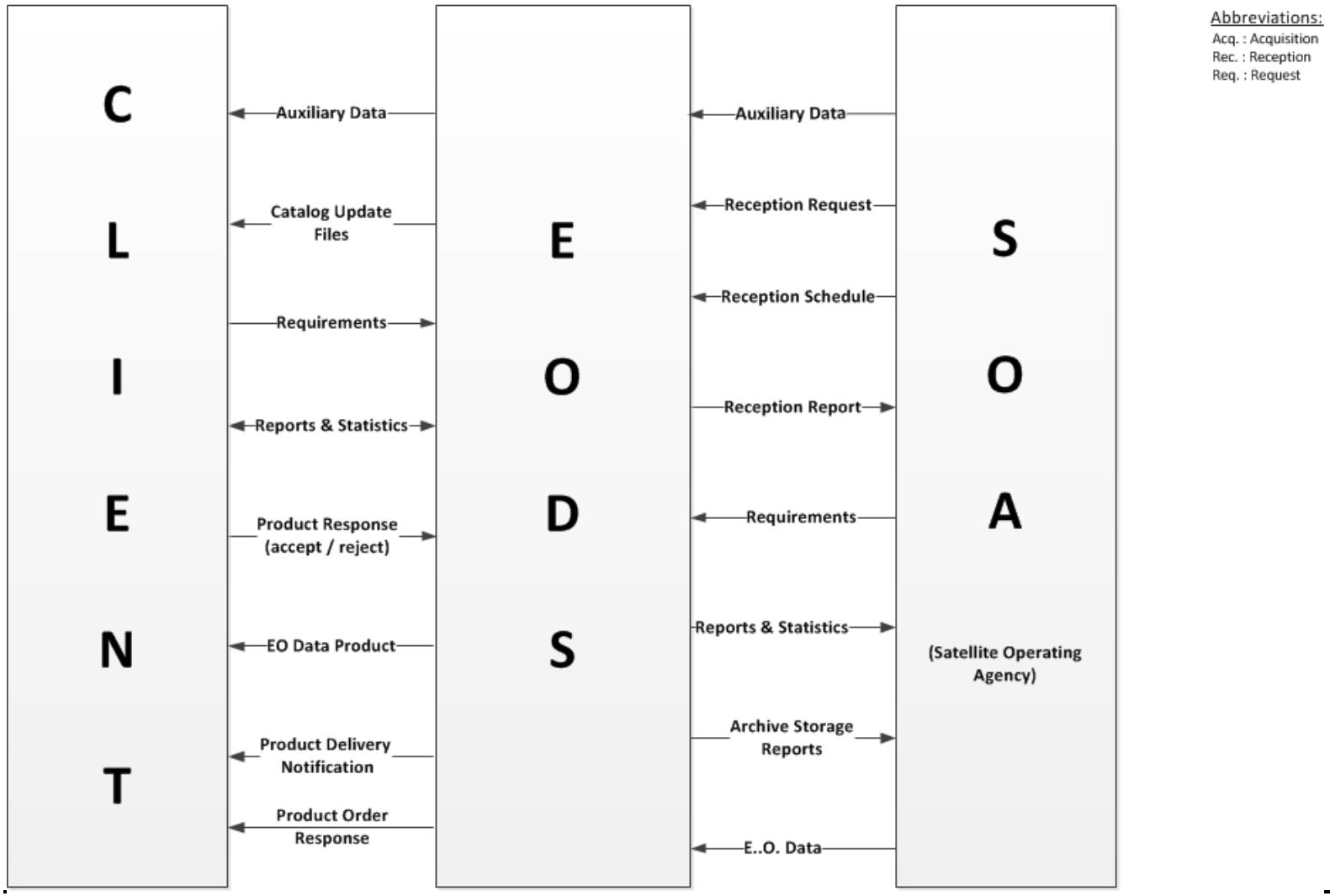

Figure 1 - Overview

ck Diagram - Overview.vsd Eng
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Note: High level links are shown. However not all links are applicable to all missions.

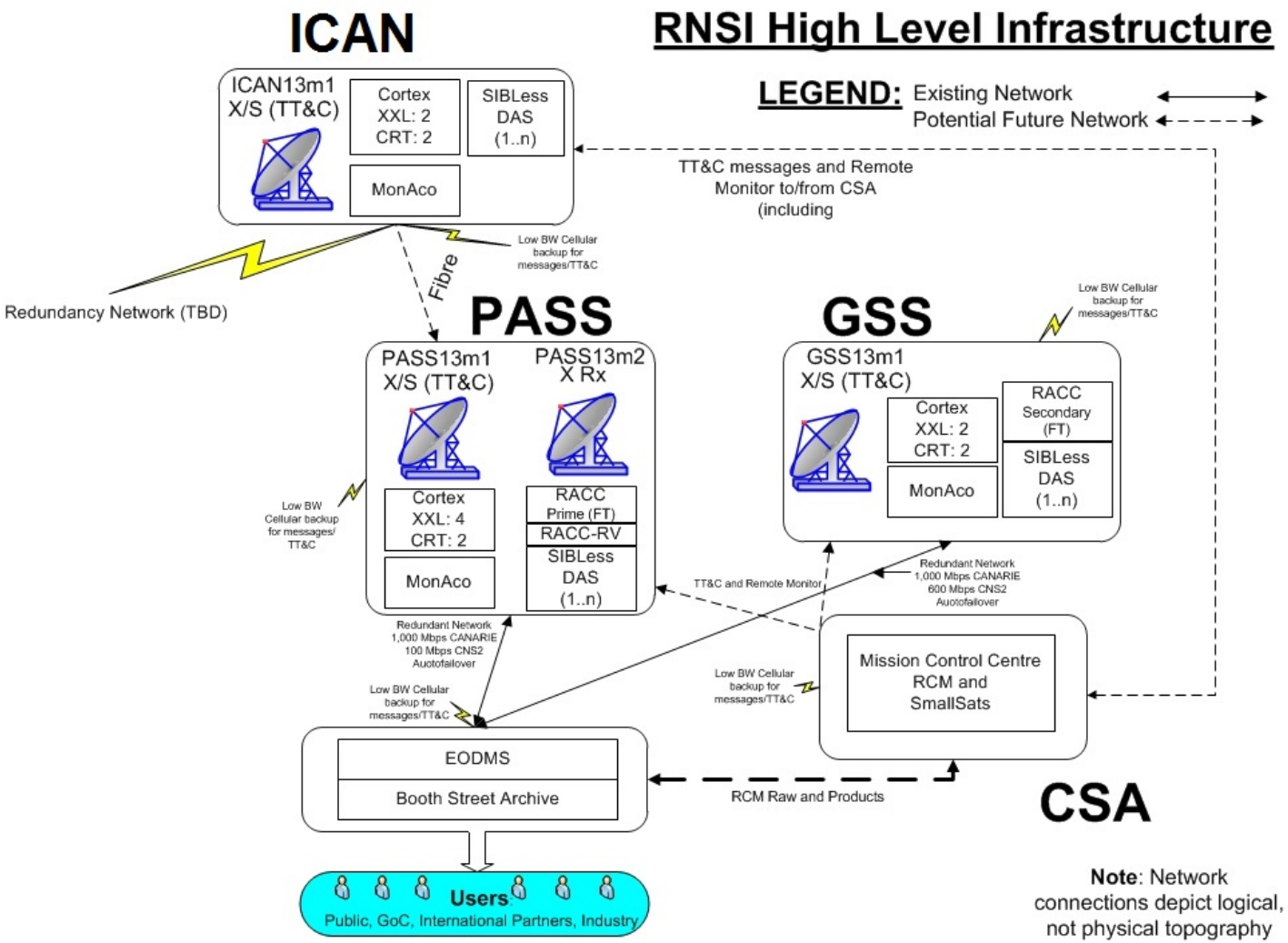

Figure 2 - Operation

2.2.1 Reception

Reception is mostly performed by the reception stations and consists primarily of:

- PASS obtaining reception schedules and control files from SOA for provision to the three reception stations;
- PASS performing the scheduling and tasking of reception activities to all three reception stations;
- PASS reporting on reception status for all three reception stations;
- The reception of earth observation data by each of the four antenna systems;
- Conversion of raw EO data to a format suitable for storage and transmission via WAN;
- The near real-time transfer of recently received data from the station to the NRCan BSA;
- The provision and support of the systems and subsystems needed to receive and deliver this data; and
- Retaining a 90 day cyclic buffer of all data collected.

2.2.2 TT&C

TT&C is mostly performed by the stations and consists primarily of:

- PASS obtaining TT&C schedules and control files from SOA for provision to the three stations;
- PASS performing the scheduling and tasking of TT&C activities to all three stations. The SOA e.g. CSA is responsible for the sending the Control commands to the stations;
- PASS reporting on TT&C status for all three stations;
- The provision and support of the systems and subsystems needed to receive this data; and
- Retaining a 90 day cyclic buffer of all data collected and transmitted.

2.2.3 Archiving

Archiving is performed by the NRCan BSA and consists primarily of the following activities:

- Accepting data from the GSS, ICAN, and PASS reception stations for long term archiving;
- Provision of long term archive data to the for use in product generation;
- Provision of access to archive data for clients;
- Long term storage of EO data;
- Periodic testing of archived data to ensure its' viability;

- Migration of long term archive to newer mediums as technology and time progresses; and
- the provision and support of the subsystems needed to store and archive EO data.

2.2.4 Cataloguing

Cataloguing is performed by BSA and consists primarily of the following activities:

- provision of catalogue update files (CUF) and associated "quick look" imagery to SOA and NRCan EODMS, which maintains the catalogues used by NRCan clients when ordering products; and
- the provision and support of the subsystems needed to produce the CUF files and associated imagery.

3 SYSTEMS

A high level block diagram illustrating the equipment and systems at the Gatineau Satellite Station are depicted in Figure 3 and are described in Sections 3.1 through 3.5.

3.1 Antenna and RF Systems

3.1.1 Systems and Subsystems

The antenna and RF systems at the Gatineau Satellite Station consist of those systems and subsystems between the satellite and the output of the demodulators. The principle systems in this chain are:

- Antenna complete with:
  - Reflector, sub-reflector and feed
  - Drive motors, motor controllers and servos
  - RF up and down converters
  - De-Icing System
- Inter-facility link cabling with:
  - Power cabling
  - Signal cabling
  - Control cabling
- Tracking receivers
- Antenna control units (DEU)
- IF switch units
- Cortex XXL HDR Demodulators and Cortex CRT Systems
- UpConvertors
- DownConvertors
- Decimator Remote Spectrum Display units
- 100Watt S-Band High Power Amplifiers
- Test Loop Translator

3.1.2 Redundancy

Most units are provided with “self-contained” redundancy such that Mon-A-Co control software will detect hardware failures and integrate alternate units for operation.

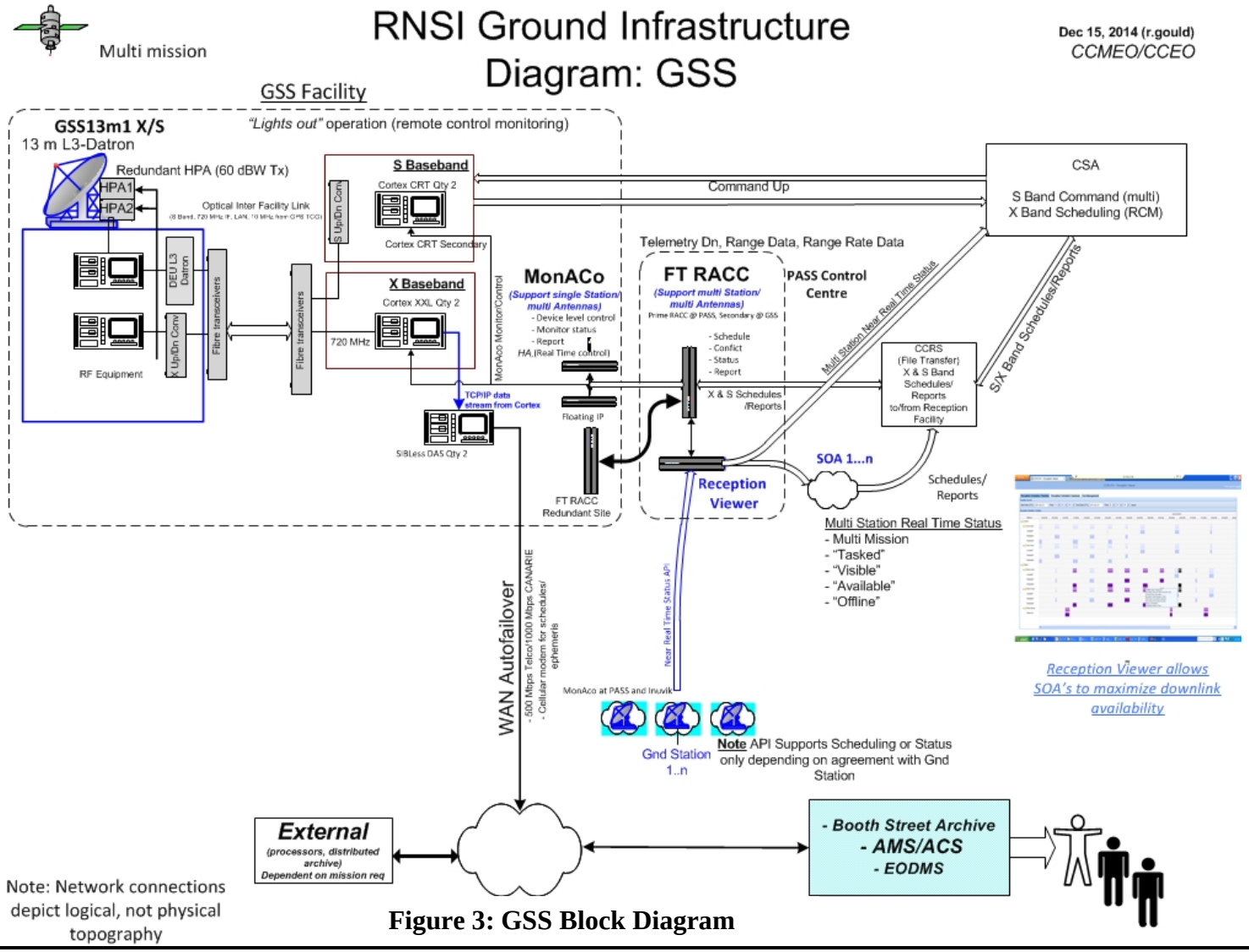

Figure 3: GSS Block Diagram

3.1.3 General Configuration

The Gatineau Satellite Station is equipped with one 13 metres Cassegrain type tracking antenna systems made by L3-Datron. These are equipped with a dichroic sub-reflector which permits the use of both an X-Band for both tracking and data reception. The antenna also retains S-Band uplink and downlink capabilities and may be used for tracking, uplink commanding, ranging, and telemetry reception.

3.1.4 13-Metre Antenna Systems

3.1.4.1 Antenna Drive

The antennas are provided with dual-drive elevation over azimuth over tilt pedestals, which provide the high slew rates, and pointing precision needed to track earth observation satellites in low earth orbit.

3.1.4.2 Tracking

Satellites are tracked from either from start of schedule data to end of scheduled data collection or horizon to horizon. The system will typically start in the “program track” mode based on the calculated satellite position as provided by Digital Equipment Units (DEU) located in the antenna pedestals. When signal levels are sufficient, tracking automatically switches to “auto track” (monopulse tracking) on S-band (where available) and will then switch to X-band when the X-band data carrier is received. These operations are pre-programmed and automatic. If the monopulse track system(s) should fail, tracking will automatically continue in the program track mode.

A monopulse tracking system is provided on the antenna for each frequency band on one antenna and both on the alternate antenna. These are installed in pressurized weather tight enclosures. The tracking output, from the feed monopulse units, are connected to a down-converter, and then fed to the tracking receivers.

3.1.4.3 Antenna Tilt Mechanism

Both 13 metre antennas are equipped with a fixed seven degree elevation tilt mechanism which can be moved to any azimuth position. This mechanism tilts the reflector / sub-reflector / drive mechanism. This allows the antennas to successfully track a satellite passing directly over the station without limitations due to "key-holing".
Determination of the requirement for tracking at zenith, and operation of the tilt mechanism, is automatic.

3.1.4.4 Tracking Receivers

Each antenna has a tracking receivers can be used for X-Band or S-Band tracking as available.

The X-Band receivers are fixed frequency (720MHz). The S-Band receivers are variable frequency (2200 – 2300 MHz). The DEU controls and configures the tracking receivers.

3.1.4.5 Antenna De-Icing System

The Gatineau Satellite Station 13M Antenna is equipped with a De-Icing system to keep the reflecting surface free of snow and ice during periods of bad weather in the winter season. The system consists of 4 fans and heaters mounted in under the surface of the antenna, a control system in a box located in the riser extension of the tower and a remote control panel located in a sub-rack in the riser of the tower. There is also insulated panels on the back surface of the antenna structure to create the enclosed space to be heated.

3.1.4.6 Operations Room

The room where antenna positioning and satellite tracking are controlled and monitored allows visual contact with the antenna.

3.1.5 X-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 720 Mhz range and is used to patch IF channel between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.6 S-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 70 Mhz range and is used to patch IF channel between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.7 X-Band Demodulators with bit synchronizers for 13 m Antenna Systems (HDR)

The station is equipped with two Cortex HDR XXL demodulators. Each HDR contains circuitry to perform demodulation, bit synchronization, and decoding functions. Each HDR is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding). Each HDR will accept up to two IF inputs.

Each HDR has RAID capability to store up to 1TB internally of data collected from satellite missions.

Each HDR outputs decoded data streams over TCP sockets to DAS systems.

3.1.8 S-Band Command, Range, and Telemetry units for one 13 m Antenna System (CRT)

The station is equipped with two Cortex CRT Command, Ranging, and Telemetry units. Each CRT contains circuitry to perform demodulation, bit synchronization, decoding, command encoding, and Range/Range rate functions. Each CRT is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding/etc). Each CRT will accept up to two IF inputs.

3.1.9 S-Band UpConvertors and Downconvertors

The S-Band system utilizes interface to the antenna at S-Band frequencies for uplink and downlink the CRT operates at an IF Frequency of 70MHz. The up and down convertors, located in the operations building translate the signals between the IF and S-Band frequencies.

3.1.10 Test Loop Translator

A test loop translator is locating in the antenna pedestal to allow loopback testing from simulated uplink command signals.

3.1.11 S-Band Test Generator

A CW selectable frequency generator is provided in the S-Band rack in the operations room and is used for test purposes.

3.1.11.1 Boresite System

Complete checkout of the auto-track system is provided using a signal source located on the Camp Fortune tower ten (10) kilometers from the site. Space on the tower is rented from Canadian Broadcasting Corportion.

The boresight test system includes two DC powered RF synthesizers, one at 8260 MHz and the other at 2265.5 MHz. The RF outputs of the synthesizers are combined together and fed through a coaxial cable to the wideband feedhorn. A DC power supply is provided for each RF synthesizer.

In addition, delivered with the 13m Antenna System is a new Boresight System which is currently stored at GSS. This Boresight System is identical i.e. built-to-print version as at PASS.

3.2 Processing Systems and Control Systems

3.2.1 Mon-A-Co (MNC)

The Monitor And Control (Mon-A-Co) system is the main controller internal to each station. The Mon-A-Co controls one or more antenna systems at a station. For example at PASS the Mon-A-Co controls both PASS13m1 and PASS13m2. The main Mon-A-Co interfaces are to the FT-RACC, antenna controllers and the Cortex units. Cortex XXL units are used for X Band data demodulation and data capture. Cortex Command Ranging and Telemetry (CRT) units are used for TT&C. In the case of the CRT units, the Mon-A-Co provides configuration and basic control/monitoring. The Canadian Space Agency (CSA) interface directly to the CRT units for retrieving telemetry data and sending command data.

The Mon-A-Co™ software executes on a pair of server computers in a redundant configuration where one of the servers is online and the second server operates as hot-standby. Mon-A-Co™ provides monitor and control of the antenna subsystem and the baseband equipment. It uses the MySQL database management system for persistent storage of data and CORBA and TCP sockets for communications between the different software components. The Graphical User Interface (GUI) software can execute on either the same computer as the server software or on a remote computer or both. The Mon-A-Co™ software is designed to operate autonomously, and only requires operator involvement during installation and configuration and to resolve anomalous conditions such as device failures. Mon-A-Co™ raises events and alarms whenever a

condition exceeds pre-defined parameters. These parameters are defined during the installation and configuration of the system. The raised events and alarms are presented on the GUI and forwarded to the set of defined recipients using either SNMP or SMTP or both. In addition to raising events and alarms Mon-A-Co™ will automatically take action to try and resolve device failures by switching in redundant equipment. If redundant equipment is not available for a given failure Mon-A-Co™ will gracefully degrade activities and command and control functionality by continuing to support operations that do not require the failed devices. The Mon-A-Co™ GUI is used to define system parameters, view current system status and command and control individual devices and generally operate Mon-A-Co™.

In addition to the common functionality that all Mon-A-Co™ systems share, the Mon-A-Co™ system being delivered is enhanced with a request interface for handling satellite tracking and data capture requests. The requests can be provided programmatically or through the Mon-A-Co™ GUI. The GUI provides windows to view the current list of pending requests, edit/replace existing requests, add new requests and delete requests.
Mon-A-Co has two GUI interface platforms locally at PASS. On computer (GUI Ops PC) is dedicated for access to the Mon-A-Co GUI system client access and one computer (Archive GUI PC) provides access to historic Mon-A-Co logs for troubleshooting and trending purposes and trending.

3.2.2 Reception Archive and Control Computer (RACC)

The Reception Archiving and Cataloguing Controller (RACC) is the top level system for the NRCan ground segment. The RACC receives schedules and ancillary data, such as the ephemeris files, from Satellite Operating Agencies (SOAs) and tasks the stations for reception and TT&C activities. After a pass, the RACC creates and sends Post Pass reports to the SOAs. The RACC also supports automatic conflict resolution based on priorities per mission and type of contact (X-Band/S-Band, Emergency etc.). The RACC is a Centralized Fault Tolerant (FT) system that tasks all NRCan sites/stations. The active FT-RACC is hosted at PASS and the hot standby FT-RACC is hosted at GSS providing a site redundancy.

The RACC is a Windows PC-based computer system which:

- Receives schedules from each satellite mission SOA
- Provides schedules to the PASS, GSS, and ICAN Mon-A-Co systems
- Delivers receptions reports to the SOA when required
- Collects ephemeris information from each satellite mission SOA and distributes it to the PASS, GSS, and ICAN Mon-A-Co systems
- Provides schedules to DAS systems for direct ingest.
- Performs device de-conflicting in the scheduling of the devices used to collect data from each planned orbit overpass

- Collects the reported status from the PASS, GSS, and ICAN Mon-A-Co systems and consolidates the content to generate each of the reports for reception activities
- Provides an operator GUI interface for scheduling performed to all three Mon-A-Co systems.

3.2.3 Direct Archive System (DAS)

The Direct Archive System (DAS) captures demodulated X Band reception data via Transmission Control Protocol/Internet Protocol (TCP/IP) from the Cortex XXL units. The DAS at each station are tasked by the FT-RACC located at PASS. The DAS units reformat the data into standard formats based on specific missions. For example for RADARSAT-2 the DAS units create standard FRED datasets and for LANDSAT-8 the DAS units create Mission Data files. This allows for operability with external systems for decryption (for RADARSAT-2 only) and processing.

The DAS systems were designed and built by MDA. The DAS Systems were installed for the direct-to-disk recording of RADARSAT, LANDSAT, and ENVISAT satellite data. The input to the DAS is serial over TCP sockets. The output of the DAS is segment-based FRED formatted data. Outputs of the DAS system include FRED segments consists of a data file and a header file, RFC Buffer files (RAW) and, Level-0 data files . The output files can be archived or can be used as input to processing systems to generate user products.

There are two (2) DAS systems at the station. Each system consists of a COTS personal computer with a 10TB RAID, two (2) processors, and 1000Mbps NIC .

3.3 Station Networks and Systems

The station has a combination of 100Mbps and 1000Mbps Ethernet network segments for station traffic.

Two (2) routers are used for network isolation, network security and routing over a WAN to NRCan Ottawa.

The majority of the network is copper UTP based.

The local and wide area network is running TCP/IP.

3.3.1 Staging Computers

DELL server computers are provided for temporary file storage and storage of backups. The computers include a RAID system and both computer and RAID are hot spared.

3.3.2 Weather Station

Weather stations are provided at the station. These allow the operations to understand the local weather.

3.3.3 WebCams

Two HTTP accessible webcam systems are located inside the operations building and one is pointed at the 13m antenna system.

3.4 VOIP

Each station will be capable of voice communication over phone, with Voice over IP (VoIP) as backup using VoIP equipment. Equipment will be installed in antennas and operations buildings.

APPENDIX A – GSS EQUIPMENT LIST AND MAINTENANCE REQUIREMENTS

System	Equipment/Sub-Systems	Manufacturer/Model	Qty	Exceptions Hardware	Exceptions Software
13 Metre RF Antenna Systems	Antenna System, inclusive of servo, and all related sub-systems	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	DEU	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	HPA	WV Communications 100W	1 + 1 Spare	Nil	Nil
13 Metre RF Antenna Systems	TLT	MU-DEL Model 44449	1	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (X-Band)	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (S-Band)	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	Overall antenna system flood lighting, HVAC systems, Electrical systems, Associated interconnections, PPA systems, Air Dryers, Emergency systems, and all related	Datron/Related	N/A	N/A	N/A
13 Metre RF Antenna Systems	Boresight Test Signal Transmitter	Datron	1	Nil	Nil
13 Metre Surface De-Icing	Fan/Heather, Control Box, Remote Control Box	Walton Enterprise	1	Nil	Nil
Boresight	Boresight Test Signal Transmitter at Camp Fortune	ViaSat	1	Nil	Nil
Mon-A-Co	MNC Server A	Dell Power Edge R320	1	Nil	NRCan Responsibility
Mon-A-Co	MNC Server B	Dell Power Edge R320	1	Nil	NRCan Responsibility

Mon-A-Co	High Data Rate Receiver	Zodiac Cortex HDR XXL	2	Nil	Nil
Mon-A-Co	Command Ranging and Telemetry Unit	Zodiac Cortex CRT	2	Nil	Nil
Mon-A-Co	MNC GUI Ops PC	DELL Optiplex 790	1	Nil	Nil
Mon-A-Co	16X16 Matrix Switch	USC 12661-001	1	Nil	Nil
Mon-A-Co	GPS receiver	End Run 3019-5114-000	1	Nil	Nil
Mon-A-Co	Keyboard/Monitor/Mouse Drawer	BSI RMK-928	1	Nil	Nil
Mon-A-Co	LAN Switch (X-Band Rack)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
Mon-A-Co	LAN Switch (S-Band Rack)	Cisco WS-C2960S-24TS-S	1	Nil	Nil
Mon-A-Co	LAN Switch (Antennas)	MOXA EDS-G308-2SFP	1	Nil	Nil
Mon-A-Co	PATCH PANEL	Trompeter	1	Nil	Nil
Mon-A-Co	Network Based Spectrum Analyzer	SED Decimator	1	Nil	Nil
Mon-A-Co	Signal Generator	Rhode & Schwartz SGS100A	1	Nil	Nil
Mon-A-Co	S-Band Up Convertor	GEOSYNC UTR-200240	2	Nil	Nil
Mon-A-Co	S-Band Down Convertor	GEOSYNC DTR-200240	2	Nil	Nil
Mon-A-Co	Rack Fan Tray Unit	Kooltronics 122502-1	2	Nil	Nil
Mon-A-Co	1 PPS Fiber Transmit Unit	LuxLink DTR-7201-7	2	Nil	Nil
Mon-A-Co	1 PPS Fiber Receiver Unit	LuxLink DR-7201	2	Nil	Nil
Mon-A-Co	Transmitter, Distribution, Optical, 10MHz	PTF-1208A/ SED 130887-1	1	Nil	Nil
Mon-A-Co	Receiver, Distribution, Optical, 10MHz	PTF-1209A/ SED 130887-2	1	Nil	Nil
Mon-A-Co	Mini MCU	SED P/N 126421-4	7	Nil	Nil
Mon-A-Co	EMI Rack FILTERS	SED 38117ASSY124028-3	2	Nil	Nil
Mon-A-Co	IF/RF Switchplates	SED	1	Nil	Nil
Mon-A-Co	Fibre Optic IFL (X-Band)	Miteq OCC-1	2	Nil	Nil
Mon-A-Co	Fibre Optic IFL (S-Band)	Miteq OCC-1	1	Nil	Nil
Mon-A-Co	Signal Distribution Unit IRIG-B	PTF-1206A/ SED 127457-2	1	Nil	Nil
Mon-A-Co	Distribution 10MHz (S-Band)	PTF-1206A/ SED 130856-4	1	Nil	Nil

Mon-A-Co	1PPS Distribution unit (S-Band)	PTF-1206A/ SED 130856-9	1	Nil	
Direct Archive Systems (DAS)	DAS Computer (GDAS6)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
Direct Archive Systems (DAS)	DAS Computer (GDAS7)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
FT RACC	Standby RACC Prime	Dell PowerEdge R320 Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise VMware ESXi v5.1	1	Nil	NRCan Responsibility
FT RACC	Standby RACC Secondary	Dell PowerEdge R320 Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise VMware ESXi v5.1	1	Nil	NRCan Responsibility
FT RACC	Standby vCenter	Dell PowerEdge R320 Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise	1	Nil	Nil
FT RACC	Standby SAN RAID Array	Dell EqualLogic PS4100XV SAN/ 7.2 TB, 15K SAS	1	Nil	Nil
FT RACC	Standby iSCSI SAN Switch	Dell PCT7024/ 24 Port, 1GbE with 10Gb	2	Nil	Nil
FT RACC	KVM 16 port	DELL	1	Nil	Nil
FT RACC	Keyboard/Monitor/Mouse Drawer	N/A	1	Nil	Nil

Station Network	Juniper Networks	SSG 550	1	NRCan Responsibility	NRCan Responsibility
Station Network	Juniper Networks	SRX 650	1	NRCan Responsibility	NRCan Responsibility
Station Network	CISCO	Catalyst 3750	1	NRCan Responsibility	NRCan Responsibility
Station Network	CISCO (MDA Rack)	WS-C2960S-24TS-S	2	Nil	Nil
Station Network	CISCO (MDA Rack)	WS-C2960S-24TS-S	Spare	Nil	Nil
Station Network	DNS Server Prime	Dell PowerEdge R420/ Windows Server 2008 or 2012 R2	1	Nil	Nil
Station Network	DNS Server Redundant	Dell PowerEdge R420/ Windows Server 2008 or 2012 R2	1	Nil	Nil
General Station Equipment	Webcam	Columbia ORION	2	Nil	Nil
General Station Equipment	Weather Station	AXIS P1347	1	Nil	Nil
General Station Equipment	Staging Computer	DELL Poweredge R710 Server	1 + Spare	Nil	Nil
General Station Equipment	Staging Computer RAID	DELL MD1000 RAID	1 + Spare	Nil	Nil

NOTE: In addition to the Spare items indicated above which are physically located at GSS, many other Spare items for all three stations (PASS, GSS, ICAN) are physically located at PASS, except for the HPA for which the spare HPA is physically installed and configurable as a hot standby unit in each TT&C-equipped antenna at all three stations.

Attachment 5 to Annex "C"

AD-3

Prince Albert Satellite Station (PASS)
Earth Observation Ground Station Description

Canada Centre for Earth Observation
CANADA CENTRE for MAPPING AND EARTH OBSERVATION
Natural Resources Canada (NRCan)

Doc. No.:	EODS-REF-003
Version:	4
Revision:	3
Status:	FINAL DRAFT
Date:	January 15, 2015

CHANGE LOG

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0.0		All	First Release for review.	
1.9		all	Major Rewrite	
3.0	April/May 2014	All	Major Rewrite for RFI	
4.0	November/December 2014	Multiple	Updating	
4.1	10 Dec 2014	Multiple	Final Update for draft RFP	
4.2	16 Dec 2014	Multiple	Update for draft RFP incl. Figure 3	
4.2	31 Dec 2014	5, 6, 8	Updated Acronyms & Abbreviations list, typo corrected on page 8	TF
4.3	15 January 2014	All	Formatting, removed Geomatics Canada 'Snail' logo, updated corporate identity	CV

REVIEWS AND APPROVALS

Reviewed and Recommended by:

_____ _____

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Approved by:

_____ _____

TABLE OF CONTENTS

ACRONYMS & ABBREVIATIONS

AMS	Archive Management System
AOS	Acquisition Of Signal
BSA	Booth Street Archive (NRCan Ottawa)
CSA	Canadian Space Agency
CCEO	Canada Centre for Earth Observation (a Division of CCMEO)
CCMEO	Canada Centre for Mapping and Earth Observation (Natural Resources Canada – NRCan)
COTS	Commercial Off The Shelf
CSA	Canadian Space Agency
DAF	Data Acquisition Facility
DAS	Direct Archive System (MDA)
DEU	Digital Equipment Unit (Datron antenna control unit)
D/C	Down Converter
DRF	Data Reception Facility
EO	Earth Observation
EODMS	Earth Observation Data Management System (co-located with BSA)
EODS	Earth Observation Data Services
FRED	Framed Raw Expanded Data (an MDA-designed data format specification)
FTP	File Transfer Protocol
GB	Gigabyte (1 000 000 000 bytes)
Gb	Gigabit (1 000 000 000 bits)
GPS	Global Position System
GSS	Gatineau Satellite Station
GSS13m1	GSS 13metre antenna #1
GUI	Graphical User Interface
HSM	Hierarchical Storage Management
ICAN	ISSF Canadian station
ICAN1	ICAN antenna #1
IF	Intermediate Frequency
IRIG	InterRange Instrumentation Group
ISO	Greek – means “the same”
ISSF	Inuvik Satellite Station Facility
kbps	kilo-bits per second
LAN	Local Area Network
LNA	Low Noise Amplifier
LO	Local Oscillator
LOS	Loss of Signal (from satellite)

MB	Megabyte (1 000 000 bytes)
Mb	Megabit (1 000 000 bits)
Mbps	Megabits per second
MDA	MacDonald Dettwiler and Associates
MON-A-CO	Monitoring and Control Unit (SED)
NRCan	Natural Resources Canada
PASS	Prince Albert Satellite Station
PASS13m1	PASS 13metre antenna #1
PASS13m2	PASS 13metre antenna #2 (no TT&C)
QA	Quality Assurance
QPSK	Quadrature Phase-Shift Keyed
RACC	Reception, Archive and Control Computer (MDA)
RAID	Redundant Array of Inexpensive Disks
RF	Radio Frequency
RM	Reception Manager
RNSI	Revitalized NRCan Satellite Infrastructure (formerly known as EODS)
RT	Real-Time
RV	Reception Viewer (MDA)
SAR	Synthetic Aperture Radar
SED	SED Systems Limited
S-Band	2.200 – 2.300 GHz
SOA	Satellite Operating Agency
SOP	Standard Operating Procedures
SOW	Statement of Work
TB	Terabyte (1 000 000 000 000 bytes)
TBD	To Be Determined
TCG	Time Code Generator
TCR	Time Code Reader
TT&C	Telemetry Transmit and Control
U/C	Up-Converter
UTC	Universal Time Coordinated
UTP	Unshielded Twisted Pair
VEC	State Vector
WAN	Wide Area Network
WWW	World Wide Web
X-Band	8.025 – 8.400 GHz

1 PURPOSE AND SCOPE

1.1 Purpose

The purpose is to provide the descriptive information for the systems located at the Prince Albert Satellite Station and a listing of the equipment and systems for which the Contractor is responsible to provide In Service Support for their maintenance and operation.

1.2 Scope

This document provides a general description of the NRCan ground stations infrastructure and the principle operational processes that occur within it.

This document describes the systems and equipment at the Prince Albert Satellite Station used for reception of satellite remote sensing data and satellite and Telemetry Transmit and Control (TT&C) operations.

This document also includes:

- a list of the NRCan furnished equipment and systems at the Prince Albert Satellite Station (PASS) and associated consolidated spares units for all three NRCan stations (Appendix A).
- a consolidated listing of NRCan furnished spare parts for all three NRCan stations (Appendix B).
- a consolidated listing of NRCan furnished electronic test equipment and tools for all three NRCan stations (Appendix C).

This document does not give any detailed information about the building structures, plumbing, electrical systems, and civil works etc., which comprise the facility or building itself.

2 BACKGROUND

2.1 NRCan Earth Observation Ground Stations Infrastructure - Background

The NRCan Earth Observation Ground Stations Infrastructure is a national service that provides Earth Observation data to Programs in the Earth Sciences Sector (ESS) of NRCan, Satellite Operating Agencies (SOA)s including the Canadian Space Agency (CSA) and Other Government Departments (OGDs), as well as to the Private Sector and other users.

Data reception, dissemination and TT&C services are provided through NRCan's three satellite stations at Prince Albert, Inuvik, and Gatineau utilizing systems contained therein.

The suite of satellites received at the stations includes the American LANDSAT-8 and the Canadian RADARSAT-2. In the future the stations will receive the Canadian RADARSAT Constellation Missions and potentially and the European Copernicus SENTINEL series. Additionally each station will be used for TT&C for Satellite Operating Agency(s) (SOA) e.g. CSA NEOSSat, SciSat missions and other SOA missions via the CSA, and in the future the RADARSAT Constellation Missions.

2.1.1 GSS, ICAN, and PASS

GSS, ICAN, and PASS are responsible for the day-to-day operations and maintenance of the satellite stations and their short-term buffer of earth observation data. These responsibilities include:

- Reception and processing of the data required by NRCan’s internal and external clients
- TT&C mission contacts required by NRCan’s external clients (e.g. CSA)
- Timely transfer of data to the NRCan Booth Street Archive (BSA).

2.2 Operations Overview

Following implementation of new systems and infrastructure, NRCan has deployed new systems whose design goal was intentionally directed to allow autonomous and lights out operation for the vast majority of the system data collections and reporting activities. The design also implemented remote reporting notifications of system status where feasible. Deployed systems also included integration of automatic redundancy for some equipment and networks.

While each of the three NRCan ground stations retain their own equipment monitoring and control, the intended operational oversight has been implemented whereas PASS is the central operations point for all four antennas located at the three site using integrated remote monitoring and control.

The primary services of NRCan Earth Observation Ground Stations Infrastructure have been divided into four main processes. The four main processes are:

- Reception (ICAN, PASS, GSS)
- TT&C (ICAN, PASS, GSS)
- Archiving (BSA)
- Cataloguing (BSA)

There is of course a large amount of interaction between the various processes. This is illustrated in the following figures:

- Figure 1: Block Diagram – Overview
- Figure 2: Block Diagram – Operations

It should be noted that these figures represent a high level view of the on-going NRCan Earth Observation Ground Stations Infrastructure operation.

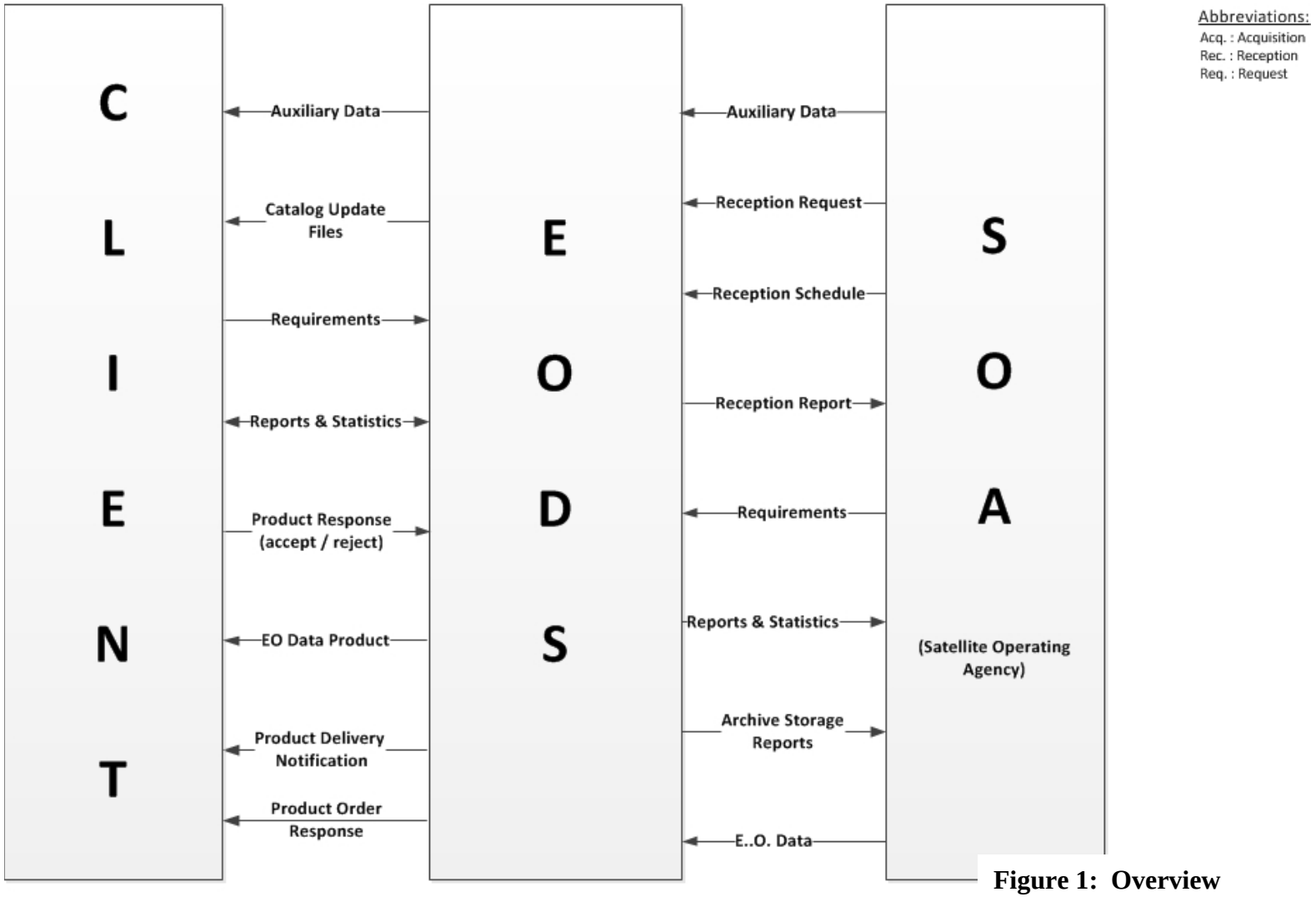

Figure 1: Overview

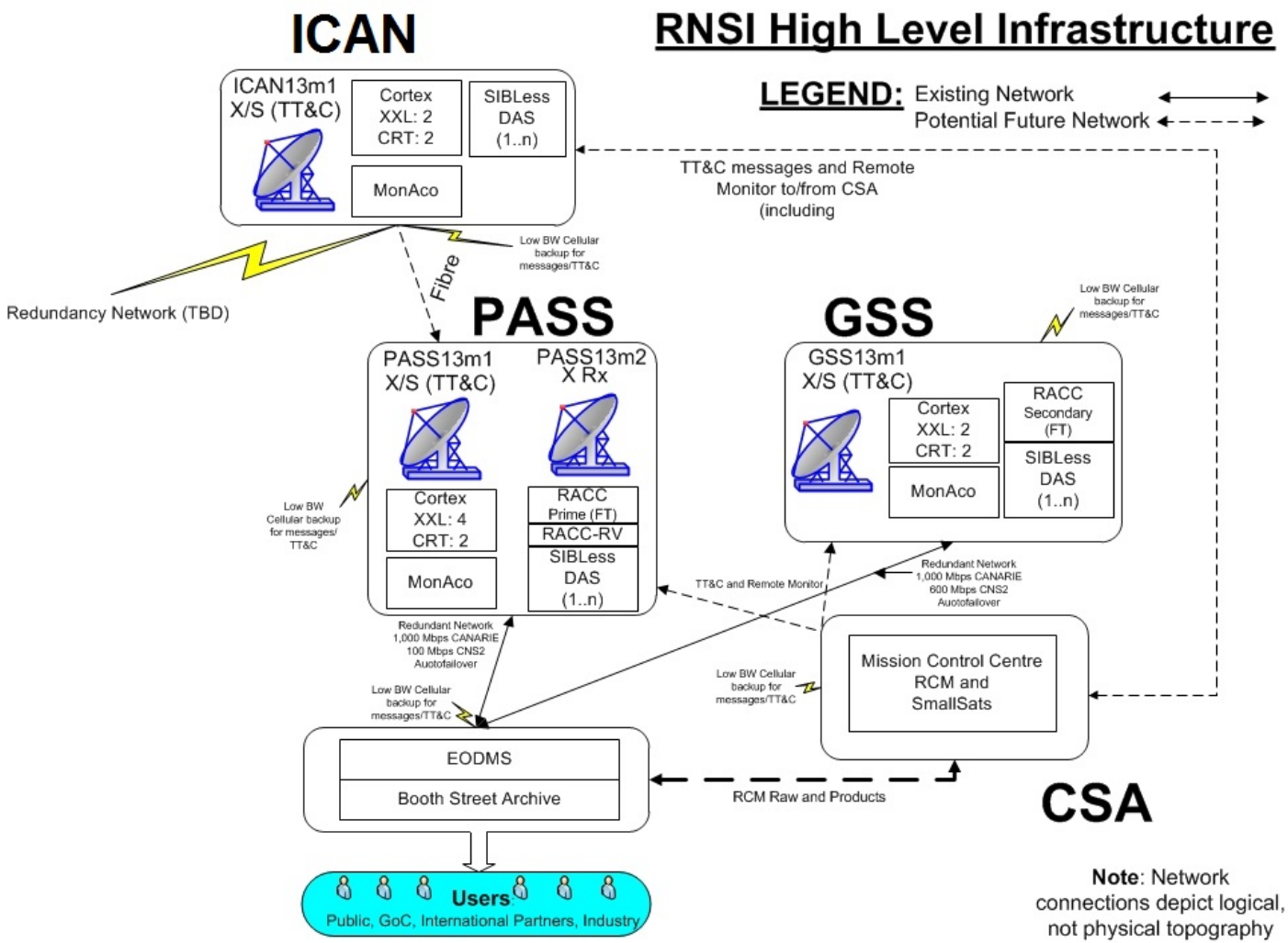

Figure 2: Operations

2.2.1 Reception

Reception is mostly performed by the reception stations and consists primarily of:

- PASS obtaining reception schedules and control files from SOA for provision to the three reception stations;
- PASS performing the scheduling and tasking of reception activities to all three reception stations;
- PASS reporting on reception status for all three reception stations;
- The reception of earth observation data by each of the four antenna systems;
- Conversion of raw EO data to a format suitable for storage and transmission via WAN;
- The near real-time transfer of recently received data from the station to the NRCan BSA;
- The provision and support of the systems and subsystems needed to receive and deliver this data; and
- Retaining a 90 day cyclic buffer of all data collected.

2.2.2 TT&C

TT&C is mostly performed by the stations and consists primarily of:

- PASS obtaining TT&C schedules and control files from SOA for provision to the three stations;
- PASS performing the scheduling and tasking of TT&C activities to all three stations. The SOA e.g. CSA is responsible for the sending the Control commands to the stations;
- PASS reporting on TT&C status for all three stations;
- The provision and support of the systems and subsystems needed to receive this data; and
- Retaining a 90 day cyclic buffer of all data collected and transmitted.

2.2.3 Archiving

Archiving is performed by the NRCan BSA and consists primarily of the following activities:

- Accepting data from the GSS, ICAN, and PASS reception stations for long term archiving;
- Provision of long term archive data to the for use in product generation;
- Provision of access to archive data for clients;
- Long term storage of EO data;
- Periodic testing of archived data to ensure its' viability;

- Migration of long term archive to newer mediums as technology and time progresses; and
- the provision and support of the subsystems needed to store and archive EO data.

2.2.4 Cataloguing

Cataloguing is performed by the BSA and consists primarily of the following activities:

- provision of catalogue update files (CUF) and associated "quick look" imagery to SOA and NRCan EODMS, which maintains the catalogues used by NRCan clients when ordering products; and
- the provision and support of the subsystems needed to produce the CUF files and associated imagery.

3 SYSTEMS

A high level block diagram illustrating the equipment and systems at the Prince Albert Satellite station are depicted in Figure 3 and are described in Sections 3.1 through 3.5.

3.1 Antenna and RF Systems

3.1.1 Systems and Subsystems

The antenna and RF systems at the Prince Albert Satellite Station consist of those systems and subsystems between the satellite and the output of the demodulators. The principle systems in this chain are:

- Antenna complete with:
  - Reflector, sub-reflector and feed
  - Drive motors, motor controllers and servos
  - RF up and down converters
- Inter-facility link cabling with:
  - Power cabling
  - Signal cabling
  - Control cabling
- Tracking receivers
- Antenna control units (DEU)
- IF switch units
- Cortex XXL HDR Demodulators and Cortex CRT Systems
- UpConvertors
- DownConvertors
- Decimator Remote Spectrum Display units
- 100Watt S-Band High Power Amplifiers
- Test Loop Translator

3.1.2 Redundancy

Most units are provided with “self-contained” redundancy such that Mon-A-Co control software will detect hardware failures and integrate alternate units for operation.

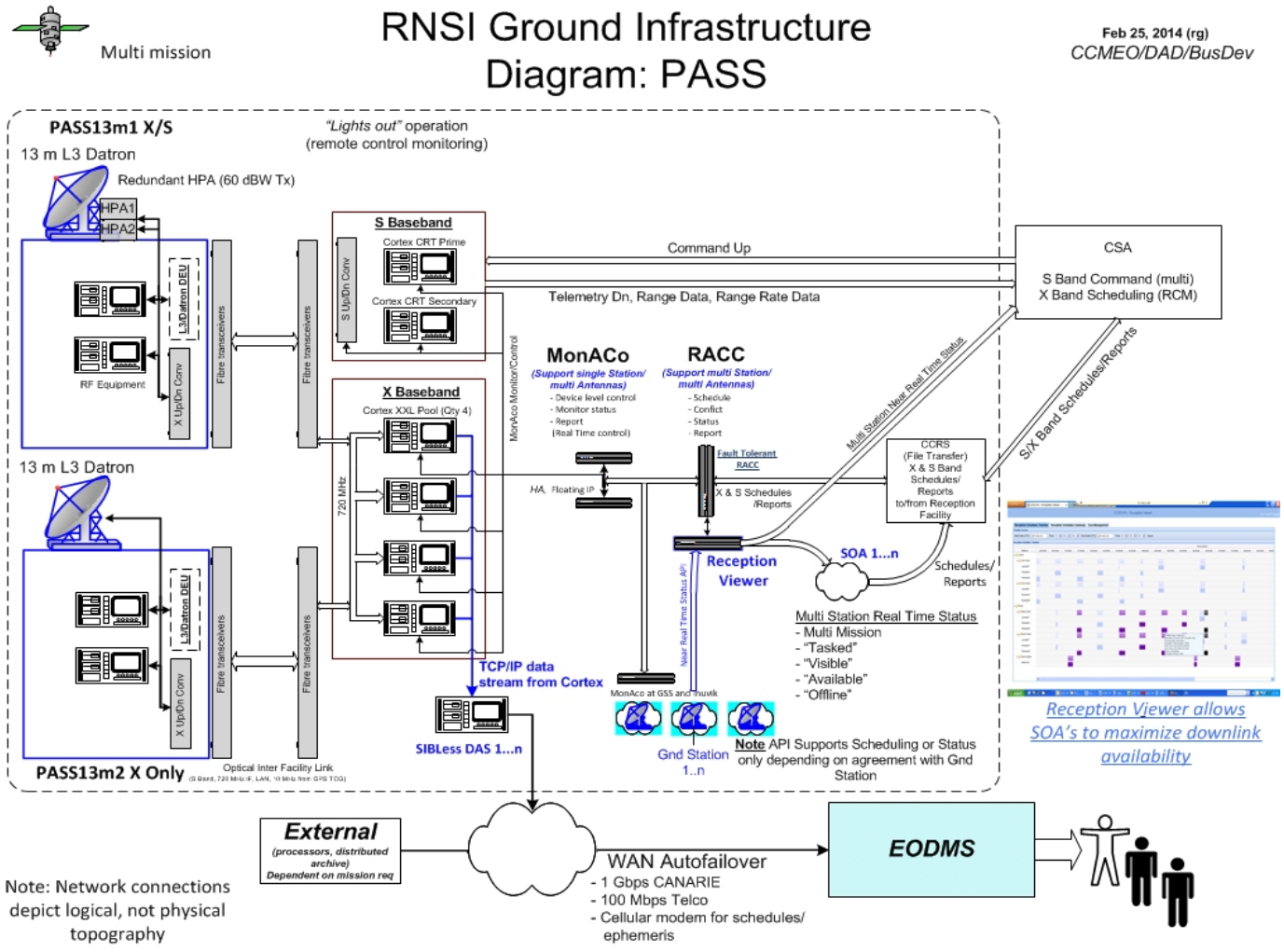

Figure 3: PASS Block Diagram

3.1.3 General Configuration

The Prince Albert Satellite Station is equipped with two 13 metre Cassegrain type tracking antenna systems made by L3-Datron. These are equipped with a dichroic sub-reflector which permits the use of both an X-Band for both tracking and data reception. One 13 Metre antenna also retains S-Band uplink and downlink capabilities and may be used for tracking, uplink commanding, ranging, and telemetry reception.

3.1.4 13-Metre Antenna Systems

3.1.4.1 Antenna Drive

The antennas are provided with dual-drive elevation over azimuth over tilt pedestals, which provide the high slew rates, and pointing precision needed to track earth observation satellites in low earth orbit.

3.1.4.2 Tracking

Satellites are tracked from either from start of schedule data to end of scheduled data collection or horizon to horizon. The system will typically start in the “program track” mode based on the calculated satellite position as provided by Digital Equipment Units (DEU) located in the antenna pedestals. When signal levels are sufficient, tracking automatically switches to “auto track” (monopulse tracking) on S-band (where available) and will then switch to X-band when the X-band data carrier is received. These operations are pre-programmed and automatic. If the monopulse track system(s) should fail, tracking will automatically continue in the program track mode.

A monopulse tracking system is provided on the antenna for each frequency band on one antenna and both on the alternate antenna. These are installed in pressurized weather tight enclosures. The tracking output, from the feed monopulse units, are connected to a down-converter, and then fed to the tracking receivers.

3.1.4.3 Antenna Tilt Mechanism

Both 13 metre antennas are equipped with a fixed seven degree elevation tilt mechanism which can be moved to any azimuth position. This mechanism tilts the reflector / sub-reflector / drive mechanism. This allows the antennas to successfully track a satellite passing directly over the station without limitations due to “key-holing”.
Determination of the requirement for tracking at zenith, and operation of the tilt mechanism, is automatic.

3.1.4.4 Tracking Receivers

Each antenna has a tracking receivers can be used for X-Band or S-Band tracking as available.

The X-Band receivers are fixed frequency (720MHz). The S-Band receivers are variable frequency (2200 – 2300 MHz). The DEU controls and configures the tracking receivers.

3.1.4.5 Operations Console

The control console for the two (2) 13-metre antenna systems are located in the computer room at the Prince Albert Satellite Station. The room where antenna positioning and satellite tracking are controlled and monitored allows visual contact with the antenna.

This console houses the Mon-A-Co GUI for operations for all three NRCan sites and systems.

3.1.5 X-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 720 Mhz range and is used to patch IF channel between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.6 S-Band IF Switch Matrix

The X-Band IF Matrix Switch is a highly integrated switching system with 16 inputs and 16 outputs operating in the 70 Mhz range and is used to patch IF channel between the Antenna and the Baseband equipment. The unit is a Universal Switching Corporation model SS244.

3.1.7 X-Band Demodulators with bit synchronizers for 13 m Antenna Systems (HDR)

The station is equipped with four Cortex HDR XXL demodulators. Each HDR contains circuitry to perform demodulation, bit synchronization, and decoding functions. Each HDR is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding). Each HDR will accept up to two IF inputs.

Each HDR has RAID capability to store up to 1TB internally of data collected from satellite missions.

Each HDR outputs decoded data streams over TCP sockets to DAS systems.

3.1.8 S-Band Command, Range, and Telemetry units for one 13 m Antenna System (CRT)

The station is equipped with two Cortex CRT Command, Ranging, and Telemetry units. Each CRT contains circuitry to perform demodulation, bit synchronization, decoding, command encoding, and Range/Range rate functions. Each CRT is configured at the Mon-A-Co system for each satellite downlink data type (modulation / speed / coding/etc). Each CRT will accept up to two IF inputs.

3.1.9 S-Band UpConvertors and Downconvertors

The S-Band system utilizes interface to the antenna at S-Band frequencies for uplink and downlink the CRT operates at an IF Frequency of 70MHz. The up and down convertors, located in the operations building translate the signals between the IF and S-Band frequencies.

3.1.10 Test Loop Translator

A test loop translator is locating in the antenna pedestal to allow loopback testing from simulated uplink command signals.

3.1.11 S-Band Test Generator

A CW selectable frequency generator is provided in the S-Band rack in the operations room and is used for test purposes.

3.1.11.1 Boresite System

Complete checkout of the auto-track system is provided using a signal source located on a tower several kilometers from the site. Space on the tower is rented from private companies.

The boresight test system includes two DC powered RF synthesizers, one at 8200 MHz and the other at 2250 MHz. The RF outputs of the synthesizers are combined together and fed through a coaxial cable to the wideband feedhorn. A DC power supply is provided for each RF synthesizer.

The RF synthesizers will be able to be turned on or off by a telephone and /or web based remote power switch made by Remote Power Switch.

3.2 Processing Systems and Control Systems

3.2.1 Mon-A-Co (MNC)

The Monitor And Control (Mon-A-Co) system is the main controller internal to each station. The Mon-A-Co controls one or more antenna systems at a station. For example at PASS the Mon-A-Co controls both PASS13m1 and PASS13m2. The main Mon-A-Co interfaces are to the FT-RACC, antenna controllers and the Cortex units. Cortex XXL units are used for X Band data demodulation and data capture. Cortex Command Ranging and Telemetry (CRT) units are used for TT&C. In the case of the CRT units, the Mon-A-Co provides configuration and basic control/monitoring. The Canadian Space Agency (CSA) interface directly to the CRT units for retrieving telemetry data and sending command data.

The Mon-A-Co™ software executes on a pair of server computers in a redundant configuration where one of the servers is online and the second server operates as hot-standby. Mon-A-Co™ provides monitor and control of the antenna subsystem and the baseband equipment. It uses the MySQL database management system for persistent storage of data and CORBA and TCP sockets for communications between the different software components. The Graphical User Interface (GUI) software can execute on either the same computer as the server software or on a remote computer or both. The Mon-A-Co™ software is designed to operate autonomously, and only requires operator involvement during installation and configuration and to resolve anomalous conditions such as device failures. Mon-A-Co™ raises events and alarms whenever a condition exceeds pre-defined parameters. These parameters are defined during the installation and configuration of the system. The raised events and alarms are presented on the GUI and forwarded to the set of defined recipients using either SNMP or SMTP or both. In addition to raising events and alarms Mon-A-Co™ will automatically take action to try and resolve device failures by switching in redundant equipment. If redundant equipment is not available for a given failure Mon-A-Co™ will gracefully degrade activities and command and control functionality by continuing to support operations that do not require the failed devices. The Mon-A-Co™ GUI is used to define system parameters, view current system status and command and control individual devices and generally operate Mon-A-Co™.

In addition to the common functionality that all Mon-A-Co™ systems share, the Mon-A-Co™ system being delivered is enhanced with a request interface for handling satellite tracking and data capture requests. The requests can be provided programmatically or through the Mon-A-Co™ GUI. The GUI provides windows to view the current list of pending requests, edit/replace existing requests, add new requests and delete requests.
Mon-A-Co has two GUI interface platforms locally at PASS. On computer (GUI Ops PC) is dedicated for access to the Mon-A-Co GUI system client access and one computer (Archive GUI PC) provides access to historic Mon-A-Co logs for troubleshooting and trending purposes and trending.

3.2.2 Reception Archive and Control Computer (RACC)

The Reception Archiving and Cataloguing Controller (RACC) is the top level system for the NRCan ground segment. The RACC receives schedules and ancillary data, such as the ephemeris files, from Satellite Operating Agencies (SOAs) and tasks the stations for reception and TT&C activities. After a pass, the RACC creates and sends Post Pass reports to the SOAs. The RACC also supports automatic conflict resolution based on priorities per mission and type of contact (X-Band/S-Band, Emergency etc.). The RACC is a Centralized Fault Tolerant (FT) system that tasks all NRCan sites/stations. The active FT-RACC is hosted at PASS and the hot standby FT-RACC is hosted at GSS providing a site redundancy.

The RACC is a Windows PC-based computer system which:

- Receives schedules from each satellite mission SOA
- Provides schedules to the PASS, GSS, and ICAN Mon-A-Co systems
- Delivers receptions reports to the SOA when required
- Collects ephemeris information from each satellite mission SOA and distributes it to the PASS, GSS, and ICAN Mon-A-Co systems
- Provides schedules to DAS systems for direct ingest.
- Performs device de-conflicting in the scheduling of the devices used to collect data from each planned orbit overpass
- Collects the reported status from the PASS, GSS, and ICAN Mon-A-Co systems and consolidates the content to generate each of the reports for reception activities
- Provides an operator GUI interface for scheduling performed to all three Mon-A-Co systems.

3.2.3 Reception Archive and Control Computer Reception Viewer (RACC-RV)

The Reception Viewer (RV) is a graphical system that presents the status of all stations and antennas. This includes past, planned and potential contacts for missions supported on each antenna. The RV is an important tool for the Contractor and potentially SOAs to view current reception scheduling status and to assist with future reception planning.

The RACC-RV is a standalone web application used to view reception schedules currently on the OTS- RACC. RACC-RV communicates with OTS-RACC using notification messages via the MFTD dropbox mechanism.

RACC-RV performs services for *RACC-RV Clients*, which include the RACC and other external entities that controls the contact chains.

RACC-RV supports the monitoring of the reception activities for each station in two main views:

- Reception Schedules Timeline, which display the summary of the reception availability at each station.

- Reception Schedules Summary, which provides the summary of the reception schedules information as well as the functionality to allow operators to cancel a reception schedule.

In addition, RACC-RV uses the Contact Schedule Bridge (CSB) to query the Mon-A-Co Antenna interface. Although part of RACC-RV, the CSB runs as a separate process.

3.2.4 Direct Archive System (DAS)

The Direct Archive System (DAS) captures demodulated X Band reception data via Transmission Control Protocol/Internet Protocol (TCP/IP) from the Cortex XXL units. The DAS at each station are tasked by the FT-RACC located at PASS. The DAS units reformat the data into standard formats based on specific missions. For example for RADARSAT-2 the DAS units create standard FRED datasets and for LANDSAT-8 the DAS units create Mission Data files. This allows for operability with external systems for decryption (for RADARSAT-2 only) and processing.

The DAS systems were designed and built by MDA. The DAS Systems were installed for the direct-to-disk recording of RADARSAT, LANDSAT, and ENVISAT satellite data. The input to the DAS is serial over TCP sockets. The output of the DAS is segment-based FRED formatted data. Outputs of the DAS system include FRED segments consists of a data file and a header file, RFC Buffer files (RAW) and, Level-0 data files . The output files can be archived or can be used as input to processing systems to generate user products.

There are three (3) DAS systems at the station. Each system consists of a COTS personal computer with a 10TB RAID, two (2) processors, and 1000Mbps NIC.

3.3 Station Networks and Systems

The station has a combination of 100Mbps and 1000Mbps Ethernet network segments for station traffic.

Three (3) routers are used for network isolation, network security and routing over a WAN to NRCan Ottawa.

The majority of the network is copper UTP based.

The local and wide area network is running TCP/IP.

3.3.1 Staging Computers

DELL server computers are provided for temporary file storage and for sending system log files to Ottawa. The computers include a RAID system and both computer and RAID are hot spared.

3.3.2 Weather Station

Weather stations are provided at each station. These allow the operations to understand what local weather

3.3.3 WebCams

Two HTTP accessible webcam systems are located on the roof of the operations building and pointed at each of the two 13m antenna systems.

3.4 VOIP

Each station will be capable of voice communication over phone, with Voice over IP (VoIP) as backup using VoIP equipment. Equipment will be installed in antennas and operations buildings.

3.5 Control Console

A large motorized console is provided in the operations building which houses the majority of equipment consoles, GUI computers, and remote displays are centralized to allow access to status and control of all three NRCan sites.

APPENDIX A – PASS EQUIPMENT LIST AND MAINTENANCE REQUIREMENTS

PASS Equipment Maintenance Requirements

System	Equipment/Sub-Systems	Manufacturer/Model	Qty	Exceptions Hardware	Exceptions Software
13 Metre RF Antenna Systems	Antenna System, inclusive of servo, and all related sub-systems	Datron	2	Nil	Nil
13 Metre RF Antenna Systems	DEU	Datron	2	Nil	Nil
13 Metre RF Antenna Systems	HPA	WV Communications 100W	1 + Spare	Nil	Nil
13 Metre RF Antenna Systems	TLT	MU-DEL Model 44449	1	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (X-Band)	Datron	2	Nil	Nil
13 Metre RF Antenna Systems	Tracking Receivers (S-Band)	Datron	1	Nil	Nil
13 Metre RF Antenna Systems	Overall antenna system flood lighting, HVAC systems, Electrical systems, Associated interconnections, PPA systems, Air Dryers, Emergency systems, and all related	Datron/Related	N/A	N/A	N/A
13 Metre RF Antenna Systems	Boresight Test Signal Transmitter	Datron	1	Nil	Nil
Mon-A-Co	MNC Server A	Dell Power Edge R310	1 + Spare	Nil	NRCan Responsibility
Mon-A-Co	MNC Server B	Dell Power Edge R310	1	Nil	NRCan Responsibility
Mon-A-Co	MNC Server Spare	Dell Power Edge R320	Spare	Nil	NRCan Responsibility
Mon-A-Co	High Data Rate Receiver	Zodiac Cortex HDR	4 + 2 spares	Nil	Nil

		XXL			
Mon-A-Co	Command Ranging and Telemetry Unit	Zodiac Cortex CRT	2	Nil	Nil
Mon-A-Co	MNC GUI Ops PC	DELL Optiplex 790	1	Nil	Nil
Mon-A-Co	MNC Archive GUI Ops PC	DELL Optiplex 9010	1	Nil	Nil
Mon-A-Co	16X16 Matrix Switch	USC 12661-001	2 + Spare	Nil	Nil
Mon-A-Co	GPS receiver	End Run 3019-5114-000	1 + Spare	Nil	Nil
Mon-A-Co	Keyboard/Monitor/Mouse Drawer	BSI RMK-928	1 + 2 Spares	Nil	Nil
Mon-A-Co	LAN Switch (X-Band Rack)	Cisco WS-C2960S-24TS-S	1 + Spare	Nil	Nil
Mon-A-Co	LAN Switch (S-Band Rack)	Cisco WS-C2960S-24TS-S	1 + Spare	Nil	Nil
Mon-A-Co	LAN Switch (Antennas)	MOXA EDS-G308-2SFP	2 + 2 Spares	Nil	Nil
Mon-A-Co	PATCH PANEL	Trompeter	2	Nil	Nil
Mon-A-Co	Network Based Spectrum Analyzer	SED Decimator	2 + Spare	Nil	Nil
Mon-A-Co	Signal Generator	Rhode & Schwartz SGS100A	1	Nil	Nil
Mon-A-Co	S-Band Up Convertor	GEOSYNC UTR-200240	2	Nil	Nil
Mon-A-Co	S-Band Down Convertor	GEOSYNC DTR-200240	2	Nil	Nil
Mon-A-Co	Rack Fan Tray Unit	Kooltronics 122502-1	3 + 2 Spare	Nil	Nil
Mon-A-Co	1 PPS Fiber Transmit Unit	LuxLink DTR-7201-7	2	Nil	Nil
Mon-A-Co	1 PPS Fiber Receiver Unit	LuxLink DR-7201	2	Nil	Nil
Mon-A-Co	Transmitter, Distribution, Optical, 10MHz	PTF-1208A/ SED 130887-1	2 + 2 Spares	Nil	Nil
Mon-A-Co	Receiver, Distribution, Optical, 10MHz	PTF-1209A/ SED 130887-2	2 + 2 Spares	Nil	Nil
Mon-A-Co	Mini MCU	SED P/N 126421-4	7 + 2 Spare	Nil	Nil
Mon-A-Co	EMI Rack FILTERS	SED 38117ASSY124028-3	6	Nil	Nil
Mon-A-Co	IF/RF Switchplates	SED	2	Nil	Nil
Mon-A-Co	Fibre Optic IFL (X-Band)	Miteq OCC-1	4	Nil	Nil
Mon-A-Co	Fibre Optic IFL (S-Band)	Miteq OCC-1	2	Nil	Nil
Mon-A-Co	Signal Distribution Unit IRIG-B	PTF-1206A/	1 + 2 Spare	Nil	Nil

		SED 127457-2			
Mon-A-Co	Distribution 10MHz (S-Band)	PTF-1206A/ SED 130856-4	1 + Spare	Nil	Nil
Mon-A-Co	1PPS Distribution unit (S-Band)	PTF-1206A/ SED 130856-9	1 + Spare	Nil	
Direct Archive Systems (DAS)	DAS Computer (PDAS5)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
Direct Archive Systems (DAS)	DAS Computer (PDAS6)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
Direct Archive Systems (DAS)	DAS Computer (PADAS7)	Dell Poweredge T620/ Windows Server 2008 R2/ 10 TB RAID	1	Nil	NRCan Responsibility
FT RACC	RACC Prime	Dell PowerEdge R320 Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise VMware ESXi v5.1	1	Nil	NRCan Responsibility
FT RACC	RACC Secondary	Dell PowerEdge R320 Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise VMware ESXi v5.1	1	Nil	NRCan Responsibility
FT RACC	vCenter	Dell PowerEdge R320	1	Nil	Nil

		Server/ Windows Server®2008 R2 SP1, 64 Bit Standard Edition/ iDRAC Port Card iDRAC 7 Enterprise			
FT RACC	SAN RAID Array	Dell EqualLogic PS4100XV SAN/ 7.2 TB, 15K SAS	1	Nil	Nil
FT RACC	iSCSI SAN Switch	Dell PCT7024/ 24 Port, 1GbE with 10Gb	2	Nil	Nil
FT RACC	KVM 16 port	DELL	1 + Spare	Nil	Nil
FT RACC	Keyboard/Monitor/Mouse Drawer		1 + Spare	Nil	Nil
Reception Viewer	RACC-RV	Dell PowerEdge R310	1	Nil	NRCan Responsibility
Station Network	Juniper Networks	SRX 650	1 + Spare	NRCan Responsibility	NRCan Responsibility
Station Network	DELL	6248 Switch	1	Nil	Nil
Station Network	DLINK	DSS-16	1	Nil	Nil
Station Network	CISCO	2960G-48	1	Nil	Nil
Station Network	CISCO	WS-3560G-48TS-S	Spare		
Station Network	DELL	Power Connect 5424	2 Spares	Nil	Nil
Station Network	CISCO (MDA Rack)	WS-C2960S-24TS-S	1	Nil	Nil
Station Network	CISCO (MDA Rack)	WS-C2960S-24TS-S	1	Nil	Nil
Station Network	DNS Server Prime	Dell PowerEdge R420/ Windows Server 2008 or 2012 R2	1	Nil	Nil
Station Network	DNS Server Redundant	Dell PowerEdge R420/ Windows Server 2008 or 2012 R2	1	Nil	Nil
General Station Equipment	Webcam	Columbia ORION	2	Nil	Nil

General Station Equipment	Weather Station	AXIS P1347	1	Nil	Nil
General Station Equipment	Staging Computer	DELL Poweredge R710 Server	1 + Spare	Nil	Nil
General Station Equipment	Staging Computer RAID	DELL MD1000 RAID	1 + Spare	Nil	Nil
General Station Equipment	Motorized Console	Winsted	1	Nil	Nil

NOTE: All Spare items indicated in the above listing are for all three stations (PASS, GSS, ICAN) but are physically located at PASS, except for the HPA for which the spare HPA is physically installed and configurable as a hot standby unit in each TT&C-equipped antenna at all three stations.

APENDIX B – CONSOLIDATED PARTS LISTINGS (FOR PASS, GSS & ICAN)

DATRON 13M ANTENNA and SED MONACO PARTS INVENTORY				
Item #	**SED Part Number**	**Vendor Part Number**	**Description**	**Qty**
1		A6NT220	POWER SUPPLY, 6V, 2.2A	2
2		SLS-24-048T	POWER SUPPLY, 24V, 4.8A	2
3		TD15-250	POWER SUPPLY, 15VDC, 2.5A	2
4		43818-4	LNA, X-BAND, WAVEGUIDE INPUT PHASED	2
5		44037-1	AMPLIFIER, LOW NOISE, S-BAND	2
6		ZHL-1042J	AMPLIFIER, .01 - 4.2 GHZ	2
7		135595-102	SWITCH ASSEMBLY, COAXIAL	2
8		137428-101	SWITCH ASSEMBLY, COAXIAL	2
9		43883-1	SWITCH, TRANSFER, COAXIAL, HIGH POWER	2
10		42068-1	6 BIT PHASE SHIFT MODULE 8.0-8.4 GHZ	2
11		43827-1	SHIFT MODULE, 2 BIT PHASE SHIFTER, S-BAND	2
12		42067-1	SWITCH, WAVEGUIDE, TRANSFER, FAILSAFE	2
13		3414N	FAN, 24 VDC, 49 CFM	2
14		4606N	FAN, 120 VAC	2
15		8506N	FAN, 115 VAC	2
16		128304-1	RADOME, X BAND	2
17		AS5-HSW0-1682	POWER SUPPLY	2
18		130614-101	MOTOR/GEARBOX ASSEMBLY, AZIMUTH	2
19		130615-101	MOTOR/GEARBOX ASSEMBLY, ELEVATION	2
20		43894-1	SERVO DRIVE, 60A	2
21		140102-101	PCB ASSEMBLY, VME SERVO INT	2
22		140101-101	PCB ASSEMBLY, VME SINGLE BOARD	2
23		23843-101	PCB ASSEMBLY, DUAL DRIVE SE	2
24		23843-102	PCB ASSEMBLY, DUAL DRIVE SE	2
25		301102-104	PCB ASSY, VME AUTOTRACK INT	2
26		5012-0001-2	RECEIVER, PCI TRACK, S-BAND	2
27		5012-0001-3	RECEIVER, PCI TRACK, 720 MHZ	2
28		119802-105	DATA PACK ASSEMBLY, ELEVATION	2

29		119802-106	DATA PACK ASSEMBLY, AZIMUTH	2
30		7901620000	RELAY, DINRAIL	2
31		A1210	RELAY, SOLID STATE	2
32		CE15KN3AB	CONTACTOR	2
33		CWA2410	RELAY, SOLID-STATE	4
34		CWD2410	RELAY, SOLID STATE, 10A	2
35		HFW1196S01	RELAY, FLANGE MOUNT	2
36		MS39016/6-105L	RELAY	2
37		S203-K32	CIRCUIT BREAKER, 32A, THREE PO	2
38		IEG-6-1-62-10.0-01	CIRCUIT BREAKER, 10A (PHILLIPS)	6
39		42622-15-2-3	CIRCUIT BREAKER, 3-PH, 15.0 A, 3	2
40		42622-25-2-3	CIRCUIT BREAKER, 3-PH, 25 A, 38	2
41		S201-K2	CIRCUIT BREAKER, 1-POLE, 2A (A	2
42		IEG-6-1-62-5.0-01	CIRCUIT BREAKER, 5A (AIRPAX)	2
43		S201-K4	CIRCUIT BREAKER, 4A (ABB)	2
44		IEG-6-1-62-7.5 -01	CIRCUIT BREAKER, 7.5A (AIRPAX)	2
45		IEG-6-1-62-15.0-01	CIRCUIT BREAKER, 15A (PHILLIPS	2
46		44093-2	SYNTHESIZER, FREQUENCY, X-BAND	2
47		133196-102	MICROCONTROLLER ASSEMBLY	2
48		136245-105	MODULE ASSEMBLY, DOWN CONVERTER	2
49		136246-104	MODULE ASSEMBLY, UP CONVERTER	2
50		2866488	POWER SUPPLY, 12V/15V, 12A/10A	2
51		2902646	POWER SUPPLY, 5V, 10A	2
52		PS350CW-HS-J3	POWER SUPPLY, COMPUTER	2
53		MAP55-1024C	POWER SUPPLY, 24V	3
54		MAP55-4003C	POWER SUPPLY, +/-15/5 VDC	2
55		191XL-120-240R	LIGHT, WARNING	2
56		137549-101	SENSOR ASSEMBLY, TEMPERATURE	4
57		D-AH8001B	HEATER, 120V, 50/60HZ	2
58		J3A65-11752	HEATER, 120V, 300W, 1/2 DIA, W/CAP	10
59		3575K42B	HEATER, 120V, 725W	5

61		137500-101	MAINTENANCE KIT, AIR DRYER	2
62		MCD2711	SWITCH, ACTUATOR	2
63		MS16106-1	SWITCH, DOOR INTERLOCK	2
64		MS25008-1	SWITCH, DPDT	2
65		1SX48-T	SWITCH, HANDCRACK INTERLOCK	2
66		MS24659-23D	SWITCH, LEVER LOCK	2
67		L3-Datron 44094-1	Dehydrator	2
73	SED P/N 130871-2	Altech PS-7524	POWER SUPPLY, INDUSTRIAL, 75 WATT	1
80	SED P/N 123819-4	Radiall R577443047	SWITCH-MICROWAVE,DC-18GHz	2
81	SED P/N 124283-3	Miteq OCCR-103000-1	RECEIVER MODULE, FIBER OPTIC	2
82	SED P/N 124283-5	Miteq OCCT-103000-1	TRANSMITTER MODULE, FIBER OPTIC	2
83	SED P/N 124283-7	Miteq PS-OCC-2	POWER SUPPLY, CARD CAGE, FIBER OPTIC	2
85	SED P/N 130869-1	EM Research ESP-8200-02	SYNTHESIZER, FREQUENCY, 8200MHz	2
86	SED P/N 130869-2	EM Research ESP-2250-03	SYNTHESIZER, FREQUENCY, 2250MHz	2
87	SED P/N 130871-1	Altech PS-3015	POWER SUPPLY, INDUSTRIAL, 30 WATT	2
90	SED P/N 124947-14	Fiber Connections PC2LUFZP-1-0	FIBER OPTIC PATCH CORD, LC to FC	1
91	SED P/N 124947-15	Fiber Connections PC2SUFZA-1-0	FIBER OPTIC PATCH CORD, ST to FC	1
92	SED P/N 131182-1	Moxa SFP-1GLXLC	FIBER OPTIC MODULE, SFP, LC TYPE	1
93	SED P/N 128719-2	Transistion Networks TN-GLC-LH-SM	FIBER OPTIC MODULE, SFP, LC TYPE	1
94	SED P/N 128947-18	Luxlink DR-7201-7	1PPS RX MODULE	1
95	SED P/N 128947-5	Liteway ALM-1000	1PPS ALARM MODULE	1
96	SED P/N 128947-16	Liteway PS-1210US	1PPS POWER SUPPLY MODULE	1
97	SED P/N 128947-17	Luxlink DT-7201-7	1PPS TX MODULE	1
98	SED P/N 127305-20	EBM 4412/2H	HDR CHASSIS FAN	1
99		Seagate ST1000NM0033	HDR Spare disk drive	1
100		Concurrent Technology PMC/RS1-50U	Four Asynchronous Serial Channel PMC Adapter	4
101		44221-1	Thermal Overload Relay	2
102		7717-175-DAP	Relay Mounting Pad	2
103		AD590KH	Temperature Sensor	2
104		M1100080144	Thermostat, 100 DEG F - 80 DEG F (KLIXON)	2
105		M1170160144	Thermostat, 170 DEG F - 160 DEG F (KLIXON)	2

106		M221L055040542	Thermostat, 55 DEG F (TI-KLIXON)	3
107		M24236/1-0295	Thermostat, OPEN @ 140 DEG INCR (KLIXON)	2
108		M24236/1-0450	SWITCH, THERMAL, 95 DEG F	2
109		M24236/1-0455	SWITCH THERMAL	2

NOTE: All parts items indicated in the above listing are for all three stations (PASS, GSS, ICAN) but are physically located at PASS.

APPENDIX C – CONSOLIDATED ELECTRONIC TEST EQUIPMENT AND TOOLS (FOR PASS, GSS & ICAN)

APPENDIX C-1: ELECTRONIC TEST EQUIPMENT

	Equipment/Sub-Systems	Manufacturer/Model	Qty	Maintenance Exceptions	
	Oscilloscope	Agilent/ DS09254A/ 4 Channel 2.5 GHz/ Accessories Included	2	Nil	
	High Impedance Probe	Agilent/ N2751A	4	Nil	
	Signal Analyzer	Agilent/ N9010A/	2	Nil	
	RMS Clamp Meter	Agilent/ U12313A	2	Nil	
	Data Acquisition/ Switch Unit	Agilent/ 34972A	2	Nil	
	20 Channel Multiplexer	Agilent/ 34901A	2	Nil	
	Power meter	Rhode & Schwarz/ NRP2	2	Nil	
	Power Sensor	Rhode & Schwarz/ NRPZ21	1	Nil	
	Signal Generator	Rhode & Schwarz/ SMB100A	2	Nil	

APPENDIX C-2: TOOLS

Specialized Tools					
	X-band Feed Alignment Fixture	DATRON			

NOTE: All Test Equipment and Tools items indicated in the above listing are for all three stations (PASS, GSS, ICAN) but are physically located at PASS.

Attachment 6 to Annex "C"

AD-4

GSS Facility Description

Canada Centre for Earth Observation
Canada Centre for Mapping and Earth Observation
Natural Resources Canada (NRCan)

Author:

Doc. Owner:

Doc. No.: EODS-REF-004

Version: 0

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Status: Final

Date: December 23, 2014

Notice

REVIEWS AND APPROVALS

Reviewed and Recommended by:

_____ _____

_____ _____

Approved by:

_____ _____

TABLE OF CONTENTS

1 OBJECTIVE

The objective of this document is to provide a high level description of the Gatineau Satellite Station facility and site.

2 REFERENCE DOCUMENTS

AD-2	EODS-REF-002	GSS Earth Observation Ground Station Description

3 LOCATION

The Gatineau Satellite Station is situated in the Gatineau Hills in the Municipality of Cantley, Quebec. By road, it is approximately twenty-eight (28) km from the City of Ottawa, and two (2) km west of highway 307.

4 SITE

The site is comprised of sixteen (16) hectares of land on a 278 meter hill. The facility is situated in an open area on top of the hill surrounded by trees indigenous to the area. Site access is via McClelland road and there is no security gate or guard house to restrict access. There is no fence surrounding the facility.

4.1 Roadway

The site is a 2.5 km drive from highway 307 via municipal roads St. Andrews and McClelland that are 5.8 metres in width. These earth and gravel roads are maintained by the Municipality.

4.2 Water Tank and Wells

There are no functional wells on the site and there in no piped in water from the Municipality. There is a 5 500 gallon underground water tank for potable water. It is the responsibility of NRCan to ensure water is supplied by a water hauler approximately every two weeks.

4.3 Septic

The facility has an independent sewage system that consists of a septic holding tank with two weeping septic fields.

4.4 Building site

The complex consists of two 60' x 100' single-storey buildings joined by a link hallway, two (2) small storage garages and a diesel generator building.

There is one 13-metre satellite receiving antenna on the site.

The site is equipped with its own water supply, septic system, diesel generator for back-up electrical power, and fire protection systems. The buildings are equipped to provide environmentally controlled work areas, office space, an eating area and a maintenance area.

The Data Processing Facility (second building) is shared with a tenant.

The Crown provides building maintenance and primary services. A free parking lot is provided adjacent to the buildings.

The building site utilizes electrical power from Quebec Hydro.

4.4.1 Lawn Area

The landscaped area of the building site consists of approximately 2.4 Hectares of grass.

4.4.2 Storage Building

This is a metal-clad building that is unheated and used for cold storage purposes. Electrical service is provided to the building for lighting purposes only.

4.4.3 Garage

A small garage next to the storage building is used to store site maintenance equipment.

4.4.4 Diesel Building

A 600kVA diesel generator in an enclosure near the loading dock provides full back-up electrical power to the facility. Next to the diesel building is a 15 000 litre diesel fuel tank. It is the responsibility of NRCan to ensure diesel is supplied as required.

4.4.5 Parking lot

A 1000 square meter, 19-vehicle gravel parking lot exists for parking. There are 16 electrified stalls suitable for winter use to plug in vehicle block heaters.

4.4.6 External Lighting

The parking lot, sidewalk, the operations building and the two antenna towers are lit with a combination of dusk-to-dawn halogen pole lights and flood lamps.

4.4.7 13 Metre Antenna Tower

One L3-Datron 13-metre antenna tower provides tracking and data collection from earth observation spacecraft. The 13-metre antenna is equipped with Telemetry, Tracking and Command equipment. The antenna is accessible via gravel roadways. A security fence surrounds the tower. The tower is cabled for electricity and control via underground cabling.

4.4.8 Refuse and Recycling

One (1) five cubic metre containers are provided behind the DRF building for garbage. Four containers are provided for paper recyclable materials. The contractor is responsible to ensure the removal of garbage and paper put in these containers. There are two municipal recycling containers for plastics. These containers are picked up from the parking lot by the municipality every other Friday.

4.4.9 Operations Buildings

There are two (2) operations building joined by a link hallway. The first building, having the main entrance, is the Data Reception Facility (DRF) building. This building is a metal clad, single story structure of approximately 600 square metres on a concrete slab. Major rooms in the operation building include kitchen, wash rooms, shower room, reception area, offices, shipment dock, workshop area, storage room, and building mechanical rooms.

The second building is the Data Processing Facility (DPF). It has the same footprint as the first building but it has a basement under one third of the building. The total area is approximately 700 square meters. This building is approximately 50% occupied by a third party consisting of not more than 20 people.

4.4.9.1 HVAC

The two buildings are heated and cooled using two glycol closed loop ground source heat pumps. The heat pumps do all areas except the computer rooms. The computer rooms are heated and cooled by four Liebert Air Handling Units - two in each building.

4.4.9.2 Diesel Generator

At the Gatineau Station, a 600kVA diesel generator with a 15,000 litre fuel tank provides backup power for the station and antennas when the primary power source, Quebec Hydro, fails. The diesel will start and be up typically to full power in less than 10 seconds. A switch is available in the front lobby of DRF to keep the buildings powered by the generator even if the Quebec Hydro is available.

4.4.9.3 Fire Protection System

The computer rooms are protected by FM-200 Fire Suppression Systems. The non-computer rooms have smoke and heat detectors. All systems are connected to a monitoring company.

Portable fire extinguishers are located throughout the building.

4.4.9.4 Electrical

The Quebec Hydro provides electrical power to the facility building. For periods when the electrical utility is unavailable, the computer rooms in facility are protected by a 130kVA Uninterruptible Power Systems (UPS) located in the basement of the DPF. In addition, there is a 600KVA diesel backup electrical power generator which automatically starts and transfers load from utility to generator during utility power outages. The backup generator provides power to the entire facility.

Wall-mounted, battery-operated emergency lighting is provided in all areas of the building.

4.4.9.5 Furniture

A compliment of discrete and open office work areas and furniture are available in various locations throughout the building.

4.4.9.6 Electronics Room

The DRF computer room houses the majority of the electronic equipment for performing the data reception.

Raised tile flooring is utilized to provide air conditioning to the room – cooled air is forced into the space beneath the raised tile floor and venting tiles and keeps the room cool. The temperature and humidity of the room is monitored and climate controlled. The approximate raised tile floor area is 140 square meters.

4.4.9.7 Electronics Workshop

The electronics workshop is equipped with benches, tables, cabinet storage, shelving for books and manuals.

4.4.9.8 Archive Room

The archive room is located in the second building. Raised tile flooring is utilized to provide air conditioning to the room – cooled air is forced into the space beneath the raised tile floor and venting tiles and keeps the room cool. The temperature and humidity of the room is monitored and climate controlled. The approximate raised tile floor area is 310 square meters.

4.4.9.9 Kitchen

Available in the first building is a kitchen which is furnished with a refrigerator, microwave oven, sink, and table surface.

4.4.9.10 First Aid

The DRF operation building contains a fully-stocked first aid station.

4.4.9.11 Lockers

There are five lockers in each washroom in the first building.

4.4.9.12 Restrooms

The facility is equipped with four restrooms, two in each building.

4.4.9.13 Conference Room

There is a conference room in the second building.

Attachment 7 to Annex "C"

AD-5

PASS Facility Description

Canada Centre for Earth Observation
Canada Centre for Mapping and Earth Observation
Natural Resources Canada (NRCan)

Author:

Doc. Owner:

Doc. No.: EODS-REF-005

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Table of Contents

1 OBJECTIVE

The objective of this document is to provide a high level description of the Prince Albert Satellite Station facility and site.

2 REFERENCE DOCUMENTS

AD-3	EODS-REF-003	PASS Earth Observation Ground Station Description

3 LOCATION

The Prince Albert Satellite Station is situated in a rural setting approximately 13 km west of the City of Prince Albert, Saskatchewan adjacent to highway #3.

4 SITE

The site is comprised of 410 Hectares of forested land within a fully enclosed, fenced compound. The facility is situated in an open area on a hill, and is surrounded by pine trees indigenous to the area. The site is accessed through a main gate, which remains open during normal office hours, via private roadway from the main highway.

4.1 Fence

The site is enclosed by fence along the outer perimeter of the 410 Hectare area. Bounding each side of the fence is a natural sand fire breaks 10 metres wide. Total fence length is 8000 metres.

4.2 Roadway

The facility building site is situated approximately 1.3 km off the provincial highway, and the access road into the site has an all-weather paved surface. Existing on each side of the roadway is a natural sand fire breaks 10 metres wide. Total paved roadway consists of 2.1 km at 6.2 metres in width.

4.3 Guard House

An unoccupied guardhouse is located adjacent to the lockable gate where the roadway meets the perimeter fence.

4.4 Well

Water for domestic use is supplied by two domestic private wells located on the property within the fenced compound. A 400 metre trail through the trees provides access to the wells.

4.5 Septic

The facility has an independent sewage system that consists of a septic holding tank with a weeping septic field.

4.6 Building Site

The building site consists of many structures, the primary one being the main operations building. A metal-clad building is used for cold storage. The water pump building contains domestic water supply equipment, and the hose storage building houses the emergency fire hoses and cart. Parking is provided on a paved and electrically serviced parking lot. There are two 13-metre satellite antennas.

While the building site utilizes electrical power and natural gas from the provincial utility companies, it is otherwise self-equipped with its own water supply (private well), sewage system, diesel generator for back-up electrical power in the computer room, and electric powered fire protection system with diesel generator back-up.

4.6.1 Lawn Area

The landscaped area of the building site consists of approximately 2.5 Hectares of groomed lawn, with a small number of pine trees and decorative shrubs throughout.

4.6.2 Cold Storage Building

This building is a metal-clad building that is unheated and used for cold storage purposes. Electrical service is provided to the building for lighting purposes only.

4.6.3 Hose Storage Building

The hose storage building is an unheated, non-electrified building approximately 9 square metres. The building stores the emergency fire fighting hoses and hose cart that may be utilized with the available outdoor fire hydrants. The water supply for the fire hydrants is the fire fighting water reservoir.

4.6.4 Water Pump Building

The water pump building is a 9 square metre heated building housing the domestic water pump, electrical fire pump, and a diesel fire pump. The building resides on a small hill on top of a 38,600 litre domestic water cistern and a 386,400 litre fire fighting water reservoir.

4.6.5 Parking Lot

A 1700 square metre, 36-vehicle paved parking lot exists for parking. There are 20 electrified stalls suitable for winter use to plug in vehicle block heaters.

4.6.6 External Lighting

The parking lot, sidewalks, operations building, and the two antenna towers are lit with a combination of dusk-to-dawn halogen pole lights and flood lamps.

4.6.7 13-Metre Antenna Towers

Two L3-Datron 13-metre antenna towers provide tracking and data collection from earth observation spacecraft. One of the 13-metre antennas is equipped with Telemetry, Tracking and Command equipment. One antenna is accessible via paved roadway, approximately 60 meters in length, and the second utilizes a sand and grass trail approximately 300 meters in length for access. Each tower is cabled for electricity and control via underground cabling.

4.6.8 Refuse and Recycling

Two four cubic metre containers are provided adjacent to the main operations building. One container is provided for paper recyclable materials, and one container for garbage and refuse. The contractor is responsible to ensure the removal of garbage and paper put in these containers.

4.6.9 Pressure Vessels

The main operations building retains three natural gas fired boilers manufactured by Slant/Fin limited, ‘Galaxy’ gas fired cast iron boiler, model number GG300HS, to provide heat to the building. The boilers are located in the HVAC mechanical room.

The main operation building is equipped with a Develbiss, model TANV-5042 air compressor with a 250 litre air reservoir located in the mechanical workshop.

4.6.10 Fuel Tanks

Tank #1
A 1297 litre steel, double-walled diesel fuel tank, installed in 2006, resides on a concrete pad adjacent to the water pump building, and is used to supply fuel to the backup fire pump engine.

Tank #2

A 738 litre, steel, double-walled, diesel fuel tank, installed in 1995, exists as part of the Cummins 105kVA electrical backup generator located in the main electrical service room in the main operations building.

4.6.11 Main Operations Building

The main operation building is a metal clad, single story structure of approximately 1900 square metres on a concrete slab suspended over a five foot sand-base crawl space. Major rooms in the operations building include: electronics room, archive room, electronics repair room, kitchen, conference room, reception area, offices, garage, machine shop, shipment dock, storage rooms, and building mechanical rooms.

4.6.11.1 HVAC

The entire building is heated and cooled using a glycol/water loop, 17 heat pump units located in the crawl space, three natural gas boilers, and an EVAPCO evaporator cooler unit that expels excess heat from the glycol loop. This heating and cooling configuration allows heat removed from the computers and equipment in the electronics room to be used to heat other areas of the building.

4.6.11.2 Fire Protection Systems

The entire main operations building is equipped with automatic fire sprinklers. Fire sprinklers in the electronics room, the archive room, and the utility power room are dry head sprinklers with pre-action systems which only become wet when a fire has been detected by smoke detectors.

Portable fire extinguishers are located throughout the building.

The electronics room and the archive room are also equipped with an FM200 fire suppression system.

4.6.11.3 Electrical

The provincial electrical utility provides power to the main operation building. For periods when the electrical utility is unavailable, the entire computer room is protected by an 80 KVA Uninterruptible Power System. In addition, there is a 150 KVA diesel backup electrical power generator which automatically starts and transfers load from utility to generator during utility power outages. The backup generator provides power to the antenna towers, the UPS, and to building essential functions including domestic water pumps, standalone HVAC unit for the electronics room, and some lighting fixtures.

Wall-mounted, battery-operated emergency lighting is provided in all areas of the building.

4.6.11.4 Office Space

A compliment of discrete and open office work areas and furniture are available in various locations throughout the building.

4.6.11.5 Electronics Room

The Electronics Room houses the majority of the electronic equipment for performing the data reception, the archiving, cataloguing and production, a UPS, and a stand-alone backup HVAC unit.

Raised tile flooring is utilized to provide air conditioning to the room – cooled air is forced into the space beneath the raised tile floor and venting tiles and keeps the room cool. The temperature and humidity of the room is monitored and climate controlled. The approximate raised tile floor area is 360 square meters.

4.6.11.6 Electronics Workshop

The electronics workshop is equipped with benches, tables, cabinet storage, and shelving for books and manuals.

4.6.11.7 Kitchen

The kitchen is furnished with a refrigerator, microwave oven, range, sink, coffee maker and table surfaces.

4.6.11.8 First Aid

The main operations building contains a fully-stocked first aid station. Additionally, regulation first aid kits are available away from the first aid station at each antenna tower, in the cold storage building, and in the water pump building.

4.6.11.9 Locker Rooms

Two locker rooms exist with a combined total of 13 personal 6-foot metal lockers. The primary locker room includes a separate washroom and walk-in shower.

4.6.11.10 Restrooms

The main operation building is equipped with five restrooms.

4.6.11.11 Conference Room

The conference room is equipped with conference table, chairs, whiteboard, and an overhead projection system.

4.6.11.12 Mechanical Workshop

The mechanical shop is equipped with band saw, grinder, welder, metal brake, metal bender, air compressor, and lathe.

Attachment 8 to Annex "C"

AD-6

Inuvik Satellite Station Facility Description

Canada Centre for Earth Observation
Canada Centre for Mapping and Earth Observation
Natural Resources Canada (NRCan)

Author: A. Reynolds

Doc. No.: EODS-REF-006

Version: 0

Revision: 7

Status: Final

Date: 30 December 2014

Table of Contents

List of Diagrams

Acronyms and Abbreviations

AMSL	Above Mean Sea Level
CCMEO	Canadian Centre for Mapping and Earth Observation of NRCan
EC	Environment Canada
EODS	Earth Observation Data Services
GOC	Government of Canada
HVAC	Heating, Ventilation, and Air Conditioning
ICAN	ISSF Canadian station
ICAN1	ICAN Antenna #1
IRC	In-Row Chiller
ISSF	Inuvik Satellite Station Facility
NRCan	Natural Resources Canada
NT	Northwest Territories
UAS	Upper Air Station
UPS	Uninterruptible Power System

1 OBJECTIVE

The objective of this document is to provide a high level description of the Inuvik Satellite Station Facility (ISSF) and site.

2 REFERENCE DOCUMENTS

AD-1	EODS-REF-001	Inuvik Canadian Earth Observation Ground Station Description (ICAN)

3 LOCATION

The Inuvik Satellite Station Facility is situated in a rural setting between the Town of Inuvik, NT, and the Inuvik Airport (Mike Zubko Airport).

3.1 General

The ISSF consists of three adjacent areas generally referred to as Phases 1, 2, and 3. All are within the limits of the Town of Inuvik.

All of the land in Phases 1, 2, and 3 is owned by the Government of Canada (GOC). Some land in Phase 1 has been leased to other (non-GOC) parties for specific uses. It is expected that land in Phases 2 and 3 could also be leased to other parties.

None of the facilities in the ISSF are manned for normal operations. There are people on site for routine maintenance work, repair work, and for installation and test work.

Figure 3-1 below is an overview of the land included in Phases 1, 2, and 3 as well as the surrounding area.. The circle on Figure 3-1 represents the 4 km zone around the airport where height restrictions apply.

Figure 3-2 below provides a more detailed view of Phases 1 and 2 of the ISSF.

Access to the site is from the Dempster Highway through the Environment Canada “Upper Air Station” (UAS). The UAS is a weather station and launches weather balloons twice daily.

Because of the proximity of the site to the airport Industry Canada and Transport Canada must be informed of and agree to any activities which would require any structure, including temporary structures (e.g. cranes), to exceed a height of 105 m above mean sea level (AMSL).

3.2 Phase 1

Access to the Phase 1 area is through the Environment Canada (EC) Upper Air Station (UAS).

Phase 1 comprises approximately 4.5 ha roughly aligned with a ridge running from the Environment Canada UAS west towards the Town of Inuvik. The land falls off sharply to the south of this ridge. The land falls off slightly to a wet area north of the ridge.

Phase 1 was the first plot of land in the ISSF to be developed. Phase 1 comprises 4.5 ha and currently houses two operational 13 m remote sensing antenna systems plus an operations building, and a diesel generator building.

The facilities in the Phase 1 area are described only to provide a complete picture of the ISSF. The operations of any facilities on the Phase 1 land are not the subject of this document.

Access to the Phase 2 area is through the Phase 1 area.

3.3 Phase 2

Phase 2 comprises 18.7 ha immediately to the west of the Phase 1 land. Access to Phase 2 is via road from the UAS through Phase 1. Phase 2 topography consists of a ridge running from the west of the Phase 1 area further to the west along the north boundary of this area. The land falls off sharply to the south of this ridge.

Figure 3-2 shows the NRCan antenna, operations shed, and diesel generator shed. The NRCan antenna (ICAN1) is a 13 m L3 Datron antenna similar to the existing antennas at the site with an added riser extension. The riser extension results in an antenna dish approximately 3 meters higher than that of the existing antennas.

3.4 Phase 3

Phase 3 comprises 578 ha extending north and east of Phases 1 and 2. This land is in general higher than the land in Phases 1 and 2 with room for 15 or more large antenna systems and numerous other facilities.

Phase 3 is not the subject of this document.

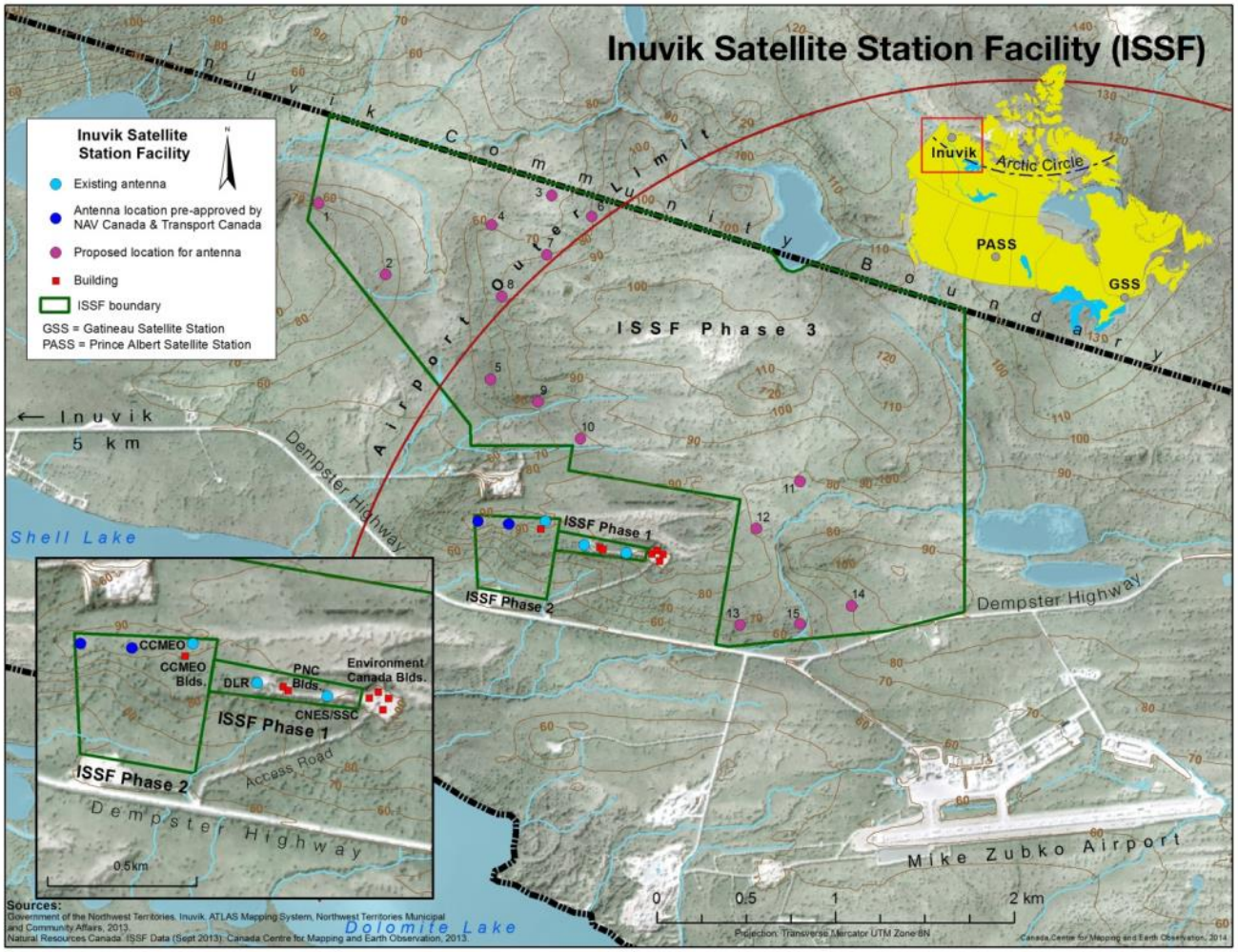

Figure 3-1 : General Layout, ISSF and Surrounding Area

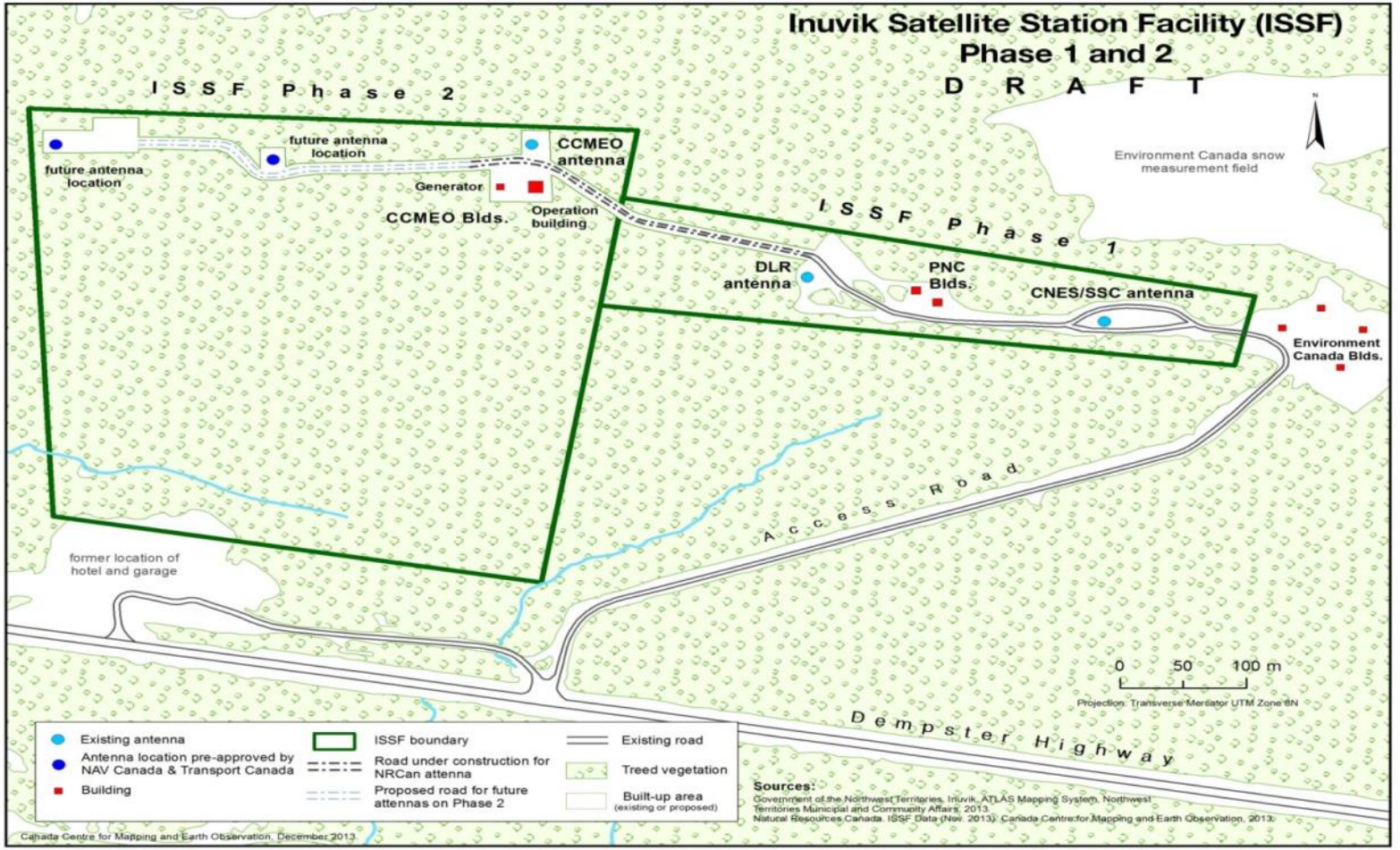

Figure 3-2 : Detailed Layout, ISSF Phases 1 and 2

4 SITE INFORMATION – PHASE 2

4.1 Fence

The site is, in general, completely open so that residents in the area can exercise their traditional access rights. The individual antennas and the sheds are fenced off for safety reasons.

4.2 Roadway

Access to the site from the Dempster highway is a gravel road.

- There is 700 m (approximate) of gravel road from the Dempster to the EC UAS.
- There is 400 m (approximate) of gravel road across Phase 2 providing access to the sheds and antennas on the Phase 2 land and to the Phase 3 land.
- There is 250 m (approximate) of gravel road and gravel pad in Phase 3 providing access to the ICAN sheds and antennas.

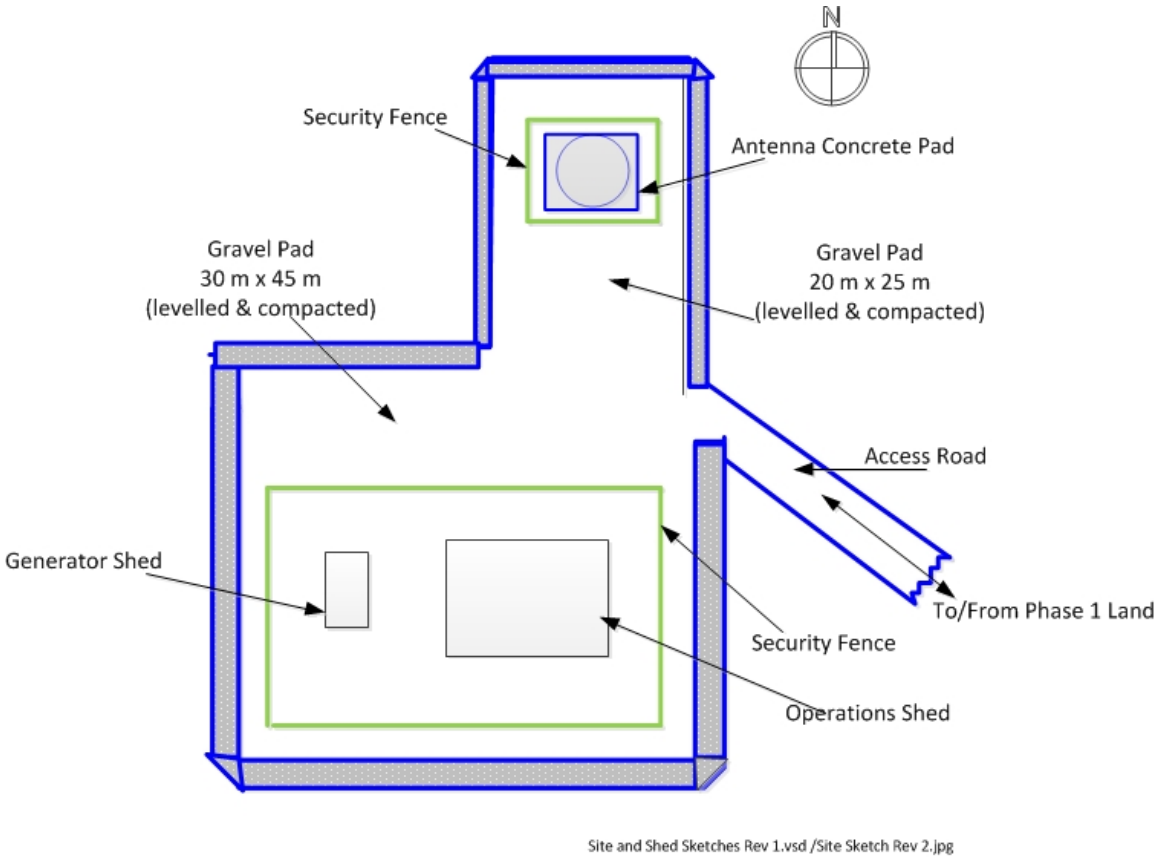

Figure 4-1: Sketch of ICAN Site

4.3 Building Site

4.3.1 General Description

The Phase 2 building site currently consists of one 13 m remote sensing antenna system (ICAN1), an operations shed and a diesel generator shed, all located on a level and well drained gravel pad.

Approximate dimensions are as follows:

- Operations shed: 14 m x 9 m plus 3 m for a ramp on the long side and 3.5 m for a chiller deck on the short side located in a 46 x 32 m gravel pad
- Diesel generator shed: 3.7 x 7.5 m sharing the 46 x 32 m gravel pad with the operations shed
- Antenna on a concrete foundation installed in a 20 x 25 m gravel pad
- The two gravel pads are adjacent and joined together.

The sheds uses commercial electrical power and is served by a telco fiber optic link for telecommunications. Power and telecommunications to the site are underground.

The telco fiber optic link is the primary data link for the site.

4.3.2 Operations Shed

The main operation shed is a metal clad, single story structure installed1.5 m above the ground on pilings. There is an equipment room, a power room, a kitchenette, an operations room, a toilet/pump room, an entrance vestibule and a closet for storage.

The second entrance, which opens directly into the equipment room, is equipped with a ramp.

All cabling and services enter the shed from beneath.

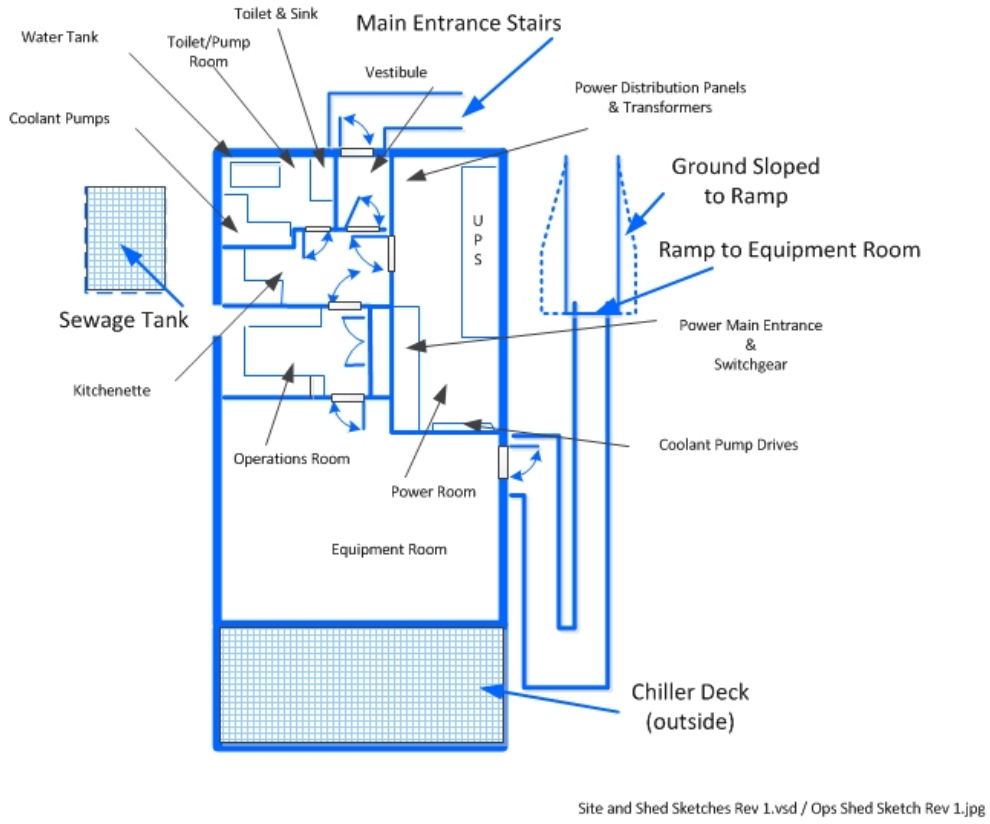

Figure 4-2: Sketch of Floor Plan for Operations Shed

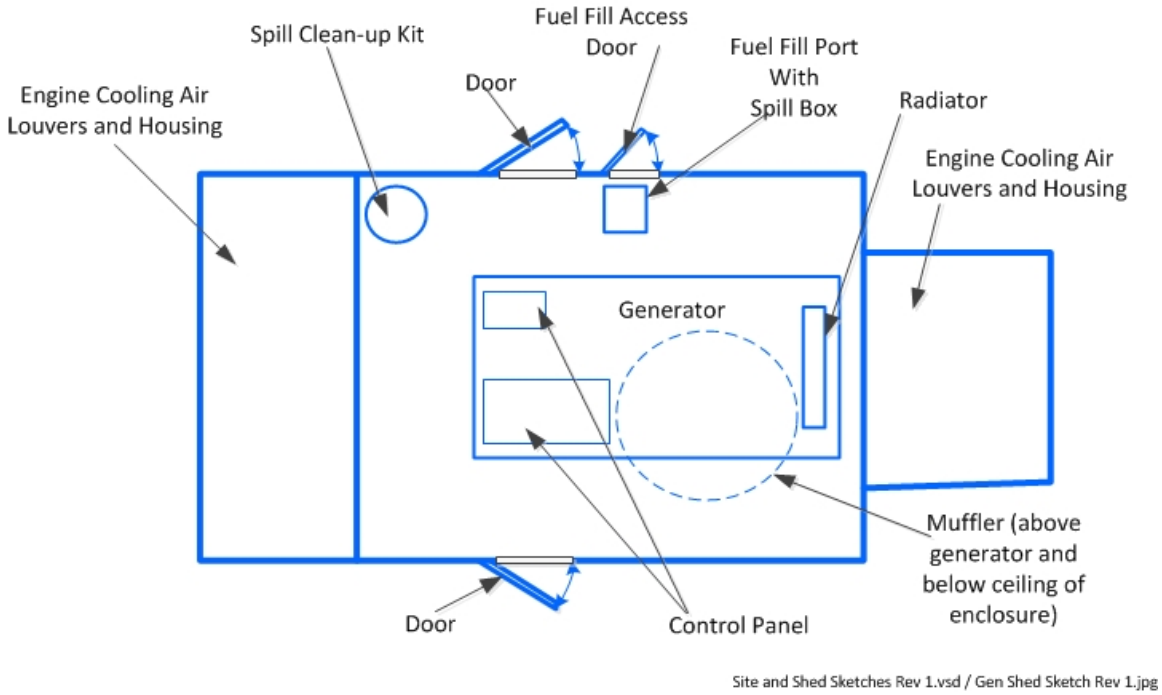

Figure 4-3: Sketch of Floor Plan of Generator Shed

4.3.3 Heating, Ventilation, and Air Conditioning (HVAC)

The shed is heated and cooled using a glycol/water loop. Chillers, installed on the chiller deck on the east side of the shed will use the natural cold of the environment for cooling ("free air" cooling) much of the year. The same chillers contain conventional air conditioning compressors to provide cooling during warmer months. In row coolers with radiators and fans use the chilled water/glycol solution to cool equipment racks. This system is fully redundant.

Make up air is provided from outside via a separate ducting system. This system is equipped with fans and heaters and is under the control of the building management system.

Conventional electric baseboard heaters are provided for heat. It is expected that these will be needed only during the early life of the station.

4.3.4 Building Management System

The shed HVAC system is controlled by a centralized computer controlled building management system. This system also monitors key parameters of the diesel generators and other selected systems in the station.

4.3.5 Electrical

The provincial electrical utility provides mains power to the facility. For periods when the electrical utility is unavailable, the entire shed and the antenna, including drive motors, is powered by a 500 kW diesel generator. The switch between mains power and diesel backup power is fully automatic.

Critical systems are protected by a 350 kVA Uninterruptible Power System.

4.3.6 Office Space

The site will not be occupied normally. There is a small operations room which will be dedicated to the different computer consoles needed to operate the antenna and related systems.

4.3.7 Equipment Room

The equipment room houses the majority of the electronic equipment for telecommunications, scheduling receptions, TT&C activities and performing data reception, archiving, and cataloguing. The equipment room currently contains five racks and two in-row chillers. The room has a capacity of approximately 28 racks plus eight in-row chillers.

4.3.8 Back-Up Data Link

The operations shed is also equipped with cellular data modems. These use a small roof mounted antenna to provide a low data rate network connection as a back up for the fiber optic data link. This system can provide a data link for schedules, some reports, and TT*C files to keep the system operating if there is a problem with the fiber optic link. However this system does not have enough bandwidth for satellite payload data.

4.3.9 Workspace

Workspace is extremely limited. It is expected that extra room in the equipment room can be used to provide a small amount of storage and for general work so long as dust and dirt are not generated.

4.3.10 Kitchenette

The kitchenette is furnished with a mini-refrigerator, a microwave oven, and a sink. The kitchenette also houses several principal components of the HVAC system.

4.3.11 First Aid

The main operations shed contains a fully-stocked first aid station and an eye wash station. Additionally, first aid kits are available at the antenna tower and in the diesel generator shed.

4.3.12 Restrooms

The main operation shed is equipped with one unisex restroom. This restroom also contains the water tank, hot water heater and some components of the HVAC system including the load loop and chiller loop pumps.

4.4 Water Supply

Non-potable water for cleaning and basic sanitation is stored in an 1100 liter tank located in the toilet/pump room of the station. The water tank is provided with pressure pump and high water and low water alarms monitored by the building management system. Bottled water is provided for drinking.

4.5 Sewage

A partially buried heated sewage storage tank is provided for waste water and sewage. The water tank is provided with high and low level alarms monitored by the building management system.

4.6 Security

Physical security is provided by an alarm system, based on motion detectors, connected locally and to NRCan security. Four interior cameras and five exterior cameras, two with pan and zoom capability, are monitored in Inuvik, locally, remotely, and by NRCan security for additional protection.

The site is equipped with smoke and temperature detectors and automatically activated dry chemical extinguishers for fire protection. Standard stand-alone dry chemical fire extinguishers are also provided. The fire alarm system is monitored by the fire department of the Town of Inuvik.

4.6.1 Landscaping

A large gravel pad encompasses the operations shed, generator shed, and antenna.

4.6.2 External Lighting

The area around the sheds and the antenna, and the area between these, are lit by a combination of dusk to dawn LED flood lights mounted on the sheds and on poles.

4.7 13 Meter Antenna Towers

One L3-Datron 13-metre antenna tower equipped with Telemetry, Tracking and Command equipment provides tracking and data collection from earth observation spacecraft. The antenna is accessible across the gravel pad approximately 45 m north of the operations shed.

Power cables, ground cables, control and signal cables between the shed and the antenna are buried.

4.7.1 Fuel Tanks

A 7200 liter steel, double-walled “belly” tank makes up the floor of the diesel shed. This tank, installed in 2014, is equipped with a leak detector, a lockable fill port with spill box, and with high and low level alarms.

ANNEX D

DRAFT EVALUATION CRITERIA

1. Mandatory Technical Criteria

At bid closing time, the Bidder must comply with the following mandatory technical criteria and provide the necessary documentation to support compliance. Any bid which fails to meet the following mandatory technical criteria will be declared non-responsive. Each criterion should be addressed separately.

If required information is addressed in the bid but the documentation demonstrating this information is incomplete, the Contracting Authority may request it thereafter in writing, including after the closing date of the solicitation, and provide the Bidder with a time frame within which to meet the requirement. Failure to comply with the request of the Contracting Authority and meet the requirements within that time period will render the bid non-responsive.

Criterion	Description	Met or Not Met
M1	The bidder must demonstrate at least 3 years of experience within the last 10 years with In-Service Support of satellite reception ground stations.	
M2	The bidder must demonstrate at least 3 years of experience within the last 10 years of delivering projects that include requirements for local economic development and local community engagement.	

2. Point Rated Technical Criteria

2.1 Point Rated Technical Criteria for the In Service Support (ISS) of the NRCan Infrastructure at GSS, PASS and ICAN

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
R1	<u>Bidder's Experience</u> a) The Bidder should describe its experience in satellite ground segment technology in the last 10 years and demonstrate how that experience is relevant to the requirements of the ISS SOW. b) The Bidder should describe its experience in providing In Services Support to satellite ground segment operations, in the last 10 years and demonstrate how that operational experience is relevant to the requirements of		200	150	75%

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
	the ISS SOW. The Bidder should provide details for up to two completed projects, each of at least one year duration, in which the bidder provided satellite ground segment operations.				
R2	<u>Understanding the In Service Support Requirement</u> The Bidder should demonstrate its understanding of the project by discussing the points listed below. The Bidder should specifically demonstrate that it fully understands all elements of the ISS SOW and of the systems to be utilized in meeting the ISS SOW requirements. a) NRCan goals of the project (25 points) b) Functional/technical requirements of the ISS SOW (125 points) c) Risk mitigation: contingency plan in case of failure of equipment under Contractor's responsibility relative to the ISS SOW (50 points) d) Constraints and issues that will shape the end project (50 points) e) Proposed way for delivery of the services (50 points)		300	225	75%
R3	<u>Project Management</u> a) The Bidder should provide a detailed implementation strategy on how it proposes to manage the project. This strategy should show how the Bidder intends to manage the operation and maintenance of the NRCan satellite receiving stations and the interaction with NRCan. b) The Bidder should also describe its start-up project plan, i.e. how it intends to meet its performance requirements		125	93.75	75%

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
	at the start of the contract. c) The Bidder should describe the sub-contracts that it plans to put into place with: NRCan furnished equipment and systems; Vendors and/or Manufacturers; as well as other service providers, in order to meet the ISS SOW requirements. The Bidder should also describe the measures that will be employed to ensure that it will have all the necessary equipment and systems, Vendor/Manufacturer and other service provider subcontracts in place at project start-up and how it will keep these sub-contracts in place over the period of the resulting Contract.				
	Technical Overall Points Score		**625**		**75%**

2.2 Point Rated Technical Criteria for Hosting at the ISSF

For the purpose of this section, the experience of the Bidder and its subcontractors will be considered.

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
R1	The Bidder should describe its experience in hosting a complex, large scale, technology- based site such as a technology park, Earth Observation and/or telecommunications antenna installations, or other. This description should include: a) Objective and output of the described project(s) with details on how it may relate to the present requirement b) Services provided by the Contractor in the described project(s) c) Role and level(s) of responsibility held by the		100	75	75%

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
	Bidder on the project(s) (Primary Contractor, Sub-Contractor, Project Management, capital investment etc.) d) Measure(s) of the Bidder's performance in delivering the project as demonstrated by a letter of reference, recommendation(s) or some other project reporting mechanism.				
R2	**Understanding Expansion of the ISSF** The Bidder should demonstrate its understanding of expansion of the ISSF by discussing the points listed below. a) NRCan goals for the expansion *(Annex A – Statement of Work)* b) The Bidder's vision and/or goals for the expansion c) Governance of the ISSF (Section 4.2 Annex A – Statement of Work) d) Constraints and issues that will shape expansion of the ISSF e) Risk assessment and mitigation		200	160	80%
R3	**Understanding Benefits to Canada** The Bidder should describe how it will address the requirement for an assessment of "Benefits to Canada" of the Project. The Bidder should propose methods of measuring benefits. *(Section 4 Annex A – Statement of Work and Section 3.1 – Attachment 2 – Requirements for Hosting at the ISSF)*		150	120	80%
R4	**Understanding the Local**		150	120	80%

Criterion	Description	Rating Scale	Maximum Points Available	Minimum Points Required	Minimum Pass Score %
	Economic Plan The Bidder should describe proposed strategies, actions, implementations, methodologies for contributing to social and economic development in the Inuvik region and the NWT. In addition, the Bidder should outline specifically an approach to meeting the Inuvik Specific Requirements. *(Section 3.6 (i – vii) – Attachment 1)*. The Bidder should describe anticipated social and economic development.				
R5	**Project Management** The Bidder should provide draft s of the Plans outlined in Attachment 2 – Requirements for Hosting at the ISSF: a) Business Plan (Section 3.3), b) Hosting Plan (Section 3.4), c) ISSF Site Plan (Section 3.5), d) Engagement Plan (Section 3.7).		100	75	75%
R6	**Project Team(s)** The Bidder should provide a high level HR Plan describing the Project Team(s), Project team structure; identifying key positions, roles and responsibilities, qualifications, and relevant and quantifiable experience that will be required to meet the ISSF SOW requirements. *(Section 3 – Attachment 2 – Requirements for Hosting at the ISSF)* The Bidder should state any assumptions on which their plan is based.		100	75	75%
	Technical Overall Points Score		**800**		**75%**