Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Travaux publics et Services gouvernementaux Canada
Place Bonaventure, portail Sud-Est
800, rue de La Gauchetière Ouest
7 ième étage
Montréal
Québec
H5A 1L6
FAX pour soumissions: (514) 496-3822

REQUEST FOR PROPOSAL
DEMANDE DE PROPOSITION

Proposal To: Public Works and Government Services Canada

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

Proposition aux: Travaux Publics et Services Gouvernementaux Canada

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

Comments - Commentaires

Issuing Office - Bureau de distribution

Travaux publics et Services gouvernementaux Canada
Place Bonaventure, portail Sud-Est
800, rue de La Gauchetière Ouest
7 ième étage
Montréal
Québec
H5A 1L6

Title - Sujet
Procurement precision transponders

Solicitation No. - N° de l'invitation	**Date**
9F044-131060/A	2014-08-20

Client Reference No. - N° de référence du client
9F044-13-1060

GETS Reference No. - N° de référence de SEAG
PW-$MTB-770-12863

File No. - N° de dossier	**CCC No./N° CCC - FMS No./N° VME**
MTB-4-37113 (770)	

Solicitation Closes - L'invitation prend fin
at - à 02:00 PM
on - le 2014-10-01

Time Zone
Fuseau horaire
Heure Avancée de l'Est
HAE

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

Address Enquiries to: - Adresser toutes questions à:	**Buyer Id - Id de l'acheteur**
Mathurin , Martine	mtb770

Telephone No. - N° de téléphone	**FAX No. - N° de FAX**
(514) 496-3859 ( )	(514) 496-3822

Destination - of Goods, Services, and Construction:
Destination - des biens, services et construction:
AGENCE SPATIALE CANADIENNE
6767 ROUTE DE L AEROPORT
ST HUBERT
Québec
J3Y8Y9
Canada

Instructions: See Herein

Instructions: Voir aux présentes

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

Delivery Required - Livraison exigée	**Delivery Offered - Livraison proposée**
.	

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

- Please refer to the REQUEST FOR PROPOSALS(RFP) hereto attached. -

REQUEST FOR PROPOSALS (RFP)

TABLE OF CONTENTS

PART 7 - RESULTING CONTRACT CLAUSES

7.1 Statement of Work
7.2 Optional Goods and/or Services
7.3 Standard Clauses and Conditions
7.4 Security Requirement
7.5 Term of Contract
7.6 Authorities
7.7 Proactive Disclosure of Contracts with Former Public Servants
7.8 Payment
7.9 SACC Manual Clauses
7.10 Invoicing Instructions
7.11 Certifications
7.12 Applicable Laws
7.13 Priority of Documents
7.14 Foreign Nationals (Canadian Contractor)
Foreign Nationals (Foreign Contractor)
7.15 Insurance
7.16 Controlled Goods Program
7.17 Progress Reports
7.18 Contract Plan and Report Form
7.19 Disclosure certification
7.20 Disclosure of Intellectual Property
7.21 Directive on Communications with the Media

List of Annexes:

Annex A Statement of Work
Annex B Basis of Payment - Schedule of Milestones
Annex C Security Requirements Check List
Annex D Non-disclosure Agreement
Annex E Contract Plan and Report form
Annex F Disclosure Certification
Annex G Disclosure of Intellectual Property

List of Attachments:

Attachment 1	to Part 2	Mandatory Non-Disclosure Agreement
Attachment 1	to Part 3	Technical and Managerial Bid Preparation Instructions
Attachment 1	to Part 4	Mandatory and Point Rated Evaluation Criteria
Attachment 1	to Part 5	Federal Contractors Program for Employment Equity – Certification

PART 1 - GENERAL INFORMATION

1.1 Introduction

The bid solicitation document is divided into seven parts plus attachments and annexes as follows:

Part 1 General Information: provides a general description of the requirement;

Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation;

Part 3 Bid Preparation Instructions: provides bidders with instructions on how to prepare their bid;

Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, and the basis of selection;

Part 5 Certifications: includes the certifications to be provided;

Part 6 Security, Financial and Other Requirements: includes specific requirements that must be addressed by bidders;

Part 7 Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract; and

The following Annexes:

Annex A Statement of Work
Annex B Basis of Payment Schedule of Milestones
Annex C Security Requirements Check List
Annex D Non-disclosure Agreement
Annex E Contract Plan and Report Form
Annex F Disclosure Certification
Annex G Disclosure of Intellectual Property

The following Attachments:

Attachment 1	to Part 2	Mandatory Non-Disclosure Agreement
Attachment 1	to Part 3	Technical and Managerial Bid Preparation Instructions
Attachment 1	to Part 4	Mandatory and Point Rated Evaluation Criteria
Attachment 1	to Part 5	Federal Contractors Program for Employment Equity – Certification

1.2 Summary

Project title
RCM and Multi-mission Precision Transponder(s)

Description
Public Works and Government Services Canada (PWGSC) on behalf of Canadian Space Agency (CSA) located in St-Hubert, (Quebec), is seeking bids to plan for the design, development,

manufacture, assembly, installation, testing, and support during the commissioning and routine operations phases of the RADARSAT Constellation Mission (RCM) and multimission precision transponder systems, as part of the development of the RCM Ground Segment (GS) development.

In the context of the contract, new precision transponder systems for the following sites are being considered:

- St-Hubert (SHUB), Quebec, Canada
- Option, Ottawa Canada, or another location in Canada. For the moment, now, the Contractor shall assume that the location could be as far away from SHUB as Ottawa, Ontario, Canada. (To be confirmed at contract award)

Period of Contract
From date of Contract award until July 31st 2017.

Intellectual Property
The Intellectual property will vest with the contractor.

Security Requirements
There is a security requirement associated with this requirement. For additional information, consult Part 6 - Security, Financial and Other Requirements, and Part 7 - Resulting Contract Clauses. Bidders should consult the "Security Requirements for PWGSC Bid Solicitations - Instructions for Bidders" (http://www.tpsgc-pwgsc.gc.ca/app-acq/lc-pl/lc-pl-eng.html#a31) document on the Departmental Standard Procurement Documents website.

Integrity provisions for procurement
This requirement is subjected to the Integrity Provisions for Procurement. Bidders must provide a list of names, or other related information as needed, pursuant to section 01 of Standard Instructions 2003 (2014-06-26). Please, also refer to Part 5 – Certifications.

Former Public Servant
For services requirements, Bidders in receipt of a pension or a lump sum payment must provide the required information as detailed in article 3 of Part 2 of the bid solicitation. Please also refer to Part 5 – Certifications and Part 7 – Resulting contract clauses.

Trade agreements
This requirement is not subject to the trade agreements as per the following dispositions:

- Agreement on Internal Trade (AIT):
Chapter 5, Annex 502.1A

- World Trade Organization Agreement on Government Procurement (WTO-AGP):
Appendix I, Annex I

- North American Free Trade Agreement (NAFTA)
Chapter 10, Annex 1001.1a-1

- Canada - Chile Free Trade Agreement (CCFTA)
Annex Kbis-01, 1-1

- Canada - Peru Free Trade Agreement (CPFTA)
Annex 1401.1-1

- Canada-Colombia Free Trade Agreement
Annex 1401-1

Production of and/or access to controlled goods
This procurement is subject to the Controlled Goods Program

Federal Contractors Program for Employment Equity
There is a Federal Contractors Program (FCP) for employment equity requirement associated with this procurement; see Part 5 - Certifications, Part 7 - Resulting Contract Clauses and the attachment named Federal Contractors Program for Employment Equity – Certification.

1.3 Debriefings

After contract award, bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within fifteen (15) working days of receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

1.4 Communications

As a courtesy and in order to coordinate any public announcements pertaining to this contract, the Government of Canada requests that successful Bidders notify the Contracting Authority, 5 days in advance of their intention to make public an announcement related to the recommendation of a contract award, or any information related to the contract. The Government of Canada retains the right to make primary contract announcements.

1.5 Conflict of Interest

The Work described herein and the deliverable items under any resulting Contract specifically exclude the development of any statement of work, evaluation criteria or any document related to a bid solicitation. The Contractor, its subcontractor(s) or any of their agent(s) directly or indirectly involved in the performance of the Work and/or in the production of the deliverables under any resulting Contract will not be precluded from bidding on any potential future bid solicitation related to the production or exploitation of any concept or prototype developed or delivered under any resulting Contract.

PART 2 - BIDDER INSTRUCTIONS

2.1 Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual (https://buyandsell.gc.ca/policy- and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The 2003 (2014-06-26) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

Subsection 5.4 of 2003, Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: sixty (60) days
Insert: two hundred and forty (240) days

2.1.1 Mandatory Non-Disclosure Agreement Requirement

If a Supplier or a subcontractor wishes to review the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD, it must request the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD from the Contracting Authority listed below through e-mail. The document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD contains information that is confidential or proprietary to Canada or third party. The Supplier or any subcontractor must sign a Non-Disclosure Agreement in the form set out in Attachment 1 to Part 2 and return the original duly signed to the Contracting Authority before being provided with a copy of the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD. All Suppliers must return the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD at the end of the RFP period, or upon request from the Contracting Authority within thirty (30) days following that request.

2.2 SACC Manual Clauses

A7035T(2007-05-25), List of Proposed Subcontractors

2.3 Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit by the date, time and place indicated on page 1 of the bid solicitation:

Public Works and Government Services Canada
Quebec Region
Place Bonaventure, South-East Portal
800 de La Gauchetière Street West
7th Floor, Suite 7300
Montreal, Quebec, Canada
H5A 1L6

Due to the nature of the bid solicitation, bids transmitted by facsimile or by electronic mail to PWGSC will not be accepted.

2.4 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts with FPS, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions
For the purposes of this clause, "**former public servant**" is any former member of a department as defined in the Financial Administration Act, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

a. an individual;
b. an individual who has incorporated;
c. a partnership made of former public servants; or
d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"**lump sum payment period**" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"**pension**" means a pension or annual allowance paid under the Public Service Superannuation Act (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the Supplementary Retirement Benefits Act, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the Canadian Forces Superannuation Act, R.S., 1985, c.C-17, the Defence Services Pension Continuation Act, 1970, c.D-3, the Royal Canadian Mounted Police Pension Continuation Act , 1970, c.R-10, and the Royal Canadian Mounted Police Superannuation Act, R.S., 1985, c.R-11, the Members of Parliament Retiring Allowances Act , R.S., 1985, c.M-5, and that portion of pension payable to the Canada Pension Plan Act, R.S., 1985, c.C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? **Yes ( ) No ( )**

If so, the Bidder must provide the following information, for all FPS in receipt of a pension, as applicable:
a. name of former public servant;
b. date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites

as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **Yes ( ) No ( )**

If so, the Bidder must provide the following information:

a. name of former public servant;
b. conditions of the lump sum payment incentive;
c. date of termination of employment;
d. amount of lump sum payment;
e. rate of pay on which lump sum payment is based;
f. period of lump sum payment including start date, end date and number of weeks;
g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is $5,000, including Applicable Taxes.

2.5 Communications - Solicitation Period

All enquiries must be submitted to the Contracting Authority in writing no later than fifteen (15) calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a “proprietary” nature must be clearly marked "proprietary" at each relevant item. Items identified as proprietary will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated and the enquiry can be answered to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

2.6 Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Québec.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the bidders.

2.7 Bidders' Conference

A bidders' conference will be held by way of teleconference or on site, **Thursday, September 17th 2014**. The conference will begin at **9h00 EDT, at the Canadian Space Agency in St-Hubert, Qc, Canada, room number will be provided before the scheduled conference**. The scope of the requirement outlined in the bid solicitation will be reviewed during the conference and questions will be answered. It is recommended that bidders who intend to submit a bid attend or send a representative.

Bidders are requested to communicate with the Contracting Authority before the conference to confirm attendance. **Bidders should provide, in writing, to the Contracting Authority, the names, country of origin and passport number of the person(s) who will be attending** and a list of issues they wish to table at least **ten (10) working days before the scheduled conference**.

Any clarifications or changes to the bid solicitation resulting from the bidders' conference will be included as an amendment to the bid solicitation. Bidders who do not attend will not be precluded from submitting a bid.

2.8. Optional Site Visit

It is recommended that the Bidder or a representative of the Bidder visit the work site. Arrangements have been made for a tour of the work site. The site visit will be held on **Thursday, September 17th 2014, at 11h00 EDT at the Canadian Space Agency in St-Hubert, Qc, Canada**. **Bidders are requested to communicate with the Contracting Authority ten (10) working days before the scheduled visit to confirm attendance and provide the name(s), country of origin and passport number of the person(s) who will attend**. Bidders may be requested to sign an attendance form. Bidders who do not attend or send a representative will not be given an alternative appointment but they will not be precluded from submitting a bid. Any clarifications or changes to the bid solicitation resulting from the site visit will be included as an amendment to the bid solicitation.

PART 3 - BID PREPARATION INSTRUCTIONS

3.1 Bid Preparation Instructions

Canada requests that bidders follow the format instructions described below in the preparation of each bid:

(a) Each bid should contain the following sections:

Section I: Technical and Managerial Bid (1 hard copy and 1 soft copy on CD/DVD)

Section II: Financial Bid (1 hard copy and 1 soft copy on CD/DVD)

Section III: Certifications (1 hard copy)

(b) For the hard copies, each section should be bound separately;

(c) If there is a discrepancy between the wording of the soft copy and the hard copy, the wording of the hard copy will have priority over the wording of the soft copy;

(d) For the soft copy of Section I (Technical and Managerial), all of the information should be contained in one file. The only acceptable formats are: MS Word and PDF;

(e) For the soft copy of Section II (Financial Bid), all of the information should be contained in one file. The only acceptable formats are: MS Word and PDF;

(f) The soft copy of Section II should be submitted on a separate CD/DVD than the soft copy submitted for Section I;

(g) Prices must appear in Section II (financial bid) only. No prices must be indicated in any other section of the bid;

(h) The bid should use a numbering system that corresponds to the bid solicitation.

In April 2006, Canada issued a policy directing federal departments and agencies to take the necessary steps to incorporate environmental considerations into the procurement process Policy on Green Procurement (http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy- eng.html). To assist Canada in reaching its objectives, bidders should:

1) use paper containing fibre certified as originating from a sustainably-managed forest and containing minimum 30% recycled content; and

2) use an environmentally-preferable format including black and white printing instead of colour printing, printing double sided/duplex, using staples or clips instead of cerlox, duotangs or binders

3.2 Section I: Technical and Managerial Bid

In their Technical and Managerial Bid, bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will meet these requirements.

Bidders should demonstrate their capability and describe their approach in a thorough, concise and clear manner for carrying out the Work.

The Technical and Managerial Bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

Part 4, Evaluation Procedures and Basis of Selection contains additional instructions that bidders should consider when preparing their technical Bid.

The structure and content requested for the Technical and Managerial Bid (Section I) are detailed in Attachment 1 to Part 3: Technical and Managerial Bid Preparation Instructions.

3.3 Section II: Financial Bid

3.3.1 Bidders should submit their financial bid in accordance with the following:

(a) A firm, all inclusive lot price for the Work. The total amount of applicable taxes should be shown separately, if applicable.

(b) For Canadian-based bidders, prices should be in Canadian funds, Applicable Taxes excluded and Canadian customs duties and excise taxes included.

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

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

3.3.2 Price Breakdown

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

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

(b) Equipment : Specify each item required to complete the Work and provide the pricing basis of each one, Canadian customs duty and excise taxes included, as applicable.

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

(d) Travel and Living Expenses : Indicate the number of trips and the number of days for each trip, the cost, destination and purpose of each journey, together with the basis of these costs which must not exceed the limits of the Treasury Board (TB) Travel Directive. With respect to the TB Directive, only the meal, private vehicle and incidental allowances specified in Appendices B, C and D of the Directive http://www.njc-cnm.gc.ca/directive/travel-voyage/index-eng.php, and the other provisions of the Directive referring to "travellers", rather than those referring to "employees", are applicable. The Treasury Board Secretariat's Special Travel Authorities, http://www.tbs-sct.gc.ca/pubs_pol/hrpubs/tbm_113/statb-eng.asp, also apply.

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

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

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

3.4 Section III: Certifications

Bidders must submit the certifications required under Part 5.

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

4.1 EVALUATION PROCEDURES

(a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical, management and financial evaluation criteria.

(b) An evaluation team composed of representatives of Canada will evaluate the bids.

4.1.1 Technical and Management Evaluation

4.1.1.1 Mandatory and Point Rated Technical and Management Evaluation Criteria

Mandatory and Point Rated (Technical, Product Assurance and Programmatic) Evaluation Criteria are included in Attachment 1 to Part 4.

4.1.1.2 Bidder Experience

Except where expressly provided otherwise, the experience described in the bid must be the experience of one or more of the following:

1. The Bidder itself (which includes the experience of any companies that formed the Bidder by way of a merger but does not include any experience acquired through a purchase of assets or an assignment of contract); or

2. The Bidder's affiliates (i.e. parent, subsidiary or sister corporations), provided the Bidder identifies and demonstrates the transfer of know-how, the use of toolsets and the use of key personnel from the affiliate for the applicable criterion; or

3. The Bidder's subcontractors, provided the Bidder includes a copy of the teaming agreements and identifies the roles and responsibilities of all parties under the agreement and how their work will be integrated.

The experience of the Bidder's suppliers will not be considered.

4.1.2 Financial Evaluation

4.1.2.1 Evaluation of Price

The price of the bid will be evaluated in Canadian dollars, Applicable Taxes excluded, Canadian customs duties and excise taxes included.

For evaluation purposes only, the price of the bid will be evaluated as detailed in section 4.2.1 below.

4.2 BASIS OF SELECTION

4.2.1 Basis of Selection – Highest Combined Rating of Technical, Product Assurance (PA) and Programmatic Merit and Price

1. To be declared responsive, a bid must:

   (a) comply with all the requirements of the bid solicitation;

   (b) meet all mandatory evaluation criteria; and

   (c) obtain the required minimum of 210 points overall for the point-rated evaluation criteria (i.e. **Technical, PA and Programmatic evaluation criteria)**.

   The rating is performed on a scale of 300 points.

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

3. The selection will be based on the highest responsive combined rating of the point-rated evaluation criteria and price. The ratio will be 60% for the point-rated evaluation criteria and 40% for the price.

4. To establish the Technical, PA and Programmatic Merit score, the overall point-rated evaluation criteria score for each responsive bid will be determined as follows: total number of points obtained / maximum number of points available multiplied by the ratio of 60%.

5. To establish the pricing score, each responsive bid will be prorated against the lowest evaluated price and the ratio of 40%.

6. For each responsive bid, the Technical, PA and Programmatic Merit score and the pricing score will be added to determine its combined rating.

7. Neither the responsive bid obtaining the highest Technical, PA and Programmatic Merit score nor, the one with the lowest evaluated price, will necessarily be accepted. The responsive bid with the highest combined rating of the point-rated evaluation criteria and price will be recommended for award of a contract.

8. In the event that more than one responsive bid obtain the same combined rating of Technical, PA and Programmatic Merit and price, the bid which obtained the highest rating for the Technical, PA and Programmatic Merit will be recommended for award of a contract.

9. In the event that more than one responsive bid obtain the same combined rating of Technical, PA and Programmatic Merit and price, and the same rating for the Technical, PA and Programmatic Merit, the bid which obtains the highest rating for the technical criterion TECH01 will be recommended for award of a contract.

The table below illustrates an example where all three bids are responsive and the selection of the contractor is determined by a 60/40 ratio of technical merit and price, respectively. The total available points equal 135 and the lowest evaluated price is $45,000 (45).

Basis of Selection - Highest Combined Rating Technical Merit (60%) and Price (40%)

	Bidder		
	Bidder 1	**Bidder 2**	**Bidder 3**
Overall Technical Score	115/135	89/135	92/135
Bid Evaluated Price	$55,000.00	$50,000.00	$45,000.00
	Calculations		
Technical Merit Score	115/135 x 60 = 51.11	89/135 x 60 = 39.56	92/135 x 60 = 40.89
Pricing Score	45/55 x 40 = 32.73	45/50 x 40 = 36.00	45/45 x 40 = 40.00
Combined Rating	83.84	75.56	80.89
Overall Rating	**1st**	**3rd**	**2nd**

PART 5 - CERTIFICATIONS

Bidders must provide the required certifications and documentation to be awarded a contract.

The certifications provided by bidders to Canada are subject to verification by Canada at all times. Canada will declare a bid non-responsive, or will declare a contractor in default, if any certification made by the Bidder is found to be untrue, whether made knowingly or unknowingly, during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Contracting Authority may render the bid non-responsive or constitute a default under the Contract.

5.1. Certifications Precedent to Contract Award

5.1.1 Integrity Provisions – Associated Information

By submitting a bid, the Bidder certifies that the Bidder and its Affiliates are in compliance with the provisions as stated in Section 01 Integrity Provisions - Bid of Standard Instructions 2003. The associated information required within the Integrity Provisions will assist Canada in confirming that the certifications are true.

5.1.2 Federal Contractors Program for Employment Equity – Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list (http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml) available from Employment and Social Development Canada (ESDC) - Labour's website.

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the “FCP Limited Eligibility to Bid” list at the time of contract award.

Canada will also have the right to terminate the Contract for default if a Contractor, or any member of the Contractor if the Contractor is a Joint Venture, appears on the “FCP Limited Eligibility to Bid” list during the period of the Contract.

The Bidder must provide the Contracting Authority with a completed Federal Contractors Program for Employment Equity - Certification found at Attachment 1 to Part 5, before contract award. If the Bidder is a Joint Venture, the Bidder must provide the Contracting Authority with a completed Federal Contractors Program for Employment Equity - Certification, for each member.

5.2 Additional Certifications Precedent to Contract Award

The certifications listed below should be completed and submitted with the bid but may be submitted afterwards. If any of these required certifications is not completed and submitted as requested, the Contracting Authority will so inform the Bidder 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 requirement within that time period will render the bid non-responsive.

5.2.1 Status and Availability of Resources

The Bidder certifies that, should it be awarded a contract as a result of the bid solicitation, every individual proposed in its bid will be available to perform the Work as required by Canada's representatives and at the time specified in the bid solicitation or agreed to with Canada's representatives. If for reasons beyond its control, the Bidder is unable to provide the services of an individual named in its bid, the Bidder may propose a substitute with similar qualifications and experience. The Bidder must advise the Contracting Authority of the reason for the substitution and provide the name, qualifications and experience of the proposed replacement. For the purposes of this clause, only the following reasons will be considered as beyond the control of the Bidder: death, sickness, maternity and parental leave, retirement, resignation, dismissal for cause or termination of an agreement for default.

If the Bidder has proposed any individual who is not an employee of the Bidder, the Bidder certifies that it has the permission from that individual to propose his/her services in relation to the Work to be performed and to submit his/her résumé to Canada. The Bidder must, upon request from the Contracting Authority, provide a written confirmation, signed by the individual, of the permission given to the Bidder and of his/her availability. Failure to comply with the request may result in the bid being declared non-responsive.

5.2.2 Education and Experience

The Bidder certifies that all the information provided in the résumés and supporting material submitted with its bid, particularly the information pertaining to education, achievements, experience and work history, has been verified by the Bidder to be true and accurate. Furthermore, the Bidder warrants that every individual proposed by the Bidder for the requirement is capable of performing the Work described in the resulting contract.

5.2.3 Language Capability

The Bidder certifies that it has the language capability required to perform the Work, as stipulated in the Statement of Work.

PART 6 – SECURITY, FINANCIAL AND OTHER REQUIREMENTS

6.1 Security Requirement

1. Before award of a contract, the following conditions must be met:

   (a) the Bidder must hold a valid organization security clearance as indicated in Part 7 - Resulting Contract Clauses;

   (b) the Bidder's proposed individuals requiring access to classified or protected information, assets or sensitive work site(s) must meet the security requirement as indicated in Part 7 - Resulting Contract Clauses;

   (c) the Bidder must provide the name of all individuals who will require access to classified or protected information, assets or sensitive work sites.

2. Bidders are reminded to obtain the required security clearance promptly. Any delay in the award of a contract to allow the successful bidder to obtain the required clearance will be at the entire discretion of the Contracting Authority.

3. For additional information on security requirements, bidders should consult the “Security Requirements for PWGSC Bid Solicitations - Instructions for Bidders” (http://www.tpsgc-pwgsc.gc.ca/app-acq/lc-pl/lc-pl-eng.html#a31) document on the Departmental Standard Procurement Documents website.

6.2 Financial Capability

SACC Manual clause A9033T (2012-07-16), Financial Capability

6.3 Controlled Goods Requirement

SACC Manual clause A9130T (2014-06-26), Controlled Goods Program – Bid

PART 7 - RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

7.1 Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work in Annex A and the Contractor's technical and Managerial Bid entitled _____, dated _____*(will be inserted at contract award)*.

7.2 Optional Goods and/or Services

The Contractor grants to Canada the irrevocable option to acquire the goods, services or both described at Annex A, Statement of Work of the Contract, under the same conditions and at the prices and/or rates stated in the Contract. The option may only be exercised by the Contracting Authority and will be evidenced, for administrative purposes only, through a contract amendment.

The Contracting Authority may exercise the option at any time before the expiry of the Contract by sending a written notice to the Contractor.

7.3. Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual (https://buyandsell.gc.ca/policy-and-guidelines/standard- acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

7.3.1 General Conditions

2040 (2014-06-26), General Conditions - Research & Development, apply to and form part of the Contract.

7.3.2 Supplemental General Conditions

The following supplemental general conditions apply to and form part of the Contract:

4001 (2013-01-28), Hardware Purchase, Lease and Maintenance
4002 (2010-08-16), Software Development or Modification Services
4003 (2010-08-16), Licensed Software

7.3.3 Non-disclosure Agreement

The Contractor must obtain from its employee(s) or subcontractor(s) the completed and signed non-disclosure agreement, attached at Annex D, and provide it to the Contracting Authority before they are given access to information by or on behalf of Canada in connection with the Work.

7.4 Security Requirement

7.4.1 The following security requirement (SRCL and related clauses) applies and form part of the Contract.

1. The Contractor/Offeror must, at all times during the performance of the Contract/Standing Offer, hold a valid Designated Organization Screening (DOS) with approved Document Safeguarding at the level of **PROTECTED A**, issued by the Canadian Industrial Security Directorate, Public Works and Government Services Canada.

2. The Contractor/Offeror personnel requiring access to PROTECTED information, assets or work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC). Until the security screening of the Contractor personnel required by this Contract has been completed satisfactorily by the CISD, PWGSC, the Contractor personnel **MAY NOT HAVE ACCESS** to PROTECTED information or assets, and **MAY NOT ENTER** sites where such information or assets are kept, without an escort.

3. The Contractor MUST NOT utilize its Information Technology systems to electronically process, produce or store PROTECTED information until the CISD/PWGSC has issued written approval. After approval has been granted or approved, these tasks may be performed at the level of **PROTECTED A**.

4. Subcontracts which contain security requirements are NOT to be awarded without the prior written permission of CISD/PWGSC.

5. The Contractor/Offeror must comply with the provisions of the:

   (a) Security Requirements Check List and security guide (if applicable), attached at **Annex C;**
   (b) Industrial Security Manual (Latest Edition)

7.5. Term of Contract

7.5.1 Period of Contract

From date of Contract award until July 31st 2017.

7.5.2 Option to Extend the Contract

The Contractor grants to Canada the irrevocable option to extend the term of the Contract by up to one (1) additional one (1) year period under the same conditions. The Contractor agrees that, during the extended period of the Contract, it will be paid in accordance with the applicable provisions as set out in the Basis of Payment.

Canada may exercise this option at any time by sending a written notice to the Contractor at least fifteen (15) calendar days prior to the Contract expiry date. The option may only be exercised by the Contracting Authority, and will be evidenced for administrative purposes only, through a contract amendment.

7.6 Authorities

7.6.1 Contracting Authority

The Contracting Authority for the Contract is:

Martine Mathurin
Supply Agent
Public Works and Government Services Canada
Quebec Region
7th Floor
Place Bonaventure, South-East Portal
800 de La Gauchetière Street West
Suite 7300
Montreal, Quebec, H5A 1L6

Telephone: 514-496-3859
Facsimile: 514-496-3822
E-mail address: martine.mathurin@tpsgc-pwgsc.gc.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

7.6.2 Technical Authority *(will be inserted at contract award)*

The Technical Authority for the Contract is:

Name : _____
Title : _____
Organization : _____
Address : _____

Telephone: ___ ___ _____
Facsimile: ___ ___ _____
E-mail address: _____

The Technical Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Technical Authority; however, the Technical Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

7.6.3 Contractor's Representative *(will be inserted at contract award)*

The Contractor's Representative for the Contract is:

Name: _____
Title: _____
Organization: _____
Address: _____

Telephone: ___-___-____
Facsimile: ___-___-____
E-mail: _____

7.7 Proactive Disclosure of Contracts with Former Public Servants

SACC Manual Clause A3025C (2013-03-21)

7.8. Payment

7.8.1 Basis of Payment - Firm Price

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price, as specified in the Contract for a cost of $ _____ *(the amount will be inserted at contract award).* Customs duties are included and Applicable taxes are extra, if applicable.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

7.8.2 Method of Payment

7.8.2.1 Milestone Payments

Canada will make milestone payments in accordance with the Schedule of Milestones detailed in Annex B - Basis of Payment and the payment provisions of the Contract if:

(a) an accurate and complete claim for payment using form PWGSC-TPSGC 1111 (http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1111.pdf) and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;

(b) all the certificates appearing on form PWGSC-TPSGC 1111 have been signed by the respective authorized representatives;

(c) all work associated with the milestone and as applicable any deliverable required has been completed and accepted by Canada.

7.8.2.2 Schedule of Milestones

The schedule of milestones for which payments will be made in accordance with the Contract is detailed in Annex B.

7.9 SACC Manual Clauses

SACC Manual Clause A9117C (2007-11-30), T1204 - Direct Request by Customer Department

SACC Manual Clause C2000C (2007-11-30), Taxes - Foreign-based Contractor

7.10 Invoicing Instructions - Progress Claim - Firm Price

1. The Contractor must submit a claim for progress payment using form PWGSC-TPSGC 1111 Claim for Progress Payment (http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1111.pdf).

   Each claim must show:

   (a) all information required on form PWGSC-TPSGC 1111;
   (b) all applicable information detailed under the section entitled “Invoice Submission” of the general conditions;
   (c) the description and value of the milestone claimed as detailed in the Contract.

2. Applicable Taxes must be calculated on the total amount of the claim before the holdback is applied. At the time the holdback is claimed, there will be no Applicable Taxes payable as it was claimed and payable under the previous claims for progress payments.

3. The Contractor must prepare and certify **one (1) original and two (2) copies** of the claim on form PWGSC-TPSGC 1111, forward:

a) the **original and one (1) copy** to the Canadian Space Agency at the address shown on page 1 of the Contract under "Invoices" (Financial Services Section) for appropriate certification by the Project Authority identified herein after inspection and acceptance of the Work takes place;

and,

b) **one (1) copy of the original** progress claim to the Contracting Authority identified under the section entitled “Authorities” of the Contract.

4. The CSA's Financial Services Section will then forward the original and one (1) copy of the claim to the Contracting Authority for certification and onward submission to the Payment Office for the remaining certification and payment action.

5. The Contractor must not submit claims until all work identified in the claim is completed.

7.11 Certifications

7.11.1 Compliance

Compliance with the certifications and related documentation provided by the Contractor in its bid is a condition of the Contract and subject to verification by Canada during the entire contract period. If the Contractor does not comply with any certification, provide the related documentation or if it is determined that any certification made by the Contractor in its bid is untrue, whether made knowingly or unknowingly, Canada has the right, pursuant to the default provision of the Contract, to terminate the Contract for default.

7.11.2 Federal Contractors Program for Employment Equity - Default by the Contractor

The Contractor understands and agrees that, when an Agreement to Implement Employment Equity (AIEE) exists between the Contractor and Employment and Social Development Canada (ESDC)-Labour, the AIEE must remain valid during the entire period of the Contract. If the AIEE becomes invalid, the name of the Contractor will be added to the "FCP Limited Eligibility to Bid" list. The imposition of such a sanction by ESDC will constitute the Contractor in default as per the terms of the Contract.

7.12 Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in _____ *(to be inserted at contract award).*

7.13 Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

(a) the Articles of Agreement;
(b) the supplemental general conditions 4001 (2013-01-28), Hardware Purchase, Lease and Maintenance; 4002 (2010-08-16), Software Development or Modification Services; 4003 (2010-08-16), Licensed Software
(c) the general conditions 2040 (2014-06-26) General Conditions - Research & Development;
(d) Annex A, Statement of Work;
(e) Annex B, Basis of Payment: Milestone schedule;
(f) Annex C, Security Requirements Check List;
(g) Annex D, Non-disclosure Agreement;
(h) Annex E, Contract Plan and Report Form
(i) Annex F, Disclosure Certification
(j) Annex G, Disclosure of Intellectual Property
(k) the Contractor's bid dated _____ (insert date of bid) (If the bid was clarified or amended, insert at the time of contract award: "as clarified on _____" **or** ", as amended on _____" and insert date(s) of clarification(s) or amendment(s))

7.14 Foreign Nationals (Canadian Contractor)

SACC Manual clause A2000C (2006-06-16), Foreign Nationals (Canadian Contractor)

- Or – *(will be determined at contract award)*

7.14 Foreign Nationals (Foreign Contractor)

SACC Manual clause A2001C (2006-06-16), Foreign Nationals (Foreign Contractor)

7.15 Insurance

SACC Manual clause G1005C (2008-05-12), Insurance

7.16 Controlled Goods Program

SACC Manual clause A9131C (2014-06-26), Controlled Goods Program
SACC Manual clause B4060C (2011-05-16), Controlled Goods

7.17 Progress Reports

1. As indicated in Annex A, the Contractor must submit monthly reports, in electronic format, on the progress of the Work, to both the Technical Authority and the Contracting Authority.

2. The progress report must contain three parts:

    (a) PART 1: As indicated in Annex A, the Contractor must answer the following two questions:

    (i) Is the project on schedule?
    (ii) Is the project free of any areas of concern in which the assistance or guidance of Canada may be required?

    Each negative response must be supported with an explanation.

    (b) PART 2: A narrative report, brief, yet sufficiently detailed to enable the Technical Authority to evaluate the progress of the Work, containing as a minimum:

    (i) The information requested in progress reports as indicated in Annex A. Sufficient sketches, diagrams, photographs, etc., must be included, if necessary, to describe the progress accomplished.

    (ii) An explanation of any variation from the work plan.

    (iii) A description of trips or conferences connected with the Contract during the period of the report.

    (c) PART 3: The "Contract Plan and Report Form", PWGSC-TPSGC 9143 at Annex E (or an equivalent form acceptable to the Contracting Authority) showing the following:

    (i) Actual and forecast expenditure on a monthly basis for the period being covered. (Expenditures are to be outlined by month and by task.)

    (ii) Progress of the Work against the Contractor's original Contract Plan (instructions for showing the above on the Contract Plan are detailed in Annex E attached). The form will provide the basis for planning and estimating the cost of work, and reporting actual progress and cost against the plan during contract performance.

7.18 Contract Plan and Report Form

1. The Contractor must use the Contract Plan and Report Form, PWGSC-TPSGC 9143, provided at Annex E, (or an equivalent form acceptable to the Contracting Authority) to report the progress of the Work and the costs to date against the original work plan.

2. An updated copy of the contract plan and report form must be provided with each claim for payment.

3. Receipt and acceptance of the contract plan and report form by the Contracting Authority is a condition for payment in accordance with the Contract.

7.19 Disclosure certification

On completion of the Work, the Contractor must submit to the Technical Authority and to the Contracting Authority a copy of the Disclosure Certification attached as Annex F stating that all applicable disclosures were submitted or that there were no disclosures to submit under General conditions 2040 (2014-06-26) article 28 - Research and Development.

7.20 Disclosure of Intellectual Property

The Contractor's Disclosure of Intellectual Property at Annex G must be completed by the Contractor and submitted as part of the Final Data Package.

7.21 Directive on Communications with the Media

1. Definitions

"Communication Activity(ies)" includes: public information and recognition, the planning, development, production and delivery or publication, and any other type or form of dissemination of marketing, promotional or information activities, initiatives, reports, summaries or other products or materials, whether in print or electronic format that pertain to the present agreement, all communications, public relations events, press releases, social media releases, or any other communication directed to the general public in whatever form or media it may be in, including but without limiting the generality of the preceding done through any company web site.

2. Communication Activities Format

The Contractor must coordinate with the Canadian Space Agency (CSA) all Communication Activities that pertain to the present contract.

Subject to review and approval by the CSA, the Contractor may mention and/or indicate visually, without any additional costs to the CSA, the CSA's participation in the contract through one or both of the following methods at the complete discretion of the CSA:

a. By clearly and prominently labelling publications, advertising and promotional products and any form of material and products sponsored or funded by the CSA, as follows, in the appropriate official language:
"This program/project/activity is undertaken with the financial support of the Canadian Space Agency."

"Ce programme/projet/activité est réalisé(e) avec l'appui financier de l'Agence spatiale canadienne."

b. By affixing CSA's corporate logo on print or electronic publications, advertising and promotional products and on any other form of material, products or displays sponsored or funded by the Canadian Space Agency.

The Contractor must obtain and use a high resolution printed or electronic copy of the CSA's corporate identity logo and seek advice on its application, by contacting the Technical Authority, as mentioned in section 7.6.2 of this contract.

3. Communication Activity Coordination Process

The contractor must coordinate with the CSA's Directorate of Communications and Public Affairs all Communication Activities pertaining to the present contract. To this end, the contractor must:

a. As soon as the Contractor intends to perform a Communication Activity, send a Notice to the CSA's Directorate of Communications and Public Affairs. The Communications Notice must include a complete description of the proposed Communication Activity. The Notice must be in writing in accordance with Article 44 of the General Conditions 2040 contract titled Notice. The Communications Notice must include a copy or example of the proposed Communication Activity.

b. The contractor must provide to the CSA any and all additional document in any appropriate format, example or information that the CSA deems necessary, at its entire discretion to correctly and efficiently coordinate the proposed Communication Activity. The Contractor agrees to only proceed with the proposed Communication Activity after receiving a written confirmation of coordination of the Communication Activity from the CSA's Directorate of Communications and Public Affairs.

c. Should the Contractor proceed with the Communication Activity without having previously received the written confirmation of coordination from the CSA's Directorate of Communications and Public Affairs, subject to giving Notice to the Contractor, Canada is entitled to exercise its right under section 155 of the *Financial Administration Act* and retain from payment to the Contractor or recover from the Contractor the amount of damages that may be due to Canada as a result of the release of information by the Contractor.

ANNEX A

STATEMENT OF WORK

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

ANNEX B

BASIS OF PAYMENT

SCHEDULE OF MILESTONES

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

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

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

ANNEX C

SECURITY REQUIREMENTS CHECK LIST

The Security requirement Check List (SRCL), appended to the bid solicitation package, is to be inserted at this point and forms part of this document.

ANNEX D

NON-DISCLOSURE AGREEMENT

I, _____, recognize that in the course of my work as an employee or subcontractor of _____, I may be given access to information by or on behalf of Canada in connection with the Work, pursuant to Contract Serial No _____ between Her Majesty the Queen in right of Canada, represented by the Minister of Public Works and Government Services and _____, including any information that is confidential or proprietary to third parties, and information conceived, developed or produced by the Contractor as part of the Work. For the purposes of this agreement, information includes but not limited to: any documents, instructions, guidelines, data, material, advice or any other information whether received orally, in printed form, recorded electronically, or otherwise and whether or not labeled as proprietary or sensitive, that is disclosed to a person or that a person becomes aware of during the performance of the Contract.

I agree that I will not reproduce copy, use, divulge, release or disclose, in whole or in part, in whatever way or form any information described above to any person other than a person employed by Canada on a need to know basis. I undertake to safeguard the same and take all necessary and appropriate measures, including those set out in any written or oral instructions issued by Canada, to prevent the disclosure of or access to such information in contravention of this agreement.

I also acknowledge that any information provided to the Contractor by or on behalf of Canada must be used solely for the purpose of the Contract and must remain the property of Canada or a third party, as the case may be.

I agree that the obligation of this agreement will survive the completion of the Contract Serial No:_____

_____
Signature

_____
Date

ANNEX E

CONTRACT PLAN AND REPORT FORM

The Contract Plan and Report Form, appended to the bid solicitation package, is to be inserted at this point and forms part of this document.

ANNEX F

DISCLOSURE CERTIFICATION

In accordance with Article 7.19 (Disclosure Certification) of the contract, you must provide the Contracting Authority and the Project Authority, a disclosure as indicated under Article 28 of General Conditions 2040 (2014-06-26) General Conditions Research and Development.

Please Check the appropriate box and return this Annex “F” with your last claim for progress payment.

_____ We hereby certify that all disclosures were submitted.

_____ We hereby certify that there were no disclosure to submit.

Signature: _____

Date: _____

ANNEX G

CONTRACTOR'S DISCLOSURE OF INTELLECTUAL PROPERTY

1. Contractor Legal Name:

2. Project Title supported by the Contract:

3. CSA Project Manager of the Contract:

4. Contract #:

5. Date of the disclosure:

6. Will there be Contractor's Background Intellectual Property brought to the project:

   - ☐ Yes_ Complete Table 1 attached (Disclosure of Background Intellectual Property)
   - ☐ No

7. For Canada's owned IP, are there any IP elements that, to your opinion, would benefit from being patented by Canada?

   - ☐ Not applicable, FIP resides with the Contractor
   - ☐ Yes_ Complete Table 3 attached (Canada's Owned Additional Information)
   - ☐ No

Definitions
Intellectual Property (IP): means any information or knowledge of an industrial, scientific, technical, commercial artistic or otherwise creative nature relating to the work recorded in any form or medium; this includes patents, copyright, industrial design, integrated circuit topography, patterns, samples, know-how, prototypes, reports, plans, drawings, Software, etc.
Background Intellectual Property (BIP): IP that is incorporated into the Work or necessary for the performance of the Work and that is proprietary to or the confidential information of the Contractor, its subcontractors or any other third party.
Foreground Intellectual Property (FIP): IP that is first conceived, developed, produced or reduced to practice as part of the Work under the Contract.

Instructions to the Contractor

Identification

- The Contractor must respond to the 7 questions at the top of this page when Foreground Intellectual Property (FIP) is created under the Contract with the CSA.

BIP

- If the Contractor intends to use Background Intellectual Property (BIP) to develop the FIP, the Contractor must complete Table 1 (Disclosure of BIP brought to the project by the Contractor) and forward it to the CSA Project Manager before the beginning of the Contract if any.
- At the end of the Contract, the Contractor must review and update the BIP disclosure (Table 1) when applicable before closing of the Contract. Only the BIP elements that were used to develop the FIP elements should be listed.

FIP

- At the end of the Contract, the Contractor must complete Table 2 (Disclosure of the FIP developed under the Contract).
- If Canada is the owner of the FIP and identifies some FIP elements that would benefit from being patented by Canada, the Contractor must also complete Table 3 (Canada's Owned FIP Additional Information).
- The Contractor must sign below and deliver the completed Contractor Disclosure of Intellectual Property (including Table 1 and Table 2) to the CSA Project Manager of the Contract for his/her approval before closing the Contract.

General Instructions for BIP and FIP tables

- Tables must be structured according to the CSA IP form provided.
- Each IP element must have a unique ID # in order to easily link the elements of the different tables.
- Titles of IP elements must be descriptive enough for project stakeholders to get a general idea of the nature of the IP.
- Numbers and complete titles of reference documents must be included.

Instructions to the Project Manager

- The CSA Project Manager is responsible to review and approve Table 1 (Disclosure of BIP brought to the project by the Contractor) upon receipt.
- He/she also has to approve the Contractor Disclosure of Intellectual Property before closing the Contract and confirm his approval of the Disclosure by signing it below.
- He/she will then forward the Disclosure to the Intellectual Property Management and Technology Transfer (IPMTT) office: PITT-IPTT@asc-csa.gc.ca
- He/she can consult with the IPMTT office when needed.

For the Contractor _____ *Signature*	_____ *Date*
For the CSA Project Manager _____ *Signature*	_____ *Date*

Table 1. Disclosure of Background Intellectual Property (BIP) brought to the project by the Contractor

1 **BIP ID#**	2 **Project Element**	3 **Title of the BIP**	4 **Type of IP**	5 **Type of access to the BIP required to use/improve the FIP**	6 **Description of the BIP**	7 **Reference documentation**	8 **Origin of the BIP**	9 **Owner of the BIP**
Provide ID # specific to each BIP element brought to the project e.g. BIP-CON-99 *where CON is the contract acronym.*	*Describe the system or sub system in which BIP is integrated (e.g. camera, control unit, etc.).*	*Use a title that is descriptive of the BIP element integrated to the work.*	*Is the BIP in the form of an invention, trade secret, copyright, design, patent?*	*Describe how the BIP will be available for Canada to use the FIP(e.g. BIP information will be incorporated in deliverable documents, software will be in object code, etc.).*	*Describe briefly the nature of the BIP(e.g. mechanical design, algorithm, software, method, etc.).*	*Provide the number and fill title of the reference documents where the BIP is fully described. The reference document must be available to Canada. Provide patent# for Canada if BIP is patented.*	*Describe circumstances of the creation of the BIP. Was it developed from internal research or through a contract with Canada? If so, provide contract number.*	*Name the organization that owns the BIP. Provide the name of the subcontract or if not owned by the prime contractor.*

Table 2. Disclosure of the Foreground Intellectual Property (FIP) developed under the Contract

1 **FIP ID #**	2 **Project Element**	3 **Title of FIP**	4 **Type of FIP**	5 **Description of the FIP**	6 **Reference documentation**	7 **BIP used to generate the FIP**	8 **Owner of the FIP**	9 **Patentability**
Enter an ID # specific to each FIP element *e.g.FIP-CON-99* *where CON is the contract acronym.*	*Describe the system or sub-system for which the FIP element was developed (e.g. a camera, ground control, etc.).*	*Use a title that is descriptive of the FIP element.*	*Specify the form of the FIP e.g. invention, trade secret, copyright, industrial design, patent.*	*Specify the nature of the FIP e.g. software, design, algorithm, etc.*	*Provide the full title and number of the reference document where the FIP is fully described. The reference document must be available to Canada.*	*BIP referenced in table 1 e.g.* BIP-CON-2, 15.	*Specify which organization owns the FIP e.g. Contractor, Canada* or Subcontractor.* *Provide the name of the subcontractor if not owned by the prime contractor.* **If Canada is the owner of the FIP, complete Table 3 below.* *Provide reference to contract clauses that support FIP ownership.* *Provide reference to WPDs under which the technical work has been performed.*	*In the case where the IP is owned by Canada, indicate with an "X", any IP elements described is patentable and complete Table 3 only for this IP.*

Table 3. Canada's Owned FIP Additional Information

1 **FIP ID #**	2 **Title of FIP**	3 **Aspects of FIP that are novel, useful and non obvious**	4 **Limitations or drawback of the FIP**	5 **References in literature or patents pertaining to the FIP**	6 **Has the FIP been prototyped, tested or demonstrated? (e.g. analytically, simulation, hardware)? Provide results**	7 **Inventor(s)**	8 **Was the FIP disclosed to other parties?**
ID# should be same as corresponding FIP element in Table2.	*Title of FIP should be same as corresponding FIP element in Table2.*	*How is the FIP addressing a problem (useful) and what is thought to be novel in this solution (novel)?*	*Describe the limitations of present apparatus, product or process.*	*Provide references in published literature or patents relating to the problem or subject if any.*	*Describe briefly how the process, product or apparatus has performed during testing or simulation. Provide reference document # where the performance is compiled if applicable.*	*Provide name and coordinates of the person(s) who created the FIP.*	*Has any publication or disclosure of the FIP or any of its elements been made to third parties? If so, provide when, where and to whom.*

ATTACHMENT 1 TO PART 2

MANDATORY NON-DISCLOSURE AGREEMENT (NDA) FOR
[RCM MULTI-MISSION PRECISION TRANSPONDER]
REQUEST FOR PROPOSAL (RFP)

PUBLIC WORKS GOVERNMENT SERVICES CANADA (PWGSC)
FILE # [INSERT GETS FILE #]

BY:

_____, a body corporate duly incorporated under the laws of _____, having its Head Office located at _____;
Hereinafter referred to as the ("Supplier')

TO: HER MAJESTY THE QUEEN IN RIGHT OF CANADA, as represented by the Minister of Public Works and Government Services;
Hereinafter referred to as ("Canada")

The Supplier agrees that, for the purpose of preparing a response to PWGSC for the RFP (the "Purpose") is being giving access to Confidential Information or proprietary to Canada or to third party and agrees to comply with the obligations referred to under this NDA;

1. The Supplier acknowledges that the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD must be treated as confidential and must not be disclosed or used in any way except in relation with the Purpose of this RFP.

2. For the purpose of this NDA, Confidential Information includes, but not limited to the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD and any documents, Instructions, guidelines, data, material, advice or another information whether received orally, in printed form or recorded electronically or otherwise and whether or not labeled as proprietary, that is disclosed to a person or entity or that person or entity becomes aware of for the purpose of this RFP.

3. The Supplier agrees that the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD will not be reproduced, copied, divulged, released or disclosed, in whole or in part, in whatever way or form any Confidential Information to any person or entity other than a person employed by the Supplier without the prior written consent of the PWGSC's Contracting Authority and for any purpose other than for the preparation of a response to this RFP.

4. The Supplier agrees to immediately notify the PWGSC's Contracting Authority if any person, other than the Supplier's current employees accesses the Confidential Information at any time.

5. Also, regardless of whether it is Confidential Information, the Supplier must at all times treat the information designated as Confidential Information and ensure it cannot be

accessed by anyone excepting the Supplier's current employees, which have a legitimate "need to know' for the Purpose of presenting a RFP.

6. The Supplier shall at all times use the same degree of care as it uses to protect its own confidential information of like importance to prevent the unauthorized use or disclosure of Confidential Information, but in no event less than a reasonable degree of care. The Supplier shall not, nor shall it permit its employees to, remove any copyright, confidential, proprietary rights, or intellectual property notices attached to or included in any Confidential Information and shall reproduce all such notices on any copies of the Confidential Information.

7. The Supplier is responsible for any breach of this NDA by any of its employees, and the Supplier shall not, nor shall permit its employees to, modify, disassemble, decompile, or reverse engineer any Confidential Information even if it relates to the Purpose.

8. All the Information contained in the document entitled RCM-IC-53-4527 / RCM Precision Transponder ICD and all other Confidential Information disclosed under this NDA shall remain the property of Canada or a third party, or of any other person or entity to whom it lawfully belongs, as applicable.

9. Without restricting the generality of the foregoing, the Supplier recognizes that no license or conveyance of any rights to the Supplier under any discoveries, inventions, patents, trade secrets, copyrights, or other form of intellectual property is granted or implied by the disclosure of Confidential Information under this NDA.

10. The Supplier must require any proposed subcontractor with a "need to know", to execute a NDA on the same conditions as those contained in this NDA prior to disclosure of the Confidential Information.

11. All Confidential Information will remain the property of Canada and must be returned to the Contracting Authority within thirty (30) days following that request.

12. The NDA remains in force indefinitely.

13. Nothing in this NDA should be construed as preventing the disclosure or use of any confidential information to the extent that such information:

    (a) is or becomes in the public domain through no fault of the Supplier or any proposed subcontractor;

    (b) is or becomes known to the Supplier from a source other than Canada, except any source that is known to the Supplier to be under an obligation to Canada not to disclose the information; or

    (c) is disclosed under compulsion of a legislative requirement or any order of a Court or other tribunal having jurisdiction.

14. The Supplier agrees that a breach of this NDA may result in disqualification of a Supplier or a Qualified Supplier at any time, or immediate termination of the resulting Contract. The Qualified Respondent also acknowledges that a breach of this NDA may result in a review of the Qualified Supplier's security clearance and review of the Qualified Supplier's status as an eligible Supplier for other requirements.

15. The Supplier acknowledges and agrees that it will be liable for any and all claims, loss, damages, costs, or expenses incurred or suffered by Canada caused by the failure of the Supplier, or by anyone to whom the Supplier discloses the Confidential Information to comply with these conditions.

IN WITNESS WHEREOF, this Non-Disclosure Agreement has been duly signed
this day of , 2014,
by an authorized representative of the

_____
Name of Supplier

_____
Name of authorized representative (print)

_____
Signature
(I have authority to bind the corporation)
Signed by its authorized representative

Witness:

_____
Name of the Witness

ATTACHMENT 1 TO PART 3

TECHNICAL AND MANAGERIAL BID PREPARATION INSTRUCTIONS

1.1 TECHNICAL AND MANAGERIAL BID

The details provided in this Attachment complement the information introduced in paragraphs 3.1 and 3.2 of Part 3 - Bid Preparation Instructions.

The Bidder should present the information about the Technical and Managerial Bid in the following order:

1. Title / Project Identification Page (see 1.2);
2. Executive Summary (see 1.3);
3. Table of Contents (see 1.4);
5. Technical Section (see 1.5);
6. Managerial Section (see 1.6);
7. Bid Appendices (see 1.7).

The structure of the Technical and Managerial Bid and its subsections are described below. Some of the subsection headings include identifiers. These identifiers represent an evaluation criterion (see Appendix C of Attachment 1 to Part 4) that is applicable to that specific section/subsection for each bid submitted by a Bidder.

1.2 Title/Project Identification Page

The first page of the bid submitted should state the following information:

a) The Request For Proposal file number;

b) The company's name and address;

c) The title of the proposed Work (the use of acronyms in the title is discouraged, unless they are described).

1.3 Executive Summary

The Bidder must provide an Executive Summary. The Executive Summary is a stand-alone document suitable for public dissemination, for example, through the CSA web site. The Executive Summary should not exceed two pages in length (8.5” x 11”) and should highlight the following elements:

a) Work objectives;

b) Technical and programmatic risks;

c) Major milestones and deliverables.

1.4 Table of Contents

The table of contents should be formatted such that its headings are linked to their respective location in the bid for ease of reference when using the bid's Soft copy version.

1.5 Technical Section

The Technical Section should describe the technical aspects of the project as outlined in the following subsections.

1.5.1 Mandatory Evaluation Criterion MAND01

(see Appendix B of Attachment 1 to Part 4)

The Bidder must provide a compliance statement as well as compliance detailed substantiation or the reference in the proposal for each mandatory requirement identified in Table 1.1.

The definitions of “detailed substantiation” and “reference in proposal” are available in Appendix A of Attachment 1 to Part 4.

Table 1.1: Mandatory Requirements for Evaluation Criterion MAND01

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-OPER-0020	Applicable Licensing Regulations	The Transponder Instrument radio-frequency emitter(s) shall conform to applicable licensing regulations.	REF PROP		
TXPD-OPER-0040	Transponder Facility Dome Control - JHC Space Centre	The Transponder System shall be able to automatically operate the full opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site, before and after scheduled transponder operations. Note TXPD-OPER-0040: Information can be found in AD-6, which can be used for example as a concept for a dome control function within the Transponder Control Software.	REF PROP		
TXPD-OPER-0050	Manual Dome Control - JHC Space Centre	The Control Computer & Software shall enable manual opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site. Note TXPD-OPER-0050: by manual dome control it is meant a software function on the Control Compute (for ex., part of the Control Computer Software), enabling to open or close the dome at will (for example for maintenance and tests), outside of its normal, scheduled operation sequence.	REF PROP		
TXPD-OPER-0060	Manual Dome Remote Control - JHC Space Centre	The Control Computer & Software shall enable manual opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site, from an external computer. Note TXPD-OPER-0060: see above comment. This requirement could be satisfied through a remote login capability giving access to the functions of the	REF PROP		

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		Control Computer & Software.			
TXPD-FUNC-0010	Function Modes	The Transponder System shall have the following modes: o Measurement Modes: • Constant RCS: The Transponder Instrument retransmits a signal to the SAR with a calibrated, very stable gain, to allow external calibration of the SAR; • Receiver: The Transponder Instrument detects and measures the amplitudes and the received SAR pulses, for the recording of incoming radar pulses, reconstruction of the azimuth pattern, and determination of power flux density; • Transmit-Receive: The Transponder Instrument performs the two above-mentioned Modes simultaneously.	DET SUBST		
TXPD-FUNC-0020	Time Delay Setting	The Control Computer & Software shall allow setting of the adjustable time delay (between the received satellite signal and the retransmitted transponder signal) of the Transponder Instrument for any given scheduled acquisition.	DET SUBST		
TXPD-FUNC-0030	Time Delay Default Value	The Control Computer & Software shall allow setting of a default time delay (between the received satellite signal and the retransmitted transponder signal) value for acquisitions for which a specific time delay has not been entered.	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0050	Data Acquisition Report Transfer	The Control Computer & Software shall have the capability to provide the Data Acquisition Report, via a communications unit, to an off-site, external computer.	REF PROP		
TXPD-FUNC-0060	Automatic Scheduling	The Control Computer & Software shall be capable of automated scheduling of the Transponder System, upon reception of a schedule file originating from an off-site, external computer.	DET SUBST		
TXPD-FUNC-0065	Automatic Scheduling Update	The Control Computer & Software shall be capable of automated updating an already existing schedule, upon reception of a schedule file originating from an off-site, external computer. Note TXPD-FUNC-0065: For RCM, Schedules of data acquisitions from an external computer of the RCM Ground Segment are described as Transponder Schedule in [AD-5].	DET SUBST		
TXPD-FUNC-0080	Automatic Schedule Update	The Control Computer & Software shall be capable of automatically updating the previous scheduling of the Transponder System, upon reception of a new schedule file whose time period overlaps the previous schedule.	REF PROP		
TXPD-FUNC-0090	Manual Scheduling	The Control Computer & Software shall enable manual scheduling of the Transponder System, through entry, by human-machine interface, of the parameters used for automatic scheduling.	REF PROP		
TXPD-FUNC-0100	Schedule Management	The Control Computer & Software shall enable manual editing, or cancelling of currently scheduled Transponder System operations, by human-machine interface.	REF PROP		

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0130	Function Mode Operation	The Control Computer & Software shall enable access to all Function modes of the Transponder System, by human-machine interface.	REF PROP		
TXPD-FUNC-0180	Azimuth Beam Pattern Record	The Control Computer & Software shall record the RCM azimuth beam pattern, in compliance with dynamic range and accuracy requirements of the RF and Antenna Subsystem section. Note TXPD-FUNC-0180: The Data Acquisition Report (TXPD-FUNC-0040) will be populated with data provided by this record.	DET SUBST		
TXPD-RFAS-0010	Centre Frequency	The Transponder Instrument operating frequency shall be 5.405 GHz.	REF PROP		
TXPD-RFAS-0020	Bandwidth	The bandwidth of the Transponder Instrument shall be at least 100 MHz.	REF PROP		
TXPD-RFAS-0060	Transmit Capability	The Transponder Instrument shall transmit delayed replicas of the acquired radar signals back to the originating SAR instrument.	REF PROP		
TXPD-RFAS-0105	Independent Transmit and Receive Polarizations	The Transponder Instrument shall have the capability to independently select transmit and receive polarizations.	DET SUBST		
TXPD-RFAS-0230	Acquisition of Radar Signals	The Transponder Instrument shall acquire and store the incoming pulse train originating from any of the RCM SARs for reconstruction of chirp pulses, and reconstruction of the SAR antenna azimuth pattern.	DET SUBST		
TXPD-POSI-0100	Positioner Alarm and Light	The Transponder System shall include an audible alarm and flashing light which shall activate prior positioner movement, as a warning to personnel local to the site.	DET SUBST		
TXPD-CTRL-0040	GPS	The Transponder System design shall incorporate a GPS, used to provide an accurate time tag reference	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		for all scheduled calibration events and calibration data.			
TXPD-CTRL-0050	GPS Mounting	The GPS shall include all components necessary to obtain the required functionality, plus all mounting hardware and structure.	REF PROP		
TXPD-PHYS-0010	Unit Separation	The Transponder System design shall accommodate a physical separation of assemblies between the Indoor Unit and the Outdoor Unit up to a maximum separation distance of 50 m. Note TXPD-PHYS-0010: This is a design provision to accommodate non-sheltered deployment of the Outdoor Unit at a distance to the Indoor Unit.	DET SUBST		
TXPD-PHYS-0020	Power Requirements	The Transponder System shall require no more than 110 VAC, 30 A (3.3 kVA) at 60Hz.	DET SUBST		
TXPD-PHYS-0030	Weight Requirement	The Outdoor Unit of the Transponder System together shall weigh less than 1600 lbs (727 kg).	DET SUBST		
TXPD-PHYS-0040	Transponder Control Subsystem Location - JHC Space Centre	At the JHC Space Centre site, the Indoor Unit shall be located on the first floor of the Transponder Facility.	DET SUBST		
TXPD-PHYS-0050	Transponder Instrument and Pedestal Assembly Location - JHC Space Centre	At the CSA JHC Space Centre site, the Outdoor Unit shall be installed on the second floor of the Transponder Facility, which consists in a dome equipped with an opening/closing mechanism.	DET SUBST		
TXPD-PHYS-0060	Outdoor Unit Height - JHC Space Centre	The height of the Outdoor Unit, from the base of the pedestal assembly, shall allow full field-of-view clearance of the Transponder antennas at 0° elevation. Note: This is to allow routine verification of boresight alignment of transmit and receive antennas using local targets. These local targets are generally	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		slightly above horizon.			
TXPD-PHYS-0070	Envelope Requirement, Rest Azimuth and Elevation - JHC Space Centre	As a minimum, the Transponder Instrument and Pedestal Assembly shall fit inside the dome of the transponder facility of the CSA JHC Space Centre in St Hubert, for rest azimuth and elevation values.	DET SUBST		
TXPD-ENVR-0050	Circuit Protection	The Transponder Instrument shall provide input circuit protection against potential system-damaging high input signal levels. The Contractor shall determine the level of protection reasonably required, subject to approval by the Crown.	REF PROP		
TXPD-ENVR-0090	Overheat Protection	The RF Subsystem of the Transponder Instrument shall include overheat protection circuitry to prevent against potential damage to the transponder instrument.	DET SUBST		
TXPD-SATR-0050	Shipping Containers	The Transponder System shall be delivered with shipping containers that are sufficiently rugged to withstand the expected shipping and handling environments, in accordance with best commercial practices.	REF PROP		

1.5.2 Self-Evaluation Against Evaluation Criteria

(see Appendix C of Attachment 1 to Part 4)

The Bidder must fill out the self-evaluation against evaluation criteria table provided in Table 1.2. This table includes all evaluation criteria detailed in Appendix C of Attachment 1 to Part 4.

Table 1.2: Bidder's Self-Evaluation Against Evaluation Criteria

Evaluation Criterion ID	Evaluation Criterion Title	Bidder's Self-Evaluation (Rating from "0" to "D")	Bidder's Substantiation on Rating	Reference Proposal Paragraph & Page
TECH01	Technical Requirements Point-Rated Evaluation			
TECH02	Understanding the System Underlying Principle			
TECH03	System Maintenance Approach			
TECH04	Technical Methodology			
PA01	Proposed Product Assurance (PA) Implementation			
PA02	Quality Assurance (QA) Methodology			
PROG01	Bidder's Experience			
PROG02	Team Expertise and Experience			
PROG03	Project Management Plan (PMP)			
PROG04	Risk Management			

1.5.3 Technical Aspects Discussed in Technical Evaluation Criteria TECHxx

(see Appendix C of Attachment 1 to Part 4)

The Bidder must provide a subsection in its bid for each technical evaluation criterion detailed in Appendix C of Attachment 1 to Part 4, by focusing on providing details pertaining to the information contained in the description of each evaluation criterion.

The technical evaluation criteria have the prefix "TECH".

1.5.3.1 Technical Aspects Discussed in Technical Evaluation Criterion TECH01

(see Appendix C of Attachment 1 to Part 4)

The Bidder must provide a compliance statement as well as a compliance detailed substantiation or the reference in the proposal for each non-mandatory requirement identified in Table 1.3.

The definitions of “detailed substantiation” and “reference in proposal” are available in Appendix A of Attachment 1 to Part 4.

Table 1.3: Non-Mandatory Requirements for Evaluation Criterion TECH01

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-OPER-0010	Design Lifetime	The Transponder System shall be designed for a lifetime of a minimum of 10 years, measured relative to the successful completion of the RCS characterization.	5	DET SUBST		
TXPD-OPER-0015	Design Lifetime	The Transponder System should be designed for a lifetime of a minimum of at least 15 years, measured relative to the successful completion of the RCS characterization.	3	DET SUBST		
TXPD-OPER-0030	Operational Sequence for Calibration Events:	The Transponder System shall assume the following typical operational sequence for acquiring satellite data, in an automated fashion: 1. To accept automatic calibration schedule file(s) from an external computer linked to the ground segment; 2. To perform Transponder System setup, in preparation for the event; 3. To perform internal calibration of the Transponder Instrument; 4. To sound an alarm and flashing light prior to Positioner movement towards the target; 5. To receive and capture data from, and retransmit the SAR signal; 6. To return the Transponder System to its initial state, after the event; 7. To sound an alarm and flashing light prior to Positioner movement back to resting position; 8. To provide and record event fault indicators, if	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		applicable; 9. To calculate SAR data summary parameters; 10. To record event status and generate an event calibration report; 11. To send calibration report file(s) to an external computer linked to the ground segment.				
		The Transponder System shall have the following modes: o Support Modes: • Off: All Transponder System elements are off with no power consumption; • Standby: Power consumption is minimized while maintaining the control computer and software running. This mode constitutes the default when no acquisition is planned in the near future. In this mode, Transponder Instrument and/or Pedestal Assembly subsystems can be activated/deactivated for maintenance and troubleshooting.; • Pre-op: Transition Mode typically between Standby and any of the Measurement Modes, where all required subsystems are activated prior to an actual Acquisition (possible ex. are pre-heating, internal calibration) , Pre-op can also be initiated between any of the measurement modes, or between a Measurement Mode and Standby; • Test: Allows built-in tests to be executed to support fault tracing. Can be launched from the Standby Mode	4	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		Note TXPD-FUNC-0010: Support Modes can be grouped differently as long as the objectives of each of the above mentioned Modes are preserved.				
		The Transponder System shall have the following modes: o Calibration Modes: • Internal Calibration: Transponder System gain stability is achieved through an internal calibration of the transponder instrument; • External Calibration: Mode to be utilized to measure the RCS of the Transponder Instrument itself.	3	DET SUBST		
TXPD-FUNC-0012	Measurement Modes Access	The Control Computer & Software shall allow a user to switch the Transponder System in any of the Measurement Modes specified in [TXPD-FUNC-0010] for the upcoming acquisition event(s).	3	DET SUBST		
TXPD-FUNC-0014	Support Modes Access	The Control Computer & Software shall allow a user to put the Transponder System into any state that will reproduce the Support Modes specified in [TXPD-FUNC-0010].	3	DET SUBST		
TXPD-FUNC-0016	Test Access	The Control Computer & Software shall allow a user to activate Calibration Modes specified in [TXPD-FUNC-0010].	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0040	Generate Data Acquisition Report	After each Transponder System operation in any of the measurement modes, the Control Computer & Software shall generate a report with the following information: o Mission ID; o Satellite ID; o Point Target (transponder) ID ; o Schedule ID; o Time and date; o Transponder status; o Transponder measurement mode; o Transponder delay; o Activation/deactivation times; o Achieved pointing values as reported from the positioner (azimuth, elevation); o Point target position (lat, lon, elevation); o Nominal Radar Cross Section; o Tx and Rx instrument polarizations; o Data acquisition event status (success or failure; if failure, all subsequent parameters are NULL or zero) o Absolute power flux density (in unit W/m2); o Azimuth data (array of dB values vs time); o Azimuth data measurement start time; o Number of azimuth samples (azimuth data sampled at the PRF, for a duration of the order of 2 to 90 seconds, see TXPD-FUNC-0185); o Number of chirp data blocks (containing as a minimum 10 chirp data pulses, including the 5	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		strongest pulses from the main azimuth pattern lobe, containing one radar pulse each); o For each chirp data block (of one chirp pulse): • Chirp pulse power (envelope) data(array of values vs time); • Chirp data measurement start time; • Number of chirp data samples (2 000 samples per 50 us pulse, see TXPD-FUNC-0205)). Note TXPD-FUNC-0040: For RCM, Data Acquisition Report format is described as Transponder Activity Report in [AD-5].				

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0070	Schedule Content	For purposes of scheduling of the Transponder System, the Control Computer & Software shall be able to input the following scheduling information from the off-site external computer [AD-5]: o Mission ID; o Schedule ID; o Schedule Generation Time (UTC); o Schedule Coverage Interval o For each acquisition in the schedule: • Acquisition ID • Satellite ID; • Start and end scheduling times; • Transponder ID; • Pointing values (azimuth, elevation); • Time Delay • Tx and Rx instrument polarizations; • Transponder measurement mode. Note [TXPD-FUNC-0070]: For RCM, Acquisition ID is described as Activity ID in [AD-5].	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0110	Acquisition Rejection Message	For each acquisition specified in a schedule that is unsupportable (conflict with another scheduled acquisition), the Control Computer & Software shall be able to generate a rejection message with the following information: o Mission ID; o Schedule ID; o Acquisition ID; o Satellite ID; o Activity Start Time (UTC); o Rejection Reason (string). Note [TXPD-FUNC-0110]: Acquisition ID is designated by Activity ID in [AD-5].	5	DET SUBST		
TXPD-FUNC-0120	Acquisition Rejection Message Transfer	The Control Computer & software shall the capability to send the Acquisition Rejection Message, via a communications unit, to an off-site, external computer.	3	REF PROP		
TXPD-FUNC-0140	System Diagnostics	The Control Computer & Software shall perform Transponder system tests and diagnostics, display the results on the Control Computer screen, and be capable of recording the results.	3	DET SUBST		
TXPD-FUNC-0150	System Status Indicators	The Control Computer & Software shall display status indicators of Transponder Instrument subsystems or components on the Control Computer screen.	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0160	Generate System Status Report	The Control Computer & Software shall routinely generate system status reports with the following information: o General message header; o Point Target (transponder) ID; o System RCS; o Present date and time tag; o Azimuth and elevation at time of reporting; o Subsystem temperatures; o Subsystem operational health indicators (ex.: GPS, RF Subsystem, Positioner, SAR pulse recording functions, etc.).	3	DET SUBST		
TXPD-FUNC-0170	System Status Report Transfer	The Control Computer & Software shall have the capability to provide the System Status Report, via a communications unit, to an off-site, external computer.	3	REF PROP		
TXPD-FUNC-0185	Azimuth Beam Pattern Record Sampling Rate	The minimum sampling of the RCM azimuth beam pattern record shall be the PRF of the RCM imaging mode being used during Transponder data acquisition.	3	DET SUBST		
TXPD-FUNC-0190	Azimuth Beam Pattern Plots	The Control Computer & Software shall be able to plot previously recorded azimuth patterns as a function of time.	5	DET SUBST		
TXPD-FUNC-0200	Radar Pulse Record	The Control Computer & Software shall record a minimum number of 10 RCM individual signal pulse envelopes (power). Note TXPD-FUNC-0200: The Data Acquisition Report (TXPD-FUNC-0040) will be populated with data provided by this record.	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-FUNC-0205	Radar Pulse Record Sampling Rate	The sampling of the RCM individual signal pulse envelopes (power) shall be performed at a minimum rate of 40 MHz.	3	DET SUBST		
TXPD-FUNC-0210	Radar Pulse Plots	The Control Computer & Software shall be able to plot previously recorded radar pulses as a function of time.	5	DET SUBST		
TXPD-FUNC-0220	Calculate Flux Density	The Control Computer & Software shall record and calculate the flux density.	3	DET SUBST		
TXPD-TIME-0010	Time Accuracy	For the purpose of recording data measurement acquisitions, the Transponder System shall maintain an internal time, which shall be synchronized to UTC time with a precision of or better than 5 us (3 sigmas).	3	DET SUBST		
TXPD-PASS-0010	Pre-pass Readiness	The Transponder System shall be ready for operations in any of the measurement modes 10 minutes before the expected satellite SAR overpass. Note TXPD-PASS-0010: An internal calibration can be performed during the pre-pass readiness period.	5	DET SUBST		
TXPD-PASS-0020	Availability Swath	The Transponder System shall be able to operate over the complete range of swaths and incidence angles of the RCM SAR imaging modes, in any of the measurement modes [AD-3].	5	DET SUBST		
TXPD-PASS-0030	Overpass Visibility	The Transponder System shall be able to operate for all RCM satellite overpasses within visibility of the transponder.	5	REF PROP		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-PASS-0040	Consecutive Overpasses	The Transponder System shall be able to operate with the same performance for consecutive overpasses separated by no less than 15 minutes between the end of a pass and the beginning of the next.	5	DET SUBST		
TXPD-RADM-0010	RCS	The maximum effective RCS of the Transponder System, as seen by the RCM satellites shall be 60 dBm2 with a design goal of 62dBm2, assuming that the polarization of the Transponder System receive and transmit antennas are set to ±45° from horizontal. Note TXPD-RADM-0010: An estimate of the maximum received power density is provided in Appendix B.	5	DET SUBST		
TXPD-RADM-0020	RCS Adjustment	The effective RCS of the Transponder System shall be adjustable from 55-60 dBm2, with a design goal of 55-62 dBm2, upon the Crown's request and/or Contractor's recommendations considering RCM specifications. Note TXPD-RADM-0020: Absolute radiometric calibration of the Transponder System is expected to be performed at the maximum RCS.	5	DET SUBST		
TXPD-RADM-0030	Absolute Calibration Accuracy in Constant RCS mode	The Transponder Instrument shall have an absolute uncertainty in the calibrated RCS value at its centre frequency, of ±0.2 dBm2 (1 sigma). Note TXPD-RADM-0030: Absolute Calibration Accuracy is the uncertainty with respect to a reference of known and characterized RCS, when a calibration of the Transponder Instrument is	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		performed using that reference.				
TXPD-RADM-0040	Radiometric Stability in Constant RCS mode	The Transponder Instrument shall have a maximum excursion in RCS value at the centre frequency of ±0.1 dB (3 sigmas) over the system design lifetime.Note TXPD-RADM-0040: To ensure this level of RCS stability, regular recalibrations are assumed.	5	DET SUBST		
TXPD-RFAS-0030	Frequency response	The Transponder Instrument gain shall vary by no more than 0.5 dB peak-to-peak over a bandwidth of ±50 MHz from its centre frequency.	5	DET SUBST		
TXPD-RFAS-0040	Out of Band Rejection	The Transponder Instrument shall have a minimum out-of-band rejection of 70 dB over the following frequency ranges: from 0.2 to 5.255 GHz and from 5.545 to 15 GHz.	3	DET SUBST		
TXPD-RFAS-0050	Pulse Width and Pulse Repetition Frequency	The Transponder Instrument shall function with Pulse Repetition Frequencies (PRFs) of up to 7000 Hz with pulses durations from 10 us to 50 us [AD-4].	5	DET SUBST		
TXPD-RFAS-0070	Time Delay Adjustment	The Transponder Instrument shall permit an adjustable/programmable time delay from 1.0 to 1000 us in increments of 0.1 us, representing the total time delay affecting the transponder signal from receive to transmit.	5	DET SUBST		
TXPD-RFAS-0080	Time Delay Variation	The Transponder Instrument shall provide a maximum peak-to-peak group delay variation of 8 ns over a bandwidth of ±50 MHz from its centre frequency.	3	DET SUBST		
TXPD-RFAS-0090	Phase Stability	The Transponder Instrument shall have a maximum phase excursion of 2° RMS as seen by	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		an observer in the far field range, within a minimum period of 12 days.				
TXPD-RFAS-0110	Receive Polarizations	The Transponder Instrument shall have the capability to select the receive polarizations for either H or V or ±45°. Note: for TXPD-RFAS-110 and TXPD-RFAS-120, a single channel transponder design is assumed. In the case of a dual-channel design, receive and transmit polarization at ±45° is not required.	5	DET SUBST		
TXPD-RFAS-0120	Transmit Polarizations	The Transponder Instrument shall have the capability to select the transmit polarizations for either H or V or ±45°. Note: for TXPD-RFAS-110 and TXPD-RFAS-120, a single channel transponder design is assumed. In the case of a dual-channel design, receive and transmit polarization at ±45° is not required.	5	DET SUBST		
TXPD-RFAS-0130	Polarization Accuracy	The RCS error budget shall consider the effect of mechanical alignment to polarization accuracy.	3	DET SUBST		
TXPD-RFAS-0140	Transmit H-V Imbalance	The Transponder Instrument shall have a transmit amplitude imbalance of less than 0.05 dB and a transmit phase imbalance of less than ±5° when the transmit polarization is at ±45°. Note TXPD-RFAS-0140.1: This requirement assumes a single-channel transponder design. In the case of the dual-channel design, the equivalent imbalance shall be derived for when the transmit channels are orthogonal.	4	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-RFAS-0150	Polarization Crosstalk - Transmit	On transmit, the energy transmitted from the Transponder Instrument with polarization perpendicular to the selected polarization shall be at least 35 dB less than the energy transmitted with the selected polarization.	4	DET SUBST		
TXPD-RFAS-0160	Polarization Crosstalk - Receive	On receive, the energy received by the Transponder Instrument with polarization perpendicular to the selected polarization shall be at least 35 dB less than the energy received by the selected polarization.	4	DET SUBST		
TXPD-RFAS-0170	Internal Calibration Functionality	The Transponder Instrument shall have an internal calibration functionality in order to provide a continuous reference for instrument gain variation monitoring and related continuous corrections before and after the radar signal acquisition.	5	DET SUBST		
TXPD-RFAS-0180	Internal Calibration Path	The internal calibration of the Transponder Instrument should cover as much as possible the signal path of the whole instrument.	3	DET SUBST		
TXPD-RFAS-0190	Internal Calibration Path Design	The characterization and stability requirements of the signal routing elements that are not included within the internal calibration path shall be considered in the design of the internal calibration functionality.	5	DET SUBST		
TXPD-RFAS-0200	Internal Calibration Pulse	The Transponder Instrument shall utilize an internal calibration pulse or pulses to achieve internal calibration stability.	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-RFAS-0202	Internal Calibration Pulse, Power Level	When the Transponder Instrument uses the internal calibration pulse or pulses to achieve internal calibration stability, the nominal power level of the calibration pulse should be within ±3 dB of the expected power level from RCM.	3	DET SUBST		
TXPD-RFAS-0205	Internal Calibration Pulse Selection	When the Transponder Instrument is using the internal calibration pulse or pulses to achieve internal calibration stability, the pulse width and PRF of the internal calibration pulse or pulses should be selectable.	3	DET SUBST		
TXPD-RFAS-0210	Receiver Failure in Transmit-Receive Mode	In the dual, Transmit-Receive mode, in case of failure of the sub-systems associated with the Receive Mode, the Transponder Instrument shall still be able to execute the functions of the Constant RCS Mode.	3	REF PROP		
TXPD-RFAS-0220	Dynamic Range in Receiver Mode	The Transponder Instrument shall have a minimum dynamic range of 30 dB to enable azimuth pattern sidelobes to be detected.	5	DET SUBST		
TXPD-RFAS-0240	Absolute Accuracy in Receiver Mode, Main Lobe	The Transponder Instrument should have an absolute accuracy of ±0.5 dB in the main lobe of the received azimuth pattern.	3	DET SUBST		
TXPD-RFAS-0250	Relative Accuracy in Receiver mode, Main Lobe	The Transponder Instrument shall have an accuracy of ±0.1 dB in the main lobe (top 3 dB of azimuth pattern) of the received azimuth pattern, relative to the peak value.	3	DET SUBST		
TXPD-RFAS-0260	Relative Accuracy in Receiver mode, -20 dB from Peak	The Transponder Instrument shall have an accuracy of ±0.5 dB at -20 dB relative to the peak value of the main lobe of the received azimuth pattern.	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-ANTA-0010	Antenna Mounting Structure	The Contractor should incorporate into the Transponder System design a mounting and alignment structure for the Antenna Subsystem and RF Subsystem onto the Positioner.	3	REF PROP		
TXPD-ANTA-0020	Antenna Adjustment Capability	The antenna mounting structure should allow ±0.5° adjustment in azimuth and ±0.5° adjustment in elevation to allow precise alignment of antenna boresights.	3	REF PROP		
TXPD-ANTA-0030	Dismount Capability	The antenna mounting structure should provide the capability to dismount the RF and Antenna Subsystems from the Positioner, if the Contractor determines this to be a Transponder System Transportability requirement.	3	REF PROP		
TXPD-ANTA-0040	Elevation Clearance	The structure of the antenna mounting shall allow sufficient clearance to adjust the boresight elevation adjustment angles from -5°to 90°.	3	DET SUBST		
TXPD-ANTA-0060	Rigidity	The total antenna mounting structure assembly shall have a rigidity to maintain the pointing command accuracy of ±0.1° with operational windloading as specified in [TXPD-ENVR-0120].	3	DET SUBST		
TXPD-ANTA-0070	Antenna Boresight Alignment	Each of the Transponder System antennas shall include a sighting telescope which is factory preset to align with the electrical antenna boresight, to allow routine adjustments of transmit and receive antenna boresight using local targets. Note TXPD-ANTA-0070: The two sighting telescopes are needed for maintenanceand verification of boresight alignment for when the Transponder System is installed and operational.	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		The approach for factory boresight alignment is left to the designer.				
TXPD-ANTA-0080	Antenna Boresight Alignment Telescopes	Each telescope shall be delivered with the associated alignment hardware and insertion markings, which allow the scope to be removed from the antenna when ready for operations.	3	DET SUBST		
TXPD-POSI-0010	Pointing Capability	The Positioner shall be capable of pointing the Transponder Instrument toward the expected satellite position, at the point where the SAR beam is expected to peak.	2	REF PROP		
TXPD-POSI-0020	Boresight Elevation Adjustment	The Positioner shall have the capability to adjust the boresight elevation in the range –3° to +85°.	3	DET SUBST		
TXPD-POSI-0030	Boresight Azimuth Adjustment	The Positioner shall have the capability to adjust the boresight azimuth in the range ±180°.	2	DET SUBST		
TXPD-POSI-0075	Azimuth and Elevation Pointing Command Accuracy	The accuracy of the azimuth and elevation pointing commands shall allow compliance to the RCS absolute accuracy [TXPD-RADM-0030] and stability [TXPD-RADM-0040].	5	DET SUBST		
TXPD-POSI-0080	Absolute Alignment Calibration	Given that power outages may be frequent at the transponder installation site, the requirement to perform an absolute alignment calibration of the Positioner requiring human intervention shall not exceed twice per year.	3	REF PROP		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-POSI-0090	Manual Control Switches	Manual Control Switches: There shall be a means to manually control the selection of azimuth and elevation, forward and reverse motion, and fine and coarse adjustment, when in close proximity of the Positioner or Pedestal, Note TXPD-POSI-0090: this requirement aims to avoid going back and forth between the Transponder Instrument and the Control Computer during service maintenance. An implementation example of this requirement could be a manual control panel on the Pedestal, with removable cover, which contains control switches for selection of azimuth and elevation control, forward and reverse motion, with fine and coarse adjustment.	2	DET SUBST		
TXPD-CTRL-0030	Absolute Location Knowledge	There shall be provision of absolute location knowledge of the Transponder System boresight at power up of the Positioner Controller. Note TXPD-CTRL-0030: An automated homing run is permitted in order to get an absolute reference.	3	REF PROP		
TXPD-CTRL-0060	UPS	The Transponder System shall include a UPS with the required UPS capacity to power the Transponder System, in whole or in part, such that when commercial power is reestablished, there is minimal or no corrective action required to get the Transponder System operational again.	5	REF PROP		
TXPD-CTRL-0070	Equipment Rack	The Transponder System shall include a ruggedized equipment rack with wheels and a	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		front cover, providing an enclosure of all Transponder Control Subsystem equipment.				
TXPD-CTRL-0080	Equipment Rack Storage Capacity	The equipment rack should have a miscellaneous storage drawer of approximately 15 cm height.	1	REF PROP		
TXPD-CTRL-0090	Equipment Rack Power Bar	The equipment rack should have a power bar with a minimum of two spare receptacles.	1	REF PROP		
TXPD-INTF-0010	Interface Data Flow	The Transponder System shall interface with one or more External Computer(s) (GFEs) according to the data flow illustrated in Figure 6, with four interface capabilities for: 1. Data acquisition scheduling ; 2. Data acquisition reporting; 3. System status reporting, and; 4. Remote access to the Transponder Control Subsystem.	5	DET SUBST		
TXPD-INTF-0015	Interface to RCM Ground System	The Transponder System shall exchange schedules, reports and messages with the RCM Ground Segment as per the interface concepts, formats and conventions described in [AD-5].	5	DET SUBST		
TXPD-INTF-0020	Interface Infrastructure	All interface services shall be implementable either through cabled or wireless infrastructure.	4	DET SUBST		
TXPD-INTF-0030	Single-Multiple External Computer	All interface services shall be implementable to a single External Computer (GFE).	4	DET SUBST		
TXPD-INTF-0040	Single-Multiple Transponder Systems	All interface services shall accommodate multiple Transponder Systems connected to External Computer(s) (GFE).	4	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-INTF-0050	Data Acquisition Schedule	The Transponder System shall include an interface that allows ingestion of RCM data acquisition schedules from an External Computer (GFE) generating or updating a transponder acquisition schedule as per the Automatic Scheduling and Scheduling Update requirements: [TXPD-FUNC-0060] and [TXPD-FUNC-0065].	5	DET SUBST		
TXPD-INTF-0060	Data Acquisition Report	The Transponder System shall provide an interface that allows the Data Acquisition Reports, generated as per the Generate Data Acquisition Report requirement [TXPD-FUNC-0160], to flow to an External Computer (GFE).	5	DET SUBST		
TXPD-INTF-0070	Acquisition Rejection Message	The Transponder System shall provide an interface that allows the Acquisition Rejection Messages, generated as per the Acquisition Rejection Message requirement [TXPD-FUNC-0120], to flow to an External Computer (GFE).	3	REF PROP		
TXPD-INTF-0080	System Status Report	The Transponder System shall routinely generate system status reports, with an anticipated daily frequency, as per the Generate System Status Report requirement herein, in a manner conducive to allowing transfer of these reports from the Transponder System to an External Computer (GFE).	2	REF PROP		
TXPD-INTF-0090	Transfer Readiness of Data Acquisition Reports	The Data Acquisition Report, generated by the Transponder System as per the Generate Data Acquisition Report requirement [TXPD-FUNC-0160], shall be created and ready for file transfer to an External Computer (GFE) within 10 minutes	4	REF PROP		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		of the end of the data acquisition event.				
TXPD-INTF-0100	Transfer Latency of Data Acquisition Reports	The Transponder System shall accommodate the transfer of the Data Acquisition Report within 15 minutes of the data acquisition event.	4	REF PROP		
TXPD-INTF-0110	Transfer Readiness of Acquisition Rejection Messages	The Acquisition Rejection Message, generated by the Transponder System as per the Acquisition Rejection Message requirement [TXPD-FUNC-0120], shall be generated and ready for file transfer to an External Computer (GFE) within 10 minutes of receiving the data acquisition schedule.	4	REF PROP		
TXPD-INTF-0120	Transfer Latency of Acquisition Rejection Messages	The Transponder System shall accommodate the transfer of the Acquisition Rejection Message within 15 minutes of receiving the data acquisition schedule.	4	REF PROP		
TXPD-INTF-0130	Remote Access to Control Computer	The Control Computer of the Transponder Control Subsystem shall provide an interface capability for remote-accessing all the functions, schedules, reports and messages of Section 4.2 as well as system status indicators from an off-site, External Computer (GFE) as though the user were locally operating the Transponder System.	5	DET SUBST		
TXPD-INTF-0140	Remote Access from Multiple External Points	The interface capability for remote access to the Control Computer of the Transponder Control Subsystem shall be available to more than one External Computer (GFE), in a non-simultaneous fashion.	4	REF PROP		
TXPD-INTF-0160	Pedestal Mounting	The Pedestal shall be installed on the GFE: cement foundation using the bolt pattern fixture as	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
		detailed in Figure 6, for both sites.				
TXPD-PHYS-0080	Envelope Requirement, All Azimuth and Elevation - JHC Space Centre	The Transponder Instrument and Pedestal Assembly should, for all azimuth and elevation values, fit inside the dome of the facility when closed. Note: for TXPD-PHYS-0060, TXPD-PHYS-0070 and TXPD-PHYS-0080, the dome dimensions are provided in Figure 8.	5	DET SUBST		
TXPD-PHYS-0090	Cable Conduits	All cables connecting the Outdoor Unit with the Indoor Unit of the Transponder System shall fit inside a conduit of 150 mm diameter.	5	DET SUBST		
TXPD-PHYS-0100	Cable Conduit Position	The Pedestal shall allow cables (electrical, data transfer) coming from the Outdoor Unit to run in the conduit situated at the centre of the bolt pattern (illustrated in Figure 6), directly underneath the Pedestal, whether the pedestal extender (shown in Figure 5) is utilized or not.	5	DET SUBST		
TXPD-ENVR-0010	Outdoor Operating Temperature	The Transponder Instrument and Pedestal Assembly shall operate between -30°C and +30°C in compliance with the requirements of the General, RF and Antenna Subsystems and Positionner Subsystem sections.	5	DET SUBST		
TXPD-ENVR-0020	Outdoor Relative Humidity	The Transponder Instrument and Pedestal Assembly shall operate between 10% and 100% relative humidity.	5	DET SUBST		
TXPD-ENVR-0030	Indoor Operating Temperature	The Indoor Unit shall operate between +10°C and +30°C.	5	DET SUBST		
TXPD-ENVR-0040	Indoor Relative Humidity	The Indoor Unit shall operate between 30% to 70% relative humidity.	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-ENVR-0100	Temperature Monitoring	The temperature(s) shall be monitored within the RF Subsystem by a sufficient number of independent sensors, strategically distributed, and relayed as system status indicators, regularly updated to the Control Computer and Software.	5	DET SUBST		
TXPD-ENVR-0110	Survival Windload	The Outdoor Unit shall withstand wind gusts of up to 100 km/h.	5	DET SUBST		
TXPD-ENVR-0120	Operational Windload	The Outdoor Unit shall be operational when wind is up to 60 km/h steady state.	5	DET SUBST		
TXPD-RMAR-0010	Field Replaceable Units	The Transponder Instrument (mainly, the RF Subsystem and related electronics) should, as much as possible, be built out of Field Replaceable Units (FRUs).	3	DET SUBST		
TXPD-RMAR-0020	Field Replaceable Unit Status	The status of the FRUs shall be reported when the Transponder System is in Test Mode.	3	DET SUBST		
TXPD-RMAR-0030	Signal Monitoring	The Transponder Instrument shall provide means for signal monitoring, parameter setting and/or test signal injection, sufficient to confirm the transponder instrument operations within specification, and facilitate RCS characterization measurements. Note TXPD-RMAR-0030: A transponder achieving these monitoring functionalities without physical external ports and signal injection is acceptable if these functionalities are demonstrated.	3	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-RMAR-0040	RCS Calibration Measurement	The Transponder System shall include the following capabilities for external RCS characterization: 1. To power the Transponder System and control its operation, on a (outdoor or indoor) designated temporary test site; 2. To utilize the Transponder System, and to control the system reset capabilities as required for RCS measurement.	5	DET SUBST		
TXPD-RMAR-0050	Mean Time Between Failures	The mean time between failures should be six (6) months or more	3	REF PROP		
TXPD-RMAR-0060	Mean Time to Repair	The mean time to repair should be no more than one (1) week. Note TXPD-RMAR-0060.1: this is equivalent the average time to repair any part within the system.	3	REF PROP		
TXPD-RMAR-0070	Maintenance Down Time	The maintenance down time per year should be no more than two (2) weeks (excluding RCS calibration).	3	REF PROP		
TXPD-RMAR-0080	Software Platform	The Transponder System software shall be developed using COTS, upgradable operating system, and COTS, upgradable software development environment.	4	DET SUBST		
TXPD-RMAR-0090	Control Computer & Software - Spare	The Transponder System shall be equipped with a spare Control Computer & Software, as a backup to the prime unit (see Figure 2), operational when powered on and connected to the rest of the system.	5	DET SUBST		

Requirement ID	Requirement Title	Requirement Description	Weight	Compliance: Detailed Substantiation (DET SUBST) or Reference in Proposal (REF PROP)?	Compliance Statement	Compliance Details (DET SUBST or REF PROP)
TXPD-SATR-0010	Storage Life	All Transponder System elements shall be designed to allow for storage for a minimum of two (2) years, either before or after OSAT, without any degradation in performance.	2	REF PROP		
TXPD-SATR-0020	Storage Temperature - Outdoor Unit	The Transponder Instrument and Pedestal Assembly shall be designed to be stored at a temperature between -40°C and +45°C.	3	DET SUBST		
TXPD-SATR-0030	Storage Temperature - Indoor Unit	The Transponder Control Subsystem shall be designed to be stored at a temperature between +10°C and +40°C.	3	DET SUBST		
TXPD-SATR-0040	Shipping	The components of the Transponder System shall be transportable using commercial air carriers, able to withstand the expected shipping and handling environments.	5	REF PROP		
TXPD-SATR-0070	Equipment Rack Transport	The equipment rack should be sufficiently rugged for transport in a van.	3	REF PROP		
TXPD-SATR-0090	RCS Calibration - Frequency	Repeat Transponder System RCS calibration measurements should be performed at a frequency no more than once a year per Transponder System.	4	DET SUBST		
TXPD-SATR-0110	RCS Calibration - Shipping Containers	The ruggedized shipping containers shall be reusable for transport of the Transponder System components identified for the repeat Transponder System RCS calibration measurements.	4	DET SUBST		

1.5.4 Product Assurance (PA) Aspects Discussed in PA Evaluation Criteria PAxx

(see Appendix C of Attachment 1 to Part 4)

The Bidder must provide a subsection in its bid for each PA evaluation criterion detailed in Appendix C of Attachment 1 to Part 4, by focusing on providing details pertaining to the information contained in the description of each evaluation criterion.

The PA evaluation criteria have the prefix “PA”.

1.6 Managerial Section

The Managerial Section should demonstrate the effectiveness and commitment of the Bidder in delivering the Work as outlined in the following subsections.

1.6.1 Managerial Aspects Discussed in Programmatic Evaluation Criteria PROGxx

(see Appendix C of Attachment 1 to Part 4)

The Bidder must provide a subsection in its bid for each programmatic evaluation criterion detailed in Appendix C of Attachment 1 to Part 4, by focusing on providing details pertaining to the information contained in the description of each evaluation criterion.

The programmatic evaluation criteria have the prefix “PROG”.

1.6.1.1 Evaluation Criterion PROG03 – Project Management Plan (PMP)

(see Appendix C of Attachment 1 to Part 4)

The Bidder must provide a Project Management Plan (PMP) with its bid. The information the PMP must contain is provided in Appendix C of Attachment 1 to Part 4 within the evaluation criterion PROG03 and in Annex A. The following subsections contain complementary information to include in the PMP.

1.6.1.1.1 Milestones and Deliverables

(see Appendix C of Attachment 1 to Part 4)

This PMP subsection should contain a definition of the milestones and describe in details all expected deliverables, including hardware, software, and relevant documentation (refer to Annex A for more details). When appropriate, the milestones and deliverables should contain all elements identified in Annex A.

1.6.1.1.2 Schedule

(see Appendix C of Attachment 1 to Part 4)

The Bidder should provide a project timetable that relates tasks, milestones and deliverables. A Gantt chart and/or PERT chart should be used to illustrate the schedule. The schedule should

show significant details for events associated with achievement of major tasks, milestones and deliverables. The Bidder should demonstrate how required milestones will be met. Linkage between activities should also be identified in the schedule. For planning purposes, use a project start date of January 2015.

1.6.1.2. Evaluation Criterion PROG04 – Risk Management

(see Appendix C of Attachment 1 to Part 4)

The bidder should provide an assessment of the technical and programmatic risks/uncertainties involved as well as the major assumptions upon which the work is based. The risks should be identified and a Risk Mitigation Plan, that would include contingency plans, alternatives or other means of limiting adverse impacts of risks being realized, should be provided. As a guideline, Table 1.4 and Table 1.5 present fictitious examples of Project Risk Assessment Matrices, while Table 1.6 presents an example of a Project Risk Profile Matrix.

Table 1.4: Example of a Technical Risk Assessment Matrix

Risk Event 1 (R1)	**Limited availability of key documents**	
Probability	Low 1/20 Past experience demonstrates important number of different sources for patents and articles covering this subject.	
Consequence to project	Low	$5 000 - $10 000 Cost growth Schedule delays
Risk Assessment	Low	$250 - $500 (R < 5% of overall project value, $250K)
Mitigation Plan	Secure at least 2 sources for each type of document	
Contingency Plan	Use second source	

.

Table 1.5: Example of a Managerial Risk Assessment Matrix

Risk Event 2 (R2)	**Late delivery of test equipment**	
Probability	High 1/3 Past experience with provider demonstrated poor respect of schedule.	
Consequence to project	High	$110 000 (cost of securing optional test facility) Significant cost growth Significant schedule delays
Risk Assessment	High	$55 000 High (R > 25% of overall project value)
Mitigation Plan	Identify and secure equivalent equipment in immediate geographical region Ensure equipment will be available for needed timeframe Memo of understanding with facility key managers	
Response Plan	Secure equipment with MOU Confirm timeframe options with facility	

Table 1.6: Project Risk Profile Matrix

Probability	High			R2
	Medium			
	Low	R1		
		Low	Medium	High
		Consequence		

It is understood that a certain amount of technical and programmatic risk should be assumed. The extent to which higher technical and programmatic risks are acceptable depends upon how well they have been identified, defined, assessed, planned for, and managed once realized. If the technical and programmatic risks are poorly defined, or the risk mitigation is inadequately planned, then the score for the current evaluation criterion is likely to diminish.

1.7 Bid Appendices

1.7.1 Appendices Required with the Bid

The following items should be addressed in individual appendices as part of the bid:

a) List of Acronyms: All the acronyms used in Section I: Technical and Managerial Bid, should be explained;

b) Resumes: The bid should include resumes of the proposed resources and these should be appended to Section I: Technical and Managerial Bid;

c) Relevant Technical Papers Published by Team Members: Only literature that is relevant and that would be useful to support the bid;

d) List of Contacts: The list of contacts should be appended to Section I: Technical and Managerial Bid, in a format suitable for distribution and should include all the Bidder's points-of-contact involved in the bid development and/or during the Contract.

The following example format should be used:

Table 1.7: Bidder's List of Contacts

Role	Name	Telephone	Fax	E-Mail
Project Manager				
Project Engineers/Head Investigator				
Contractor's Representative				
Claims (Invoicing) Officer				
Communications (for press release)				
Other				

If possible, and for the Technical Authority ease of reference, the Bidder is also encouraged to include an electronic business card for each of the points-of-contact.

e) Additional Deliverables: The deliverables identified as required for proposal submission as described in Annex A, namely:

i) Project Management Plan (PMP): Its contents will be evaluated in evaluation criterion PROG03;

ii) Master Project Schedule: Its contents will be evaluated in evaluation criterion PROG03;

iii) Quality Assurance (QA) Plan: Its contents will be evaluated in evaluation criterion PA02.

ATTACHMENT 1 TO PART 4

MANDATORY AND POINT RATED EVALUATION CRITERIA

1. EVALUATION METHODOLOGY

1.1. EVALUATION USING MANDATORY CRITERIA

Proposals that are responsive after evaluating them according to mandatory criteria detailed at Appendix B will then be evaluated according to the point-rated criteria as specified in Appendix C. The criteria are grouped under the following categories:

- Technical;
- Product Assurance (PA); and
- Programmatic.

1.2. EVALUATION USING POINT-RATED CRITERIA

To be responsive, a proposal should get the minimum score requirements as indicated in Appendix C. The point-rated evaluation criteria defined in Appendix C are each supported by a set of a maximum of 5 benchmark statements (“0”, “A”, “B”, “C”, “D”) and corresponding relative values as displayed in Table 1. Some statements may not be available for some evaluation criteria. In such case, no benchmark statement is defined for these unavailable statements and the statement is greyed out in Appendix C.

Table 1: Point-Rated Evaluation Criteria Benchmark Statements and Relative Values

Statement	Relative Value
0	0% of maximum point rating
A	25% of maximum point rating
B	50% of maximum point rating
C	75% of maximum point rating
D	100% of maximum point rating

As an example, the maximum point rating for the “System Maintenance Approach” (TECH03) criterion is 21 points. If a proposal receives a “C” for this criterion in the evaluation process, the score attributed will be:

75% of 21 points = 15.75 points (score)

2. PROPOSAL SELECTION

2.1. CONTRACTOR SELECTION METHOD

The most appropriate contractor selection method for this particular RFP is deemed to be the selection on the basis of the highest combined rating of technical, PA and programmatic merit and price.

See Section 2.2 for more details on the points allocated to technical, PA and programmatic merit and price and how proposals will be sorted after evaluation.

2.2. EVALUATION RESULTS

As described in Section 1.2 and Section 2.1, responsive proposals will be ranked according to:

- Their overall score, which is obtained as the sum of the “Technical”, “PA” and “Programmatic” category scores from point-rated evaluation criteria for a total of 60%; and
- The cost for a total of 40%. Contract options are described in Annex A. It is important to emphasize that only the cost for the baseline (i.e. procurement of one transponder) + option 1 (i.e. procurement of a second transponder) will be taken into consideration in this evaluation process. The cost for all other options (i.e. dual-channel design, remote control of antenna polarizations, procurement of spares, extended warranty, maintenance contract during routine operations, etc.) will not be evaluated.

Proposals will then be ranked starting from the proposal with the highest overall score down to the lowest overall score resulting in a responsive proposals list.

3. APPENDICES

A. APPENDIX A – DEFINITIONS

The following list provides the definitions of terms used in the evaluation criteria presented in both Appendix B and Appendix C.

A.1 TYPES OF RATIONALE COMPLEMENTING THE COMPLIANCE STATEMENTS

Detailed substantiation (DET SUBST)

When a detailed substantiation is required, the bidder must include a concise yet sufficiently comprehensive demonstration of the compliance against the requirement with a sufficient level of details that will provide enough confidence to the evaluators that the requirement will be met. Cross-references to appropriate sections of the proposal should be provided when applicable and the essence of the referenced information should be summarized in the substantiation as required. It is expected that approximately half a page should be sufficient to make the bidder’s case against their compliance to the requirement.

In the case of partial compliance or non-compliance with a requirement, the bidder must provide details as to why they are not compliant with the requirement. When applicable, the bidder should provide an alternative to the requirement that would be satisfactory to preserve the system overall performance, either by performing an impact assessment or another means.

Reference in proposal to the compliance statement (REF PROP)

When a reference in the proposal to the compliance statement is required, the bidder must include cross references to appropriate sections of their proposal where the compliance to the requirement is stated.

A.2 DEFINITIONS OF "CREDIBLE", "NOT COMPLIANT", "PARTIALLY COMPLIANT" AND "COMPLIANT"

Credible

A statement, word, idea, or notion is credible if it is trustworthy, plausible, believable and substantiated or factual.

Not Compliant (NC)

The bidder is not compliant with a requirement when they are not capable of meeting the requirement as stated or has not demonstrated any capacity to meet the requirement.

Partially Compliant (PC)

The bidder is partially compliant with a requirement when they are capable of meeting only part(s) of the requirement as stated. Some aspects or parts of the requirement are met while others are not or the bidder has demonstrated their capacity to meet only a part of the requirement.

Compliant (C)

The bidder is compliant (or Fully Compliant (FC)) with a requirement when they have fully demonstrated their capacity to meet the requirement as stated without exceptions.

B. APPENDIX B – MANDATORY EVALUATION CRITERIA

Table 2 presents the mandatory evaluation criteria, which are the requirements for proposals to be considered responsive and eligible for evaluation against the point-rated evaluation criteria provided in Appendix C.

These criteria are deemed mandatory by CSA as the minimum necessary competence and capability for undertaking the work. Mandatory requirements are evaluated on a simple pass or fail basis and they will be evaluated very strictly as to compliancy. Therefore, no rating is associated with them.

.

Table 2: Mandatory Evaluation Criteria

#	Mandatory Evaluation Criteria	Description
Technical		
MAND01	**Mandatory Technical Requirements** This criterion assesses the degree to which the bidder intends to meet all the mandatory (M) technical requirements of the system identified in the Technical Requirements Compliance Matrix (See Attachment 1 to Part 3 for more details).	In order to demonstrate the criterion, the bidder must comply with all mandatory (M) technical requirements identified in the Technical Requirements Compliance Matrix provided in Attachment 1 to Part 3. The compliance statement must be accompanied by either: • A detailed substantiation; or • A reference in the proposal to the compliance statement. The bidder must use the Technical Requirements Compliance Matrix provided in Attachment to Part 3 to fill out their compliance to each mandatory (M) technical requirement. A definition of the different types of rationales to provide along with the compliance statement is available in Section A.1. *Note: The bidder must be compliant with every mandatory (M) technical requirement identified in the Technical Requirements Compliance Matrix. If at least one mandatory (M) technical requirement is not met, then the proposal will be considered as non responsive and not eligible for evaluation against the point-rated evaluation criteria provided in Appendix C.*

C. APPENDIX C – POINT-RATED EVALUATION CRITERIA

The maximum overall score for technical, PA and programmatic point-rated evaluation criteria as detailed in Section C.1 and Section C.2 and summarized in Table 3 is 300 points.

To be considered responsive and valid, a proposal shall have a total of a minimum of 210 points (70%) overall for the point-rated portion of the evaluation. A summary of the methodology used to evaluate proposals based on the point-rated criteria is provided in Table 3.

Table 3: Summary of Point-Rated Evaluation Criteria Evaluation Methodology

Overall Category Weight	Overall Category Name	Detailed Category Weight	Detailed Category Name	Detailed Category Passing Score	Evaluation Methodology Description	Criteria ID & Title	Criteria Individual %	Criteria Global %
50% (150 pts)	**TECHNICAL**	50% (75 pts)	Technical (Technical Requirements Compliance Matrix)	55% (42/75 pts)	Assessment of results of Technical Requirements Compliance Matrix. Each requirement will receive 0% of pts (Level 0), 50% of points (Level B) or 100% of points (Level D) of their designated weight in the matrix. See Section C.1 and Table 5 for more details.	TECH01: Technical Requirements Point-Rated Evaluation	100% (75/75 pts)	25% (75/300 pts)
		50% (75 pts)	Technical (other criteria)	55% (42/75 pts)	All point-rated criteria starting with prefix TECHXX except TECH01 (see above). Each criterion will be evaluated according to the benchmark statements for Level 0, Level A, Level B, Level C and Level D described in Table 6.	TECH02: Understanding the System Underlying Principle	48% (36/75 pts)	12% (36/300 pts)
						TECH03: System Maintenance Approach	28% (21/75 pts)	7% (21/300 pts)
						TECH04: Technical Methodology	24% (18/75 pts)	6% (18/300 pts)

Overall Category Weight	Overall Category Name	Detailed Category Weight	Detailed Category Name	Detailed Category Passing Score	Evaluation Methodology Description	Criteria ID & Title	Criteria Individual %	Criteria Global %
25% (75 pts)	**PA**	100% (75 pts)	PA	55% (41.25/75 pts)	All point-rated criteria starting with prefix PAXX. Each criterion will be evaluated according to the benchmark statements for Level 0, Level A, Level B, Level C and Level D described in Table 6.	PA01: Proposed Product Assurance (PA) Implementation	60% (45/75 pts)	15% (45/300 pts)
						PA02: Quality Assurance (QA) Methodology	40% (30/75 pts)	10% (30/300 pts)
25% (75 pts)	**PROGRAM MATIC**	100% (75 pts)	Programmatic	55% (41.25/75 pts)	All point-rated criteria starting with prefix PROGXX. Each criterion will be evaluated according to the benchmark statements for Level 0, Level A, Level B, Level C and Level D described in Table 6.	PROG01: Bidder's Experience	36% (27/75 pts)	9% (27/300 pts)
						PROG02: Team Expertise and Experience	28% (21/75 pts)	7% (21/300 pts)
						PROG03: Project Management Plan (PMP)	20% (15/75 pts)	5% (15/300 pts)
						PROG04: Risk Management	16% (12/75 pts)	4% (12/300 pts)

C.1 TECH01 - POINT-RATED CRITERION AGAINST TECHNICAL REQUIREMENTS COMPLIANCE MATRIX

TECH01 is evaluated differently than the other evaluation criteria described in Section C.2. The goal of this evaluation criterion is to make a detailed assessment of the technical solution proposed by the bidder by analyzing the compliance provided by the bidder on the non-mandatory (NM) technical requirements from the Technical Requirements Compliance Matrix provided in Attachment 1 to Part 3 and for which an excerpt is provided in Table 4. The requirements listed in this matrix are all defined in CSA-RC-RD-0010 Rev. A RCM and Multimission Precision Transponder Requirements Specification.

Table 4: Technical Requirements Compliance Matrix

Requirement ID	Requirement Title	Requirement Description	Mandatory (M) / Non-mandatory (NM)?	Weight (NM only)	Detailed substantiation (DET SUBST) or reference in proposal (REF PROP)
TXPD-OPER-0010	Design Lifetime	The Transponder System shall be designed for a lifetime of a minimum of 10 years, measured relative to the successful completion of the RCS characterization.	NM	5	DET SUBST
TXPD-OPER-0015	Design Lifetime	The Transponder System should be designed for a lifetime of a minimum of at least 15 years, measured relative to the successful completion of the RCS characterization.	NM	2	DET SUBST
TXPD-OPER-0020	Applicable Licensing Regulations	The Transponder Instrument radio-frequency emitter(s) shall conform to applicable licensing regulations.	M	-	REF PROP

Basically, each NM technical requirement defined in the Technical Requirements Compliance Matrix will be evaluated individually according to its designated weight value and the type of rationale required as a complement to the bidder's compliance statement (refer to Section A.1 for more details). The weight value for each NM technical requirement ranges from 1 (least important) to 5 (most important). The total number of points obtained from this assessment will be converted into an overall score and will count for the detailed category weight of TECH01 as specified in Table 3.

Each NM technical requirement defined in the Technical Requirements Compliance Matrix will be assessed according to the benchmark statements of Level 0 to Level D as described in Table 5. Refer to Table 1 for more details on the grade (maximum point rating) associated with each level and to Section A.2 for the definition of expressions like "credible", "not compliant", "partially compliant" and "compliant".

Table 5: Benchmark Statements for Point-Rated Evaluation Criterion TECH01

Level 0	Level B	Level D
[The bidder is not compliant (NC) with the technical requirement] or [the bidder is partially compliant (PC) with the technical requirement but the rationale is not provided or is not credible].	[The bidder has confirmed to be compliant (C) with the technical requirement but the rationale provided is not substantiated enough to be credible] or [the bidder is partially compliant (PC) with the technical requirement and the rationale is provided and is credible].	The bidder is compliant (C) with the technical requirement and the rationale is provided and is credible.

C.2 OTHER POINT-RATED CRITERIA AND BENCHMARK STATEMENTS

Evaluation criteria defined in Table 6 will be rated based on the specific statements provided for each level from Level 0 to Level D. Refer to Table 1 for more details on the grade (maximum point rating) associated with each level.

Table 6: Point-Rated Criteria and Benchmark Statements

#	Criterion	Level 0	Level A	Level B	Level C	Level D
Technical						
TECH02	**Understanding the System Underlying Principle** This criterion assesses	Does not understand the system underlying technical principles driving the project	Exhibits a limited understanding of the system underlying technical principles	Exhibits a general understanding of the system underlying technical principles	Adequately demonstrates understanding of the system technical principles relevant to the central goal of the required	Adequately demonstrates an exhaustive understanding of

.

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	the degree to which the bidder understands the system underlying technical principles through the description of the design proposed.	and the proposed system is not credible and not substantiated: proposal has no reference to existing literature and no previous relevant work.	and the proposed system lacks credibility and is partially substantiated: proposal has no credible reference to existing literature or no previous relevant work.	and the proposed system is credible and is partially substantiated: proposal includes references to existing literature and/or previous work that are limited in scope or relevance compared to the project.	system and the proposed system is credible and is fully substantiated: proposal includes credible references to existing literature and previous work relevant to the project.	the system technical principles and knowledge relevant to the central goal of the required system and the proposed system is credible and is fully substantiated: proposal includes credible references to existing literature and other previous work highly relevant to the project.
TECH03	**System Maintenance Approach** This criterion assesses the degree to which the bidder intends to ensure that the system delivered is maintainable, both for hardware and software components.	The system maintenance approach for both hardware and software components is not provided or measures to ensure maintainability of the system in order to maximize its lifetime are	The system maintenance approach for both hardware and software components is deemed inappropriate or measures to ensure maintainability of the system in order to maximize its lifetime are	The system maintenance approach for both hardware and software components is reasonable and not all measures to ensure maintainability of the system in order to maximize its lifetime are identified and/or credible.	The system maintenance approach for both hardware and software components is reasonable and all measures to ensure maintainability of the system in order to maximize its lifetime are identified, but all are not	The system maintenance approach for both hardware and software components is reasonable and all measures to ensure

.

#	Criterion	Level 0	Level A	Level B	Level C	Level D
		not identified nor credible to have the confidence that the proposed system will have a lifetime of more than 1 year (standard warranty).	not identified sufficiently or are not credible.		complete and/or credible.	maintainability of the system in order to maximize its lifetime are identified, complete and credible.
TECH04	**Technical Methodology** This criterion assesses the suggested technical methodology and its correlation with the work plan as presented in the proposal. It also evaluates the effectiveness of the described methodology in resolving the technical challenges, in attaining the stated technical objectives of the work, and in meeting technical requirements of CSA-RC-RD-0010 Rev. A RCM and Multimission Precision Transponder Requirements Specification.	The methodology described in the proposal does not demonstrate how it will address the technical objectives.	The methodology described in the proposal follows a weak methodical approach or the proposal is not well substantiated.	The methodology described in the proposal demonstrates a somewhat acceptable approach but the proposal does not substantiate the methodology being employed for achieving the technical objectives.	The methodology described in the proposal demonstrates a robust approach and the proposal partially substantiates the methodology being employed for achieving the technical objectives.	The methodology described in the proposal is based on state-of-the-art expertise and demonstrates a robust approach and the proposal substantiates the methodology being employed for achieving the technical objectives of the work, with clarity and thoroughness.

#	Criterion	Level 0	Level A	Level B	Level C	Level D
PA						
PA01	**Proposed Product Assurance (PA) Implementation** This criterion assesses the degree to which the bidder intends to meet all PA requirements described in CSA-RC-RD-0010 Rev. A RCM and Multimission Precision Transponder Requirements Specification.	Shows full compliance with less than 25% of the PA requirements. At least 50% of the requirement compliances are not substantiated.	Shows full compliance with no less than 25% of the PA requirements or shows no compliance with at least one of the PA requirements. At least one requirement compliance is not or poorly substantiated.	Shows full compliance with no less than 50% of the PA requirements and does not show no compliance with any of the PA requirements. Each requirement compliance is substantiated.	Shows full compliance with no less than 75% of the PA requirements and does not show no compliance with any of the PA requirements. Each requirement compliance is substantiated.	Shows full compliance with or exceeds 100% of the PA requirements. Each requirement compliance is substantiated.
PA02	**Quality Assurance (QA) Methodology** This criterion assesses the Quality Management System (QMS) (QA standards, QA processes, etc.) proposed by the bidder in its QA Plan against the requirements in Section 3.4 of CSA-RC-SOW-0005 Statement of Work (SOW) for the RCM and Multimission Precision Transponder.	The QA Plan does not show that the bidder has an established QMS required to conduct the work or the QA manager in the proposed team has no experience in similar projects and no credible backup for the QA manager is	The QMS presented in the QA Plan provides insufficient information to demonstrate compliance to less than 50% of the requirements in Section 3.4 of CSA-RC-SOW-0005 Statement of Work (SOW) for the RCM and Multimission Precision Transponder or the QA manager in the proposed team has almost no experience in	The QMS presented in the QA Plan provides insufficient information to demonstrate compliance to at least 50% of the requirements in Section 3.4 of CSA-RC-SOW-0005 Statement of Work (SOW) for the RCM and Multimission Precision Transponder or the QA manager in the proposed team has limited experience in similar projects and	The QMS presented in the QA Plan provides insufficient information to demonstrate compliance to at least 75% of the requirements in Section 3.4 of CSA-RC-SOW-0005 Statement of Work (SOW) for the RCM and Multimission Precision Transponder or the QA manager in the proposed team has some experience in similar projects and	The QMS presented in the QA Plan provides sufficient information to demonstrate compliance to all of the requirements in the SOW Section 3.4 of CSA-RC-SOW-0005 Statement of Work (SOW) for the RCM and Multimission Precision

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	This criterion also assesses the experience of the QA manager and his/her backup proposed.	proposed.	similar projects and no credible backup for the QA manager is proposed.	a backup for the QA manager is proposed, but the backup has limited experience in similar projects.	a backup for the QA manager is proposed and the backup has some experience in similar projects.	Transponder and the QA manager in the proposed team has significant experience in similar projects and a backup for the QA manager with similar experience is proposed.
Programmatic						
PROG01	**Bidder's Experience** This criterion assesses the bidder's experience and expertise in similar projects and how long the bidder has been actively in business related to the technology being procured. The bidder is asked to provide a description of previous similar or related projects along with references that will	The bidder has no expertise or experience in key technical fields required for the project and the bidder has no significant experience or expertise in similar projects (SAR signals, and precision transponder design and delivery).	The bidder has limited expertise or experience in key technical fields required for the project or the bidder has limited expertise or experience relevant to, or similar in complexity to, SAR signals and precision transponders design and delivery and the management of the	The bidder demonstrates to have expertise or experience in key technical fields required for the project and the bidder demonstrates to have experience, in the last 7 years, in the delivery of projects relevant to, or similar in complexity to, SAR signals and precision transponders design and delivery. Track record of budget and schedule performance is either not	The bidder demonstrates to have expertise or experience in key technical fields required for the project and the bidder demonstrates to have experience, in the last 7 years, in the delivery of projects relevant to, or similar in complexity to, SAR signals and precision transponders design and delivery. Track record of budget and schedule performance is presented, and includes on-time and in-budget	The bidder demonstrates to have expertise or experience in key technical fields required for the project and the bidder demonstrates to have experience, in the last 7 years, in the delivery of projects directly relevant to SAR

.

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	be able to provide information on past similar projects that the bidder conducted in the past. See Table 7. The key technical fields necessary to perform the work includes the following disciplines, which the bidder is expected to have a certain level of experience and expertise: • RF hardware design and construction; • Digital control hardware design and construction; • Real-time computing; • Computer-controlled systems with human interfaces. In addition, experience in projects involving the following areas, or areas of similar complexity, would contribute to establish the bidder's		projects conducted by the bidder depended more on the quality of the team assigned to the project rather than the bidder's established infrastructures and integrated processes for design and development.	presented, or not clearly proven and the management of the projects conducted by the bidder depended more on the quality of the team assigned to the project rather than the bidder's established infrastructures and integrated processes for design and development.	deliveries and the bidder has integrated processes and practices for design and development.	signals calibration and precision transponders design and delivery. Bidder has a repeated proven track record of successful budget and schedule performance. and the bidder has integrated processes and practices for design and development,

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	level of experience: • SAR signals; • Precision transponder design and delivery. In describing previous experience in similar projects, the bidder should emphasize on schedule and budget performance in project delivery					
PROG02	**Team Expertise and Experience** This criterion assesses the capability (education, knowledge, experience, expertise and complementarities) of the key resources assembled to carry out the work. The skills of the team should include those necessary to lead teams resident in different partner locations and through different	The team proposed is incomplete or key resources are lacking and the team members have very limited expertise in the key roles, team members have almost no experience in similar previous projects and there are limited credible backups for the team members, in terms of expertise or experience.	The team proposed is incomplete or key resources are lacking and some of the team members have expertise in some key roles, but have limited experience in similar previous projects and there are limited credible backups for the team members, in terms of expertise or experience.	The team proposed has the main key resources, with partial complementarities of skills of its members over the life of the project and some of the team members have expertise in some key roles, and/or have limited experience in similar previous projects and there are credible backups for key team members, in terms of expertise or experience.	The team proposed has the main key resources, with partial complementarities of skills of its members over the life of the project and most of the team members have expertise in key roles, and have experience in similar previous projects and there are credible backups for key team members, in terms of expertise or experience.	The team proposed has the main key resources, with complete complementarities of skills of its members over the life of the project and most of the team members have high level of expertise in key roles, and have experience in previous project

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	project phases (such as requirements analysis, design, manufacturing, testing, for example). Key technical fields necessary to perform the work are identified in criterion PROG01.					directly relevant to SAR signals calibration and precision transponders design and delivery and there are credible backups for key team members, in terms of expertise or experience.
PROG03	**Project Management Plan (PMP)** This criterion assesses if the Project Management Plan (PMP) provided in the bidder's proposal is credible (sufficient resources are allocated for the project, activity durations and activity flow are credible, level of details in the master project schedule is adequate, critical path is provided, adequate margins are identified,	The master project schedule is not providing sufficient details to consider it credible and/or there are not enough details provided by the bidder in the PMP because of the following reasons: • the level of resources is clearly insufficient to perform the work; • there are no assumptions	The master project schedule is minimally detailed and/or the level of details provided by the bidder in the PMP is insufficient because of the following reasons: • the level of resources doesn't seem sufficient to perform the work; • most of assumptions are not credible or	The master project schedule is less detailed than expected, minimally substantiated and minimally credible and/or the level of details provided by the bidder in the PMP is correct but the PMP is not totally as per the description of the evaluation criterion for at least one of the following reasons: • the level of resources doesn't seem sufficient to perform the work; • not all assumptions are credible or substantiated;	The master project schedule is well detailed, less substantiated and less credible and/or the PMP provided by the bidder is detailed but is not totally as per the description of the evaluation criterion for the following reason: some parts of the PMP and assumptions are less substantiated and credible and/or the ability to effectively deliver on the project requirements is	The master project schedule is very detailed, well substantiated, very credible and demonstrates that the bidder can meet the target delivery date and the PMP provided by the bidder is as per the description of the evaluation criterion and

#	Criterion	Level 0	Level A	Level B	Level C	Level D
	assumptions are credible and substantiated, control gate mechanisms are defined and mitigation approaches are provided). This criterion also assesses the PMP's effectiveness in directing the contract to a successful completion.	provided; • duration of activities is not credible; • flow of activities is not fully logical.	substantiated; • there are no schedule control mechanisms and no schedule mitigation approaches.	• there is a lack of schedule control mechanisms and/or schedule mitigation approaches.	demonstrated in the PMP, but is somewhat limited because of lack of details.	the ability to effectively deliver on the project requirements is clearly demonstrated in the PMP.
PROG04	**Risk Management** This criterion assesses how the bidder is able to identify and manage project risks. It also evaluates the effectiveness of the described methodology in resolving the project challenges and in successfully attaining the stated objectives of the work.	The bidder shows a clear lack of understanding of project risks, challenges and critical issues that may jeopardize the successful achievement of the technical and programmatic objectives or analysis of risk consequence and probability is not provided or no credible risk mitigations are provided.	Important project risks, challenges and critical issues that may jeopardize the successful achievement of the technical and programmatic objectives have not been identified and analysis of risk consequence and probability is not detailed enough to demonstrate its credibility and	Few project risks, challenges and critical issues that may jeopardize the successful achievement of the technical and programmatic objectives have not been identified and analysis of risk consequence and probability is detailed enough to demonstrate some credibility and some risk mitigations were provided, but lack of details to demonstrate they are proactive, credible and effective.	The bidder shows a good understanding of project risks, challenges and critical issues that may jeopardize the successful achievement of the technical and programmatic objectives and analysis of risk consequence and probability is detailed enough to demonstrate a good credibility and risk mitigations were provided for most risks, but are not completely proactive, credible and/or effective	The bidder shows a clear understanding of project risks, challenges and critical issues that may jeopardize the successful achievement of the technical and programmatic objectives and analysis of risk consequence and probability is detailed enough to

#	Criterion	Level 0	Level A	Level B	Level C	Level D
			only some risk mitigations were provided and only at high level.		and some decision points are identified.	demonstrate a strong credibility and proactive, credible and effective risk mitigations are provided for all risks and important decision points are identified.

As described in evaluation criterion PROG01, the bidder is requested to provide references that will enable CSA to get more information on similar projects that the bidder conducted in the past. The information to be provided for each reference must be in tabular format as presented in Table 7.

Table 7: Reference Table Template

Client Name	Point of Contact	Telephone Number	Email Address	Project Name and Timeframe

APPENDIX D – ACRONYMS

C	Compliant
CSA	Canadian Space Agency
FC	Fully Compliant
M	Mandatory
NC	Not Compliant
NM	Non-mandatory
PA	Product Assurance
PC	Partially Compliant
PMP	Project Management Plan
QA	Quality Assurance
QMS	Quality Management System
RCM	RADARSAT Constellation Mission
RF	Radio Frequency
RFP	Request for Proposal
SAR	Synthetic Aperture Radar
SOW	Statement of Work

ATTACHMENT 1 TO PART 5

FEDERAL CONTRACTORS PROGRAM FOR EMPLOYMENT EQUITY – CERTIFICATION

I, the Bidder, by submitting the present information to the Contracting Authority, certify that the information provided is true as of the date indicated below. The certifications provided to Canada are subject to verification at all times. I understand that Canada will declare a bid non-responsive, or will declare a contractor in default, if a certification is found to be untrue, whether during the bid evaluation period or during the contract period. Canada will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply with any request or requirement imposed by Canada may render the bid non-responsive or constitute a default under the Contract.

For further information on the Federal Contractors Program for Employment Equity visit Employment and Social Development Canada (ESDC)-Labour's website.

Date:_____(YYYY/MM/DD) (If left blank, the date will be deemed to be the bid solicitation closing date.)

Complete both A and B.

A. Check only one of the following:

( ) A1 The Bidder certifies having no work force in Canada.
( ) A2 The Bidder certifies being a public sector employer.
( ) A3 The Bidder certifies being a federally regulated employer being subject to the *Employment Equity Act*.
( ) A4 The Bidder certifies having a combined work force in Canada of less than 100 employees (combined work force includes: permanent full-time, permanent part-time and temporary employees [temporary employees only includes those who have worked 12 weeks or more during a calendar year and who are not full-time students).

A5. The Bidder has a combined workforce in Canada of 100 or more employees; and

( ) A5.1 The Bidder certifies already having a valid and current Agreement to Implement Employment Equity (AIEE) in place with ESDC-Labour.

OR

( ) A5.2 The Bidder certifies having submitted the Agreement to Implement Employment Equity (LAB1168) to ESDC-Labour. As this is a condition to contract award, proceed to completing the form Agreement to Implement Employment Equity (LAB1168), duly signing it, and transmit it to ESDC-Labour.

B. Check only one of the following:

( ) B1. The Bidder is not a Joint Venture.

OR

( ) B2. The Bidder is a Joint venture and each member of the Joint Venture must provide the Contracting Authority with a completed annex Federal Contractors Program for Employment Equity - Certification. (Refer to the Joint Venture section of the Standard Instructions).

CSA-RC-SOW-0005

ANNEX A - STATEMENT OF WORK

Canadian Space Agency

RADARSAT CONSTELLATION MISSION (RCM)

Statement of Work (SOW) for the RCM and Multimission Precision Transponder

Revision A

July 3, 2014

FOR CANADIAN SPACE AGENCY USE ONLY
This document and the information contained herein are not to be used for any purpose other than to accomplish Canadian Space Agency programs and projects whether they are completely Canadian initiatives or in cooperation with International Partners. The contents of this document are not to be disclosed or transferred in whole or in part, to any third party without the prior written consent of the Canadian Space Agency.

© HER MAJESTY THE QUEEN IN RIGHT OF CANADA 2014

Canadian Space Agency | Agence Spatiale Canadienne

This Page Intentionally Left Blank

PREFACE

This document and all changes to it shall be approved by the Canadian Space Agency (CSA)'s RCM GS GFE Project Manager. Proposed changes to the currently approved baselined version of this document shall be forwarded to the CSA Configuration Management (CM) Receipt Desk for evaluation and submission for approval. Approved changes shall be incorporated in the next revision.

Prepared by:	/s/ Marie-Hélène Cyr Marie-Hélène Cyr RCM GS GFE Project Engineer Space Utilization	2014-06-23 Date
Reviewed by:	/s/ Stéphane Côté Stéphane Côté RCM Data Quality Manager Space Utilization	2014-06-23 Date
Reviewed by:	/s/ Patrice Côté Patrice Côté RCM GS GFE Systems Engineer Space Science and Technology	2014-06-23 Date
Reviewed by:	/s/ Nicodemo Giurleo for Victor Chang Victor Chang Safety and Mission Assurance Manager Space Science and Technology	2014-06-27 Date
Approved by:	/s/ Réjean Fortier Réjean Fortier RCM GS GFE Project Manager Space Utilization	2014-06-27 Date

REVISION HISTORY

Rev.	Description	Initials	Date
Draft1	Draft1 For Transponder Development and Installation Request For Information (RFI)	MHC	November 13, 2013
Draft2	Draft2 Sent to translation for the Transponder Development and Installation Request For Proposal (RFP)	MHC	April 10, 2014
IR	Initial Release Released per the approval of Draft 3	MHC	May 15, 2014
A	Revision A Released per the approval of CSACR1334 that includes: • Various clarifications for the RFP; • Listing of all options to the procurement contract.	MHC	July 3, 2014

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 PROGRAM BACKGROUND

The RADARSAT Constellation Mission (RCM) is the evolution of the RADARSAT Program with the objective of ensuring all-weather day/night data and imagery continuity, improved operational use of Synthetic Aperture Radar (SAR), improved system reliability and a new series of applications enabled through the constellation approach. RCM is the third in the RADARSAT series of SAR-based Earth Observation missions following RADARSAT-1 and RADARSAT-2.

The three-satellite constellation will provide complete coverage of Canada's land and oceans offering an average daily revisit with a range of resolutions and beam modes, as well as daily access to 95% of the world to Canadian and International users. RCM will have three main uses:

- Maritime surveillance (ice, wind, oil pollution and ship monitoring);
- Disaster management (mitigation, warning, response and recovery); and
- Ecosystem monitoring (forestry, agriculture, wetlands and coastal change monitoring).

RCM is decomposed into two main segments: Space Segment and Ground Segment (GS). The RCM GS is comprised of a Primary Control Facility (PCF) and a Backup Control Facility (BCF) in Canada as well as access to facilities abroad in emergency situations. The GS is required to command and monitor the satellites for navigation and imaging, receive satellite telemetry, receive data from the satellites' payloads, and manage the data for users. The GS includes various subsystems both delivered by RCM Prime Contractor and by the Government of Canada as Government Furnished Equipement (GFE) items.

One of the GS subsystems to be delivered by RCM Prime Contractor is the Image Quality Subsystem (IQS) necessary to ensure the capability to calibrate the RCM satellites to ensure that RCM data can be regularly assessed for quality and performance.

1.2 PRECISION TRANSPONDER BACKGROUND

1.2.1 General Information

Precision transponders are automatic devices that, on schedule, receive the radar signal of a SAR satellite, which is then amplified and retransmitted as a calibrated response to the satellite, for evaluation of imaging performance through analysis of the visible instrument response. A transponder system is basically a controllable, calibrated active radar target which can also store signal data for further analysis. Transponder systems perform direct measurements of radiometric, polarimetric and geometric calibration parameters, and other measurements required to monitor SAR image quality performance: radiated power, SAR antenna azimuth pattern, radar pulse duration and power level, etc.

A calibration transponder system typically needs to execute three groups of functions, namely:

1. Measure specified attributes of the received signal on a pulse-by-pulse basis and report these after a satellite pass;
2. Generate synthetic target signals (suitable for SAR processing) of known cross section and transmit these to satellites for each radar pulse; and

3. Perform self-calibration functions and report results.

1.2.2 RCM Image Quality Recommendations

In light of an analysis conducted by a CSA calibration-validation team in 2012, three (3) recommendations were made concerning RCM image quality, namely:

1. RCM investment requires a proper absolute calibration process independent of changes and fluctuations of natural targets because natural targets, even the most stable ones, are known to be subjected to cycles, variations, changes in their backscatter absolute level, in some instances unexplained or unverified;
2. Because of RCM polarimetric capabilities, transponders for RCM require polarimetrically settable receive and transmit ports, with H, V as possible settings. The receive and transmit ports should be separate assemblies; and
3. Through the auspices of the RCM/Sentinel-1 Calibration Working Group, encourage mutual use of precision transponders. Upgrades to the control subsystems for Sentinel-1 and future RCM transponders should be endeavoured for leveraging efficient mutual use of calibration systems.

Scope was thus added to the IQS to include the possibility of utilizing precision transponders to provide active calibration capabilities based on the above recommendations. A precision transponder system will be delivered to the RCM Prime Contractor as a GFE for integration into the IQS.

Although a dedicated precision transponder system is required for RCM, recommendation 3 above puts a multi-mission requirement on the precision transponder system for RCM and shared use of the precision transponder system is thus expected between the RCM project and other SAR missions owned by CSA or CSA's international partners such as ESA with Sentinel-1.

1.3 PROJECT DESCRIPTION

CSA intends to replace its aging precision transponder systems with new systems as part of the development of the RCM GS development. In the context of the contract, new precision transponder systems for the following sites are being considered:

- St-Hubert (SHUB), Quebec, Canada; and
- (Option) Another location in Canada. For now, the Contractor shall assume that the location could be as far away from SHUB as Ottawa, Ontario, Canada. Other sites closer to SHUB are also being considered by the RCM Transponder Team. For the sake of clarity within this document, the location is indicated as "Ottawa (TBC)". The location will be confirmed by the RCM Transponder Team no later than the contract award.

The precision transponder system in SHUB, and (option) the precision transponder system in Ottawa (TBC), will be used as high precision active radar calibrators for the external characterization of the RCM SAR instrument.

Both sites listed above have existing infrastructure, for which a description is provided in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1], intended to be used for RCM and multimission transponder deployment.

1.4 SCOPE

The scope of this SOW includes:

- All the work by the Contractor planned for the design, development, manufacture, assembly, installation, testing, and support during the commissioning and routine operations phases of the RCM and multimission precision transponder systems; and
- A description of GFE items provided to the Contractor, such as installation sites, utility power, network capabilities, etc. These utilities will be available in existing shelters for indoor equipment that will be supplied by the Government of Canada (GoC) at each installation site.

1.5 DOCUMENT CONVENTIONS

This document is unclassified.

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

a) "Shall" is used to indicate a mandatory requirement;

b) "Should" indicates a preferred alternative but is not mandatory;

c) "May" indicates an option; and

d) "Will" indicates a statement of intention or fact, as does the use of present indicative active verbs.

These expressions are further clarified when followed by the phrases "be capable of" which indicates an intention for an automated or semi-automated activity, and "provide the capability of" which indicates an intention for human intervention in the activity.

The term "transponder" as used hereafter in this document refers to the RCM and multimission precision transponder.

1.6 ROLES & RESPONSIBILITIES

The Contractor is responsible for the overall execution of the work described in this SOW. CSA will provide the technical and programmatic requirements, interface definitions and will supervise the installation of the transponder system in SHUB and (option) the installation of a second transponder system in Ottawa (TBC).

CSA's role is to validate and verify RCM and multimission requirements associated with the transponder system in SHUB and (option) the transponder system in Ottawa (TBC) and confirm that the work has been carried out as specified in the SOW and accept the work and the deliverables. Any verification or validation done by CSA does not relieve the Contractor from meeting the contractual requirements.

1.6.1 Administrative Authorities

Engineering discussions and technical agreements do not constitute authority for change to this procurement, without proper written authorization as defined below.

Note that the "CSA" from the subgroup names defined below may or may not be used throughout this document when referring to one of these subgroups.

1.6.1.1 CSA RCM Transponder Team

The CSA RCM Transponder Team is composed of all people at CSA working on the transponder project. It includes all the subteams and the TA listed below.

1.6.1.2 PWGSC Contract Officer – CA

The PWGSC Contract Officer is the Contracting Authority (CA) for this contract. The CA authorizes changes to the contract, with the concurrence of the TA. Changes that impact contract cost or the SOW have to be done through the CA.

1.6.1.3 CSA RCM GFE Project Manager – TA

As part of a larger group called the CSA RCM Project Management Office (PMO), the CSA RCM GFE Project Manager is the Technical Authority (TA) for this contract. The TA is responsible for the management of the project on behalf of CSA and is the sole official representative of CSA to the Contractor throughout this contract. However, in this document, the term "TA" may include the TA and/or his/her representative within the CSA RCM PMO.

In general, the TA has approval authority of all deliverables of this contract. The TA has no authority to authorize changes to the deliverables. Changes to the deliverables can only be made through a contract amendment issued by the CA.

In the event of disagreements between the TA and the Contractor regarding any of the work described in this SOW, the issues will be brought up to the CSA RCM Project Manager to quickly resolve any disagreements and minimize any resulting impact.

1.6.1.4 CSA RCM Transponder Technical Team

The CSA RCM Transponder Technical Team is led by a lead systems engineer and is composed of other technical experts. It is responsible for all matters concerning the technical content of the work under this contract. Any proposed changes to the technical content shall be agreed with the CSA RCM Transponder Technical Team. However, it shall be noted that the CSA RCM Transponder Technical Team has no authority to authorize changes to the scope of work. Changes to the scope of work can only be made through a contract amendment issued by the CA.

1.6.1.5 CSA RCM Transponder Product Assurance (PA) Team

The CSA RCM Transponder Product Assurance (PA) Team is responsible for all matters concerning the PA content of the work under this contract. Any proposed changes to the PA content shall be agreed with the CSA RCM Transponder PA Team. However, it shall be noted that the CSA RCM Transponder PA Team has no authority to authorize changes to the scope of work. Changes to the scope of work can only be made through a contract amendment issued by the CA.

2 DOCUMENTS

The AD and RD listed below shall be provided to the Contractor as GFI.

2.1 APPLICABLE DOCUMENTS

The following documents at the issue and revision level as specified in the contract are applicable and form an integral part of this document to the extent specified herein.

Ref #	Document Number	Revision	Title
AD-1	CSA-RC-RD-0010	A	RCM and Multimission Precision Transponder Requirements Specification
AD-2	RCM-IC-53-4527	1/1	RCM Precision Transponder ICD
AD-3	ISO 9001:2008		Quality Management Systems - Requirements

2.2 REFERENCE DOCUMENTS

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

Ref #	Document Number	Revision	Title
RD-1	CSA-SE-STD-0001	A	Systems Engineering Technical Reviews Standard
RD-2	CSA-SE-STD-0003	IR	CSA Software Coding Standards
RD-3	CSA-SE-PR-0001	B	Systems Engineering Methods and Practices
RD-4	IEEE 12207.0	N/A	IEEE Standard for Information Technology - Software Life Cycle Processes
RD-5	MIL-STD-498	N/A	Military Standard: Software Development and Documentation
RD-6	MIL-HDBK-217	F	Military Handbook: Reliability Prediction of Electronic Equipment
RD-7	MIL-HDBK-781	A	Military Handbook: Reliability Test Methods, Plans, and Environments for Engineering, Development Qualification, and Production
RD-8	N/A	N/A	Nonelectronic Parts Reliability Data (NPRD)
RD-9	RS2CSA-ML0007	IR	Dome Scheduler User Manual

2.3 DOCUMENT PRECEDENCE

In the event of a conflict between this document and other applicable documents, the following order of document precedence is applicable.

a) Transponder contract;

b) SOW for the RCM and Multimission Precision Transponder (this document);

c) RCM and Multimission Precision Transponder Requirements Specification [Document AD-1]; and

d) Contractor's proposal.

The Contractor shall notify the TA of any document conflicts.

3 WORK REQUIREMENTS

3.1 GENERAL REQUIREMENTS

The Contractor shall provide, either directly or through subcontracts, all facilities, personnel, equipment, materials and services necessary to perform the work specified in this SOW.

The Contractor shall design and manufacture one (1) precision transponder system compliant with the requirements described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and functioning properly at the PCF in SHUB according to the requirements stated in this SOW.

The SHUB installation site infrastructure is described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and its GFE components are listed in Table 5-1.

(Option) The Contractor may be asked to manufacture one (1) additional precision transponder system compliant with the requirements described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and functioning properly at the Ottawa (TBC) installation site according to the requirements stated in this SOW. Refer to Section 3.3.3 for the timeframe when the confirmation to exercise this option or not will be provided to the Contractor.

The Ottawa (TBC) installation site infrastructure is described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and its GFE components are listed in Table 5-1.

3.1.1 Language

All documentation (generic documents, technical documents, change requests, change notices, RFDs, RFWs, reports, minutes of meeting, manuals, etc.) written by the Contractor shall be in English.

The RCM Transponder Team shall be granted the right to translate, reproduce and use all documentation.

All operator displays shall be in English.

3.1.2 Units

The Contractor shall use System International (SI) units. Where SI units are not used, the Contractor shall supply a conversion factors table for all non-SI units used in the deliverable documents.

3.1.3 End Item Deliverables

As listed in Appendix A, the Contractor shall package and deliver end items developed under the contract including:

- All hardware developed or procured to meet the requirements of the contract;
- An electronic copy of all software generated or procured to meet the requirements of the contract, including the source code of the Contractor's written software; and

- An electronic copy of all documentation generated or procured to meet the requirements of the contract as a minimum in their native format.

3.1.3.1 Hardware Deliverables

Refer to Appendix A.1 for more information.

Hardware deliverables shall meet the technical requirements described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].

3.1.3.2 Software Deliverables

Refer to Appendix A.2 for more information.

Software deliverables shall meet the technical requirements described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].

Firmware shall be considered as a software component.

All software shall be developed in accordance with the requirements described in Section 3.4.1.1 of this document.

All software shall be delivered on media that is directly compatible with the delivered hardware. For each transponder system delivered:

- One set of software shall be installed on the delivered hardware;
- Another set of software shall be installed on a redundant computer unit acting as a spare unit for the delivered hardware; and
- A third set shall be supplied on a CD-ROM or DVD.

The Contractor shall provide documentation on all software used in the system from both the operational and maintenance points-of-view. The Contractor shall develop and deliver the Software Version Description Document (VDD) (CDRL EN-12) as specified in Appendix A.3.

3.1.3.2.1 Contractor's Written Software

The Contractor's (or subcontractor's if applicable) written custom software shall consist of fully commented source code and executable files, coded in the specified high-level language. It shall also include source files, compiled files, configuration and parameter files, software environment, reloadable Field Programmable Gate Array (FPGA) configuration files and the command files (SW-1) necessary to compile, build and run these programs for third party modification of the software.

Any additional software developed under this contract to test, debug and verify the system and its performance shall be delivered, and shall include fully documented and commented software source files.

3.1.3.2.2 COTS Purchased Software

The Contractor shall deliver all software purchased, whether to provide the required functionality or to support development, to the RCM Transponder Team. It shall include purchased compilers, libraries, utilities and documentation as supplied by the vendor and supplemented by the Contractor.

All third party software shall be accompanied by a license that allows the software to be archived and copied as necessary for all future operations with the transponders.

The Contractor shall either supply or transfer licenses to the TA at the completion of the contract that allows the use the software for at least one (1) year following the project closeout meeting.

Whenever possible, all software source code (including microcode if any) listings shall be delivered on computer compatible media acceptable to the RCM Transponder Team.

3.1.3.3 Document Deliverables

The Contractor shall prepare and deliver the documents or review data packages (CDRLs PM-8, PM-9 and PM-10) requested in Appendix A.3 in accordance with the relevant DIDs from Appendix B. Copy protection shall not be used in any documentation.

The Contractor shall consider implementation of changes suggested by the RCM Transponder Team if the changes are in accordance with the relevant DID in Appendix B and this SOW.

The Contractor may propose to combine documents called by more than one CDRL into one (1) document, but this is subject to prior approval from the RCM Transponder Team. Where this approval is granted, the document cover page shall list all the CDRL numbers that are covered by this document.

Document deliverables are either submitted for approval (see Section 3.1.3.3.1) or for review (see Section 3.1.3.3.2).

For any document deliverable, the Contractor shall accept Review Item Discrepancies (RIDs) from the RCM Transponder Team to convey feedback against a given review or approval item. The Contractor shall provide an electronic template for RIDs. The Contractor shall maintain a RID database containing as a minimum the RID description, disposition and closure details. A complete RID process is described in the CSA SE Technical Reviews Standard [Document RD-1] as a reference.

The Contractor shall perform documentation configuration control and follow a internal systematic review cycle for document deliverables as described in the Project Management Plan (PMP) (CDRL PM-1) (see Section 3.2.1).

The delivery schedule for all documentation is defined in Appendix A.3. Where multiple deliveries of the same document are called (for example, at PDR and CDR), a subsequent delivery may be satisfied by a statement indicating that the previous issue of the document still applies (referenced by title, document number and issue), if this is the case.

3.1.3.3.1 Documents Delivered for Approval

The term “Approval” as used in this document and in other documents referred to herein means written approval by the TA, of documents submitted by the Contractor. Once approved, the document is authorized for further use by the RCM Transponder Team. The RCM Transponder Team does not take responsibility for the validity of the data, or statements, and the Contractor is fully responsible for the content and secondary effects derived therefrom.

Documents shall not be changed without the TA’s approval. No request or document for which approval is required shall be acted upon or implemented by the Contractor until such approval is provided. Such requests and documents will be reviewed promptly by the RCM Transponder

Team and the necessary written approval or disapproval will be provided after their receipt by the TA. In the event of a failure by the TA to approve or disapprove the document within fifteen (15) working days, the documents may be deemed approved.

In the event that a request or document is disapproved, the RCM Transponder Team will advise the Contractor in writing as to the reasons for such disapproval and will define the additions, deletions or corrections that the RCM Transponder Team deems necessary to render the request or document acceptable. Disapproved requests or documents that are subsequently amended by the Contractor and resubmitted for approval will be either approved or disapproved by the TA. Approval or disapproval of resubmitted requests or documents will be based solely on those points that were not previously deemed to be acceptable.

3.1.3.3.2 Documents Delivered for Review

The term "Review" as used in this document and in all other documents referred to herein means, unless specifically stated otherwise, an RCM Transponder Team review of the documents submitted for that purpose by the Contractor. The acceptance by the TA of a document for review implies that the document has been reviewed, commented on, revised as necessary, and has been determined to meet the requirements. The RCM Transponder Team does not take responsibility for the validity of the data or statements, and the Contractor is fully responsible for the content and secondary effects derived therefrom.

If written notification of concurrence is not provided by the TA within fifteen (15) working days of the receipt of the document, the document must be deemed to have been reviewed and accepted by the RCM Transponder Team without comment.

In the event that the TA does not concur with a document submitted for review, the TA will so notify the Contractor within fifteen (15) working days of the document submission. Such notification will include a full explanation of the reasons for the lack of concurrence and will recommend the additions, deletions and/or corrections, which the RCM Transponder Team deems are beneficial to the project.

3.2 PROJECT MANAGEMENT

The Contractor shall manage the project by establishing and maintaining a project management control to effectively achieve project performance, cost, scope, quality, potential risk issues and schedule requirements of this SOW.

The Contractor shall provide the management, technical leadership, and support necessary to ensure effective and efficient performance of all Contractor efforts and activities under the contract. The Contractor shall dedicate experienced personnel to the project in all the disciplines required to carry out the work.

The Contractor personnel shall establish and maintain a close management and technical interface with the RCM Transponder Team to assure a coordinated effort to meet or exceed the contract objectives.

The Contractor shall include, within its project management structure, the necessary leadership to effectively manage the performance of subcontractors if applicable in keeping with the contract objectives.

3.2.1 Project Management Plan (PMP)

The Contractor shall implement the Project Management Plan (PMP) (CDRL PM-1) and deliver it as per the information contained in Appendix A.3.

As a minimum, each element listed in the preparation instructions of the PMP DID from Appendix B shall be addressed.

The PMP will be discussed and reviewed at the Kick-off Meeting (KOM).

The approved PMP shall be the official document by which the Contractor will manage and control the project.

3.2.2 Contractor's Project Manager (PM)

The Contractor shall appoint a Project Manager (PM) for the purpose of managing and controlling the work. The function of the Contractor's PM is to run the project and be responsible for successful delivery of the transponder system in SHUB and (option) the transponder system in Ottawa (TBC) on schedule, within budget and in compliance with CSA's technical, quality and performance requirements.

The Contractor's PM shall possess all the qualifications and experience needed to lead the Contractor's work and take responsibility for all aspects of the work carried out by the Contractor throughout the duration of the contract and in accordance with the terms of the contract. The Contractor's PM shall have full access to the Contractor's senior management for timely resolution of all issues affecting the contract.

The same controls and requirements placed on the Contractor's PM should also be applicable to all major subcontractors (if applicable).

3.2.3 Schedule Management and Reporting

The Contractor shall maintain and implement the master project schedule (CDRL PM-2) submitted with their proposal. The master project schedule (CDRL PM-2) shall include key activities, milestones and dependencies from and between lower-level subcontractor schedules (if applicable).

Milestones dictated by technical reviews listed in Table 3-2 shall also be included in the master project schedule (CDRL PM-2) as well as the dates and duration of the following events in order to demonstrate the required dates for the delivery of the GFE items described in Table 5-1:

- Contract award;
- Test with the transponder system data at the factory;
- Installation of the transponder system in SHUB and (option) installation of the transponder system in Ottawa (TBC);
- Interface compatibility test with the IQS in SHUB; and
- Tests performed with real satellite signals, such as RADARSAT-2.

The Contractor shall build the master project schedule (CDRL PM-2) in a way that critical path is comprehensible and that activities are clearly leading to the delivery of a tangible transponder system.

The level of detail of activities shall be commensurate with the criticality or importance of the activities.

The Contractor shall manage their lower-level subcontractor schedules (if applicable) with the milestones contained in the master project schedule (CDRL PM-2). As a minimum, the master project schedule (CDRL PM-2) shall keep track of schedule baselines, as well as dependencies between activities, critical path, progression of activities and milestones completion up to the completion of the project.

The master project schedule (CDRL PM-2) shall be provided in its native tool format, Microsoft Project 2010 or earlier, as well as in PDF.

Tasks that are not related to any specific deliverable, such as project management and quality assurance activities, may be grouped separately from the groups of deliverables, and may be shown at the top of the chart.

Activities may be identified to a specific Work Breakdown Structure (WBS) element.

3.2.4 Risk Management

The Contractor shall manage project risks according to the risk management approach described in the PMP (CDRL PM-1).

The Contractor shall implement and present at the KOM a risk management process supporting identification and assessment of risks that may impact cost, schedule, programmatic and technical performance and the development of appropriate risk response/risk mitigation plans. The risk management process shall consist of risk management planning, risk identification and assessment, risk response planning and risk tracking, monitoring and control.

The Contractor shall assess and report the status of each risk element, including new risks, in the monthly progress reports (CDRL PM-3) and during Progress Review Meetings (PRMs) (see Section 3.3.1.3).

The Contractor shall maintain a risk database to raise, track and record the resolution of transponder risks found over the course of the work. The Contractor may use its own format for the risk database. The Contractor shall deliver the risk database at the end of the project in an electronic format, ideally embedded in the last monthly progress report (CDRL PM-3) delivered to the TA.

3.2.5 Progress Reports

The Contractor shall send progress reports (CDRL PM-3) to the TA by email starting one (1) month after contract award and continuing until project completion, at the rate of one every month and no later than 10 working days after the end of the month covered by the report.

All problems and proposed solutions reported in the progress reports shall be listed and retained on the list until satisfactory solutions are obtained.

3.2.6 Intellectual Property (IP) Management

The Contractor shall manage the inventory of all Crown property to be produced and/or acquired by the Contractor and any of its subcontractors if any under this project. Crown property shall be documented in the Crown Assets List (CDRL PM-11).

The Contractor shall mark or identify any proprietary information delivered to the TA in accordance with the instructions contained in the contract.

The Contractor shall maintain the Background Intellectual Property (BIP) and Foreground Intellectual Property (FIP) Report (CDRL PM-12) through the project and deliver the report as specified in Appendix A.3.

3.2.7 Reviews and Meetings

3.2.7.1 General

A number of specific reviews and meetings are considered critical by the RCM Transponder Team and shall be a basic requirement for the project. These reviews and meetings, including their proposed timeframe, are later described in Table 3-2 and in Section 3.3.1. The Contractor shall notify and invite the RCM Transponder Team to participate in technical and programmatic reviews and meetings.

Additional ad hoc meetings may be scheduled as deemed necessary by the Contractor or the RCM Transponder Team, such as ad hoc teleconferences between the Contractor and the RCM Transponder Team to discuss unforeseen, urgent and short-term issues affecting the project. The selection of participants will depend on the nature of the issue. The Contractor shall participate, either in person or via teleconference, to any ad hoc meetings requested by the RCM Transponder Team.

Representatives of the RCM Transponder Team may attend these meetings, or other organizations nominated by the RCM Transponder Team.

3.2.7.1.1 Meeting Agenda

The Contractor shall deliver a meeting agenda (CDRL PM-4) for all meetings (technical and programmatic), including teleconferences, to the TA no later than ten (10) working days before review meetings and at least one (1) day before teleconferences and other ad hoc meetings.

3.2.7.1.2 Minutes of Meeting

The Contractor shall be responsible for taking the minutes (CDRL PM-5) at all meeting (technical and programmatic) including teleconferences. Any document, presentation or other documentation that has been used during the meeting, shall be included as annexes.

Minutes shall primarily report decisions, the summary of discussions and Action Items (AIs).

The Contractor shall deliver the minutes to the TA within 10 working days from the date of review meetings and the next business day for teleconferences. The RCM Transponder Team will have 5 working days to review and approve the minutes. The meeting minutes will be used to provide a record of discussion and document the progress of the project.

3.2.7.1.3 Action Item (AI) Log

The Contractor shall maintain a detailed AI log throughout the project to track actions resulting from all reviews and meetings, including teleconferences, where the RCM Transponder Team is a participant. The Contractor shall include and update the AI log within the progress report (CDRL PM-3).

Closed-out AIs shall not be deleted from the AI log for history keeping. However, closed-out AIs will not formally be reviewed at every meeting.

The structure of the AI log will be approved at the KOM.

The AI log shall be updated each time a new AI is created during meetings and delivered at the completion of the project as part of the last progress report (CDRL PM-3).

3.2.7.1.4 Issues Database

The Contractor shall maintain an issues database to raise, track and record the resolution of issues found over the course of the work. The Contractor may use its own format for the issues database. The Contractor shall report status of relevant issues at key milestones and in progress reports (CDRL PM-3) as necessary.

The Contractor shall provide access to the issues database to the RCM Transponder Team for information.

3.3 SYSTEMS ENGINEERING

3.3.1 Technical Reviews – General

As specified in Table 3-1, the Contractor shall nominally deliver CDRL items associated with a review as listed in Appendix A.3 at least fifteen (15) working days prior to the review, unless otherwise specified and agreed by the TA when circumstances justify a deviation from the 15-working-day restriction on the delivery of CDRLs, such as considerable impact on the master project schedule (CDRL PM-2) or costs.

The Contractor should discuss with the TA the timing of any technical review. The Contractor should confirm to the TA such date, as well as duration and location of the review, at least two weeks in advance.

The SRR, PDR and CDR shall be conducted in the manner and sequence defined by Table 3-1.

TABLE 3-1: FORMAL REVIEW PROCESS

Timeframe	Activity
Deadline: 15 working days prior to review	The Contractor submits documents. A deviation from the 15-working-day deadline may be accepted if agreed by the TA (see Section 3.3.1). Document versions shall be as per the CDRL listed in Appendix A.3.
15 working days prior to the review	The RCM Transponder Team reviews documents, determines whether the documents are satisfactory, requests actions from the Contractor if necessary and delays the review if necessary. The RCM Transponder Team submits Review Item Discrepancies (RIDs) as they are generated. The deadline for the RCM Transponder Team to submit RIDs is up to 5 working days prior to the review. The Contractor prepares RID responses in parallel. The Contractor supports ad hoc question and answer sessions from the RCM Transponder Team, whose goal is to resolve issues without the need for a formal RID.

Timeframe	Activity
	The TA determines whether the entry criteria have been met and requests actions from the Contractor if necessary.
Duration: 1-2 days	Review is held. The Contractor conducts the review, summarizing status. The RCM Transponder Team may raise additional RIDs during the review based on discussions held at the review. The Contractor proposes RID dispositions for discussion. As a goal, all RIDs should have dispositions agreed at this meeting. At the end of the meeting, the review board convenes to decide on whether the exit conditions of the review have been achieved (per the exit criteria), considering the number and severity of the RIDs. If necessary, additional meetings may be planned for resolution of outstanding RIDs. In this case the review board is delayed until all RID closures are agreed.
Duration agreed during the review, on a RID basis	The Contractor submits documents implementing RID dispositions; these revised documents shall be released versions of one revision higher.

The Contractor and the RCM Transponder Team shall participate in a joint review board to determine the success of technical reviews. The joint review board will be co-chaired by the RCM Transponder Team and the Contractor and the decision on the success of technical reviews will be made by the RCM Transponder Team based on the review of the exit criteria. The entry criteria, specific objectives and exit criteria for each technical reviews shall be in accordance with Table 3-2.

To help develop the Technical Review Plan (CDRL PM-6) and the Technical Review Presentation (CDRL PM-7) for each technical review, the Contractor should take the pertinent specific entry and exit criteria, as well as specific objectives, from the CSA SE Technical Reviews Standard [Document RD-1] to adapt them to the scope of the project to efficiently conduct the technical reviews. A technical review plan template is also available in the CSA SE Technical Reviews Standard [Document RD-1].

Each Technical Review Plan (CDRL PM-6) and each Technical Review Presentation (CDRL PM-7) will be reviewed by the RCM Transponder Team and the entry and exit criteria, as well as objectives proposed by the Contractor for each technical review, will be agreed upon between the TA and the Contractor before the technical review.

The following requirements, as described in the CSA SE Technical Reviews Standard [Document RD-1], are applicable to any technical review to be conducted throughout the project. Specific entry and exit criteria as well as objectives for each technical review are also available in the CSA SE Technical Reviews Standard [Document RD-1].

3.3.1.1.1 Technical Review Entry Criteria

Refer to Section 3.3.1 for general guidelines on how to define entry criteria for technical reviews.

The following are the requirements that shall be met before a technical review can be confirmed and started ("entry criteria"):

1. A list of participants whose presence is mandatory to hold the review shall be established and agreed with the TA (additional people may attend but their presence is not mandatory);
2. The Technical Review Plan (CDRL PM-6) and agenda (CDRL PM-4) have been agreed with the TA and distributed to all attendees;
3. AIs from previous reviews are completed and RIDs from previous reviews are closed (residual RIDs may be rolled over into new RIDs at the current review);
4. For phase-ending reviews, all of the work required by the SOW for the applicable phase has been completed, except for the review itself;
5. All documents identified as required for the technical review have been placed under configuration control, have been delivered within the period stipulated in the SOW and in accordance with the DID;
6. The Technical Review Presentation (CDRL PM-7) addresses all the review objectives;
7. Any regulations that might affect the preparation and execution of the review, such as the International Traffic in Arms Regulations (ITAR) and Controlled Goods Registration Program (CGRP), have been complied to such that the review can be held; and
8. Technical criteria for a successful review have been defined from a review of the technical objectives. The technical objectives for each review are defined in Table 3-2.

If the TA determines that entry criteria for a specific technical review to be held are not fulfilled or that the deliverables submitted are incomplete or insufficient to perform a quality review, then the TA will propose to the Contractor:

- To take the necessary corrective actions before the review; or
- Exceptionally, to postpone the review.

3.3.1.1.2 Technical Review Exit Criteria

Refer to Section 3.3.1 for general guidelines on how to define exit criteria for technical reviews.

The following are the requirements that shall be met before a technical review can be completed ("exit criteria"):

1. All objectives of the technical review have been achieved;
2. All RIDs have a disposition agreed with the RCM Transponder Team and its project partners;
3. AIs (if any) have clear descriptions, actionees and due dates with the concurrence of the RCM Transponder Team; and
4. A forward plan or equivalent has been defined.

3.3.1.1.3 Technical Review Objectives

Refer to Section 3.3.1 for general guidelines on how to define objectives for technical reviews.

3.3.1.2 Kick-off Meeting (KOM)

At the beginning of the contract, the KOM is the first meeting to be scheduled. The objectives of the KOM are listed in Table 3-2. Exceptionally since the KOM is held very early in the contract, the KOM data package (CDRL PM-10), including the presentation, may be delivered up to one (1) week before the KOM.

This meeting will be chaired by the TA. All of the Contractor's key project staff, including one representative from each major subcontractor if applicable, shall attend.

In addition to the objectives listed in Table 3-2, the following items shall also be discussed during the KOM, as a minimum:

- Introduction of the Contractor and its resource allocation including subcontractors to be engaged for specialized tasks if applicable;
- Identify and initialize key parameters for the success of the project;
- Validate the Contractor's assumptions for the contract;
- Review the requirements of the work and deliverables;
- Structure of risk item log, AI log and agenda for the quarterly PRMs; and
- Identify risk items.

3.3.1.3 Progress Review Meetings (PRMs)

The Contractor shall conduct quarterly Progress Review Meetings (PRMs) with the RCM Transponder Team by teleconference, videoconference or other internet enabled means. The duration of the PRMs shall be nominally one (1) to two (2) hours. The Contractor shall prepare and manage the PRMs as any other meeting (preparation of agenda, production of minutes of meetings and maintenance of AI log).

The agenda for the quarterly PRMs shall be recurring and be jointly agreed by the Contractor and the RCM Transponder Team at the KOM. The intent of these PRMs, in general, is to exchange information, to resolve issues and to review the contents of the monthly progress reports (CDRL PM-3) delivered during the quarter.

The quarterly PRMs shall be held one (1) week after the release of the last corresponding progress report (CDRL PM-3) of the three-month period ending the quarter.

The Contractor shall schedule additional PRMs in the following situations:

- During Work Phase 1 (refer to Section 3.3.3), when the period between technical reviews such as the SRR, PDR and CDR is shorter than a quarter; as a guideline, a PRM should be held at mid-point during the period between technical reviews; and
- When significant problems arise from the progress reports (CDRL PM-3), if requested by the RCM Transponder Team.

3.3.1.4 Technical Teleconferences

If necessary, the Contractor may schedule ad hoc and/or recurrent technical teleconferences with the RCM Transponder Team at a time jointly agreed by the Contractor and the RCM Transponder Team to discuss technical issues as specified in Section 3.2.7.1.

3.3.1.4.1 Working Group Meetings

The Contractor and the RCM Transponder Team should set up a joint working group to establish in detail the requirements and implementation of the user interface to the transponder system especially with regard to the amount of historical data that shall be retained and the comparative analysis required on this data.

The precise timeframe for the working group meetings, assumed to be held via teleconference, shall be scheduled at a time jointly agreed by the Contractor and the RCM Transponder Team.

3.3.1.5 Project Closeout Meeting

The intent of the project closeout meeting is to discuss the following:

- Any and all outstanding contract issues;
- Confirm the compliance with the contract and technical requirements; and
- Confirm the completion of the project, also confirming the beginning of the warranty and technical support period for the transponder system delivered.

TABLE 3-2: TECHNICAL REVIEWS

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
1.	Kick-off Meeting (KOM)	Contractor's facility or SHUB or Teleconference (TBC)	Contract Award + 3 weeks	Contract is signed. KOM CDRLs are released.	Meet with the RCM Transponder Team. Address contractual and any other outstanding issues. Clarify system requirements. Clarify any outstanding items in the contract proposal and its relation to the requirements. Review the Contractor's PMP (CDRL PM-1), master project schedule (CDRL PM-2) and QAP (CDRL PA-1). Outline and review the high-level transponder development plan as proposed by the Contractor. Confirm that the project is ready to proceed with the requirements analysis and design phase (Work Phase 1 (see Section 3.3.3)).	The Contractor's PMP (CDRL PM-1), master project schedule (CDRL PM-2) and QAP (CDRL PA-1) are approved by the RCM Transponder Team.
2.	System Requirements Review (SRR)	Contractor's facility (teleconference for those from SHUB who will not travel)	TBD by Contractor's master project schedule (CDRL PM-2)	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Demonstrate the validity of the system requirements and the project readiness to proceed with the preliminary design. Discuss Contractor's comments on the RCM Precision Transponder ICD [Document AD-2].	See Section 3.3.1.1.2.
3.	Preliminary Design Review (PDR)	Contractor's facility (teleconference for those from SHUB who will not travel)	TBD by Contractor's master project schedule (CDRL PM-2)	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Demonstrate that the preliminary design meets all the requirements and is feasible within the cost and schedule constraints, and that the project is ready to proceed with the detailed design. Confirm definition of hardware and software components to, at least, block-diagram level.	See Section 3.3.1.1.2.
4.	Technical Interchange Meeting 1	Contractor's facility	CDR - 2 months	IQS PDR held with RCM	Provide details to the Contractor on the	The RCM Prime

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
	(TIM1)	(teleconference for those from SHUB who will not travel)	Exact timeframe TBD by Contractor's master project schedule (CDRL PM-2)	Prime Contractor. RCM Precision Transponder ICD [Document AD-2] is up to date.	interface between the IQS and the transponder system defined between the RCM Transponder Team and the RCM Prime Contractor. Provide utilities (power, network, etc.) specifications required at the installation site in SHUB and (option) installation site in Ottawa (TBC).	Contractor, the RCM Transponder Team and the Contractor all have the same understanding of the interface between the IQS and the transponder system.
5.	Critical Design Review (CDR)	SHUB (teleconference for those from the Contractor's facility who will not travel)	TBD by Contractor's master project schedule (CDRL PM-2)	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Demonstrate that the final detailed design will meet all requirements and is feasible within the cost and schedule constraints, and that the project is ready to proceed with the MAIT phase (Work Phase 2 (see Section 3.3.4)). Present hardware design at the schematic diagram and component layout level and the software design at the algorithm and flowchart level.	See Section 3.3.1.1.2.
6.	Technical Interchange Meeting 2 (TIM2)	Teleconference	During MAIT phase (Work Phase 2 (see Section 3.3.4)) Exact timeframe TBD by Contractor's master project schedule (CDRL PM-2)	Manufacturing and assembly ongoing.	Plan tests to perform on the system and define the steps leading to full system integration.	Tests and steps leading to full system integration are defined.
7.	Factory Acceptance Test (FAT) Readiness Review	Contractor's facility (teleconference for those from the RCM Transponder Team who will not travel)	FAT – 1 week	See Section 3.3.1.1.1. Factory IV&T and system testing is complete and documented. Software is configuration controlled. Test software has been verified and validated and is configuration controlled. As-built and as-designed hardware configurations	See Section 3.3.1.1.3. Review the FAT Procedure (CDRL EN-16) in order to maximize the changes of having the system produced at factory is in condition to pass the FAT.	See Section 3.3.1.1.2. Requirement verifications planned to be performed at FAT are accepted.

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
				are reconciled.		
8.	Factory Acceptance Test (FAT)	Contractor's facility	TBD by Contractor's master project schedule (CDRL PM-2)	MAIT of transponder system for SHUB and (option) of transponder system for Ottawa (TBC) is completed and ready for formal verification. SHUB site and (option) Ottawa (TBC) site are ready to start on-site installation. Team and logistics preparation activities are completed.	Prove that the system produced at factory has been manufactured properly and that the tests performed passed without issues impacting performance of the system. Demonstrate that the transponder system for SHUB and (option) the transponder system for Ottawa (TBC) are ready for shipping from Contractor's facility to installation sites, on-site installation and on-site testing activities phase (Work Phase 3 (see Section 3.3.5)).	No outstanding issues with the transponder system for SHUB and (option) the transponder system for Ottawa (TBC) are preventing shipment. Transport is ready and site preparations (by the RCM Transponder Team) are completed.
9.	Factory Acceptance Test (FAT) Data Review	Teleconference	FAT + 1 week	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Validate and verify the data obtained as part of tests conducted at the FAT.	See Section 3.3.1.1.2.
10.	On-Site Acceptance Test 1 (OSAT1) Readiness Review (SHUB Transponder)	SHUB (teleconference for those from the Contractor's facility who will not travel)	OSAT1 – 1 week	See Section 3.3.1.1.1. On-site IV&T and system testing is complete and documented. Software is configuration controlled. Test software has been verified and validated and is configuration controlled. As-built and as-designed hardware configurations are reconciled.	See Section 3.3.1.1.3. Review the OSAT Procedure (CDRL EN-18) in order to maximize the chances of having the system produced and installed in SHUB is in condition to pass the OSAT1.	See Section 3.3.1.1.2. Transponder system is integrated on-site and ready to be accepted by the RCM Transponder Team.
11.	On-Site Acceptance Test 1 (OSAT1) (SHUB Transponder)	SHUB	TBD by Contractor's master project schedule (CDRL PM-2)	Installation of hardware components is complete. Software components are	Prove that the transponder system produced and installed in SHUB functions as specified under the operational environment.	Transponder system in SHUB is ready to be accepted by the RCM Transponder team and the

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
				integrated into the transponder system.	Confirm that the project is ready to proceed with the training phase (Work Phase 4 (see Section 3.3.6)) and the commissioning operations phase (Work Phase 5 (see Section 3.3.7)) of the transponder system in SHUB.	RCM Prime Contractor*.
12.	On-Site Acceptance Test 1 (OSAT1) Data Review (SHUB Transponder)	Teleconference	OSAT1 + 1 week	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Validate and verify the data obtained as part of tests conducted at the OSAT1.	See Section 3.3.1.1.2.
13.	Transponder GFE Acceptance Review (GAR)	SHUB	See Table 3-3	Transponder system in SHUB* is ready for integration into the IQS.	Acceptance of the transponder system in SHUB* by the RCM Prime Contractor.	Transponder system in SHUB* is accepted by the RCM Prime Contractor.
14.	(Option) On-Site Acceptance Test 2 (OSAT2) Readiness Review (Ottawa (TBC) Transponder)	Teleconference	OSAT2 – 1 week	See Section 3.3.1.1.1. On-site IV&T and system testing is complete and documented. Software is configuration controlled. Test software has been verified and validated and is configuration controlled. As-built and as-designed hardware configurations are reconciled.	See Section 3.3.1.1.3. Review the OSAT Procedure (CDRL EN-18) in order to maximize the chances of having the system produced and installed in SHUB is in condition to pass the OSAT2.	See Section 3.3.1.1.2. Transponder system is integrated on-site and ready to be accepted by the RCM Transponder Team.
15.	(Option) On-site Acceptance Test 2 (OSAT2) (Ottawa (TBC) Transponder)	Ottawa (TBC)	TBD by Contractor's master project schedule (CDRL PM-2)	Installation of hardware components is complete. Software components are integrated into the transponder system.	Prove that the transponder system produced and installed in Ottawa (TBC) functions as specified under the operational environment. Confirm that the project is ready to proceed with the commissioning operations phase (Work Phase 5 (see Section 3.3.7)) of the transponder system in Ottawa (TBC).	Transponder system in Ottawa (TBC) is ready to be accepted by the RCM Transponder Team.
16.	(Option) On-Site Acceptance Test 1 (OSAT2) Data Review (SHUB	Teleconference	OSAT2 + 1 week	See Section 3.3.1.1.1.	See Section 3.3.1.1.3. Validate and verify the data obtained as part of	See Section 3.3.1.1.2.

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
	Transponder)				tests conducted at the OSAT2.	
17.	Project Closeout Meeting	Teleconference	GAR + 10 months	Transponder system in SHUB* is integrated into the IQS. Commissioning activities for the transponder in SHUB are complete. (Option) Commissioning activities for the transponder in Ottawa (TBC) are complete.	Demonstrate that the transponder system in SHUB and (option) the transponder system in Ottawa (TBC) are ready for handover to the TA for routine operations.	Transponder system in SHUB* is ready for RCM operations.

* NOTE: The transponder system installed in SHUB is the only transponder system dedicated for RCM operations and therefore will be accepted by the RCM Transponder Team and the RCM Prime Contractor. (Option) The transponder system installed in Ottawa (TBC) will primarily be used for RCM and also other missions and will be accepted by the RCM Transponder Team only.

3.3.1.6 GS Technical Reviews Led by RCM Prime Contractor

Some RCM technical reviews impacting the master project schedule (CDRL PM-2) are listed in Table 3-3 for information to the Contractor to help them build their master project schedule (CDRL PM-2). The timeframe associated with these dates are fixed by the RCM Prime Contractor and accepted by the TA, with the risk that these dates may change throughout the course of the RCM GS development.

TABLE 3-3: GS TECHNICAL REVIEWS LED BY RCM PRIME CONTRACTOR

#	Review Name	Planned Timeframe	Additional Notes
1.	IQS PDR	October 2014	This review will be used by CSA and the RCM Prime Contractor to agree on the definition the concept of the interface between the IQS and the precision transponder for RCM.
2.	IQS CDR	June 2015	This review will be used by CSA and the RCM Prime Contractor to agree on the final definition of the interface between the IQS and the precision transponder for RCM.
3.	GS CDR	November 2015	Review to be held between CSA and RCM Prime Contractor to baseline the RCM GS design. No major changes to the GS design is expected after this review.
4.	IQS FAT	July 2016	This review will be held at the end of the MAIT activities of the IQS. Therefore, IQS products will be available starting at the IQS FAT to be ingested by the precision transponder for RCM.
5.	GS FQT	December 2016	Review to be held at the RCM Prime Contractor's facility to verify if all GS subsystems to be delivered by Industry are ready to be shipped to SHUB for integration (same purpose as the transponder system FAT).
6.	Transponder system GAR	December 2016	Minimum support from the Contractor may be required since the review will be held between the RCM Prime Contractor and the TA. Objectives of the GAR are presented in Table 3-2. The transponder system installed in SHUB shall be available for this review, with the OSAT1 held successfully.
7.	GS FAR	July 2017	Review to be held in SHUB to verify that the GS is operational with GS subsystems delivered by Industry and GFE items (same purpose as the transponder system OSAT1). Commissioning operations (Work Phase 5) of the transponder system installed in SHUB shall be successfully completed at this review.

3.3.2 System

One (1) transponder system shall be installed in SHUB and (option) one (1) additional transponder system may be installed in Ottawa (TBC). Refer to Section 3.1 for more information on the infrastructures available.

The Contractor shall develop and deliver systems engineering-related document deliverables as specified in Appendix A.3. In particular, the Contractor shall provide a system requirements verification and compliance matrix (as part of the Verification, Validation and Test Plan (CDRL

EN-8)) and a system requirements traceability matrix (as part of the System Requirements Specification (CDRL EN-1)) demonstrating that the requirements described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] are met.

For the sole purpose of clarifying the anticipated work to be performed by the Contractor, the anticipated tasks have been broken down into a series of defined work phases, which are described in the following sections and provided as a summary in the following list:

- Work Phase 1 – Requirements analysis and design;
- Work Phase 2 – Manufacturing, Assembly, Integration and Test (MAIT);
- Work Phase 3 – Shipping, installation and test;
- Work Phase 4 – Training;
- Work Phase 5 – Commissioning operations; and
- Work Phase 6 – Operations and technical support.

It is anticipated that documentation requirements, reviews or audits will accompany each work phase.

It is anticipated that the work will be progressive, with the documented results of each work phase containing the information and start point for the next work phase.

The Contractor shall propose the actual work schedule, outlining key work milestones, as stated in Section 3.2.3.

3.3.3 Work Phase 1 – Requirements Analysis and Design

The Contractor shall start Work Phase 1 following the KOM in accordance with the approved master project schedule (CDRL PM-2).

The Contractor shall perform the following tasks during Work Phase 1:

- Validate the technical requirements as presented in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] with the RCM Transponder Team;
- Develop and deliver the System Requirements Specification (CDRL EN-1) to document subsystems in more details than what is already covered in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1];
- Review and provide comments on the RCM Precision Transponder ICD [Document AD-2] no later than the SRR. In particular, provide:
    - Errors detected in the document or items missing from the document;
    - Comments to complete the interface between the transponder system and the RCM GS in order to integrate efficiently the transponder system into the RCM GS and to be able to use it to its full capacity;
- Prepare the SRR data package (CDRL PM-10) and hold the SRR (see Section 3.3.3.1);

- Carry out the preliminary and critical designs of the transponder system, including all hardware and software, according to the technical requirements defined in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1];
- Plan for the design of the dome control software for which an existing version and a description document [Document RD-9] will be provided as GFE items (see Section 5). The dome control software shall be seamlessly integrated into the Transponder Control Software (SW-1) available on the control computer (HW-2) for the SHUB installation site;
- Evaluate whether the use of the existing pedestal extender is required at the SHUB installation site. Note: The pedestal extender is described in details in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1];
- Prepare the PDR and CDR data packages (CDRLs PM-8 and PM-9) and hold the PDR (see Section 3.3.3.2) and CDR (see Section 3.3.3.3);
- Develop the Verification, Validation and Test Plan (CDRL EN-8) incorporating performance verification, absolute calibration and field trials using an operating SAR satellite, such as RADARSAT-2;
- Develop/update and deliver the documents as identified to be delivered at the SRR, PDR or CDR in Appendix A.3, Engineering Analyses (CDRL EN-11) as required and Technical Notes (CDRL EN-10) as required. The Contractor shall use their own format for summary engineering analyses and the DID indicated in Appendix A.3 for critical analyses impacting the design and end performance of the transponder system;
- Identify spare parts necessary for system maintenance and document the spare parts in the System Maintenance Concept (CDRL OPS-2). The RCM Transponder Team will confirm if the option to manufacture/procure spare parts (HW-3) is exercised or not no later than the PDR;
- Participate in the TIM1 to discuss the interfaces between the transponder system and the installation site in SHUB and (option) installation site in Ottawa (TBC) as well as the interfaces between the transponder system and the RCM GS; and
- Propose data formats for data exchange between the transponder system and the external control computer for approval by the TA.

The RCM Transponder Team will confirm at the SRR at the latest if the option of the procurement of the second transponder system is exercised or not.

The designs developed and the methodology used by the Contractor will be reviewed for consistency with the RCM Transponder Team requirements.

Work Phase 1 shall be completed upon successful completion of the CDR.

3.3.3.1 Systems Requirements Review (SRR) Meeting

The SRR shall occur according to the approved master project schedule (CDRL PM-2).

The RCM Transponder Team will chair the SRR. At this time, all system requirements, concept design and verification planning will be reviewed. The objectives of the SRR are listed in Table 3-2.

Once the SRR data package (CDRL PM-10) is submitted to the RCM Transponder Technical Team, questions and comments shall be formally tracked through the standard RIDs process (see Section 3.1.3.3) initiated and maintained by the Contractor.

The Contractor is responsible for summarizing all issues and AIs raised at this meeting and preparing responses (either at the meeting or afterwards) for approval by the RCM Transponder Team. Issues and AIs arising from the SRR shall be resolved prior to the PDR.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the SRR results in the establishment of the functional (requirement) configuration baseline under formal change control, demonstrates that the system requirements are mature, the system conceptual design will provide a system that meets the system requirements within an acceptable level of risk and that the project is ready to proceed with the preliminary design.

3.3.3.2 Preliminary Design Review (PDR) Meeting

The PDR shall occur according to the approved master project schedule (CDRL PM-2).

The Contractor shall present its system design and supporting documentation at the PDR meeting. Backup material in the form of analysis or calculations (CDRL EN-11), that support the suggested implementation in the preliminary design and based on the submitted proposal, shall be made available when requested by the RCM Transponder Technical Team.

In addition to the objectives listed in Table 3-2 for the PDR, this meeting will discuss the transponder system and will identify the design option to be pursued. This step is essential as it impacts the total design.

Once the PDR data package (CDRL PM-8) is submitted to the RCM Transponder Technical Team, questions and comments shall be formally tracked through the standard RIDs process (see Section 3.1.3.3) initiated and maintained by the Contractor.

The Contractor is responsible for summarizing all issues and AIs raised at this meeting and preparing responses (either at the meeting or afterwards) for approval by the RCM Transponder Team. Issues and AIs arising from the PDR shall be resolved prior to the CDR.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], acceptance of the preliminary design can be deemed sufficient justification for the Contractor to proceed with the procurement of Long-Lead Items (LLIs).

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the PDR results in the establishment of the allocated (development) configuration baseline under formal change control, and constitutes readiness for detailed design and the system development to proceed.

3.3.3.3 Critical Design Review (CDR) Meeting

The CDR shall occur according to the approved master project schedule (CDRL PM-2).

The Contractor shall present its detailed design and supporting documentation at the CDR meeting. Objectives of the CDR are presented in Table 3-2.

Once the CDR data package (CDRL PM-9) is submitted to the RCM Transponder Technical Team, questions and comments shall be formally tracked through the standard RIDs process (see Section 3.1.3.3) initiated and maintained by the Contractor.

Due to the differing constraints of hardware and software design, the CDR may be split into two (2) parts: a Hardware CDR and a Software CDR. If this approach is preferred by the Contractor, the Contractor shall have specified it in the master project schedule (CDRL PM-2) approved at the KOM.

The Contractor is responsible for summarizing all issues and AIs raised at this meeting and preparing responses (either at the meeting or afterwards) for approval by the RCM Transponder Team. Progress to the next milestone in the contract cannot continue until all CDR issues are resolved to the satisfaction of the TA.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the CDR results in the establishment of the build-to (design) configuration baseline under formal change control, and constitutes readiness for full-scale manufacturing and completion of system development to proceed.

As a result of successful completion of the CDR, production and verification plans are approved. Approved drawings (CDRL EN-13) are released and authorized for fabrication. It also authorizes coding of software deliverables, and system testing and integration.

3.3.4 Work Phase 2 – Manufacturing, Assembly, Integration and Test (MAIT)

Unless otherwise directed by written confirmation from the TA, Work Phase 2 shall begin only after the successful completion of all activities of Work Phase 1, the delivery of all deliverables from Work Phase 1 and the approval of all deliverables by the RCM Transponder Team.

The Contractor shall perform the following tasks during Work Phase 2:

- Perform MAIT activities at the Contractor's facility for one (1) transponder system (HW-1 and SW-1) to be further installed in SHUB and (option) one (1) additional transponder system (HW-1 and SW-1) to be further installed in Ottawa (TBC), for which hardware and software requirements and design were approved in Work Phase 1. More specifically, the Contractor shall be responsible for:
    - The integration of all software into the total Transponder Control Software (SW-1), and should prove and document satisfactory performance of the resulting software at all stages during the integration;
    - As logistical issues may arise from completely developing the dome opening control functions of the Transponder Control Software off-site with no direct capability of testing it with the dome, at this phase a task is required to at least put in place prototype / commented software code and functions of the Transponder Control Software (SW-1) related to the dome control (scheduled and manual opening and closing) at the SHUB installation site,. The RCM Transponder Team may counter-verify the code during software development;
    - The integration of all hardware modules into equipment units and then all equipment units into the total system hardware (HW-1). There may be documented proof of performance of the resulting hardware at all stages during the integration in accordance with the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1];

- Assemble all equipment hardware and software requirements for one (1) remote login system capability (HW-2 and SW-1) in order to deliver the Remote Access software (SW-2) (it is assumed that SW-2 will likely be a COTS package to be installed on HW-2 and on a CSA-owned workstation);
- Carry out performance verification as defined in the Verification, Validation and Test Plan (CDRL EN-8);
- Calibrate the transponder system by a method approved by the RCM Transponder Technical Team and according to the calibration plan outlined in the System Maintenance Concept (CDRL OPS-2) and the System Calibration Procedures (CDRL OPS-4);
- Prepare the FAT data package (CDRL PM-10) and hold the FAT readiness review meeting (see Section 3.3.4.4), the FAT (see Section 3.3.4.5) and the FAT data review meeting (see Section 3.3.4.6);
- Develop/update and deliver the documents as identified to be delivered at tests on subsystems, the FAT readiness review meeting, the FAT or the FAT data review meeting in Appendix A.3;
- Provide to the RCM Transponder Team prior to the FAT the temporary storage space requirements to store the transponder system at the SHUB installation site and (option) the transponder system at the Ottawa (TBC) installation site after their shipment; and
- (Option) Perform the following tasks related to spare parts if the option to procure spare parts is exercised (refer to Section 3.3.3 for more details):
    - Manufacture or procure spare parts (HW-3);
    - Perform testing on the spare parts (HW-3) to ensure that they demonstrate the capability to function correctly; and
    - Deliver the spare parts (HW-3) with a data package containing their associated information. This information may be an update to the System Maintenance Concept (CDRL OPS-2) or a separate companion document to the spare parts.

Work Phase 2 shall be completed upon successful completion of the FAT and after the FAT data review meeting is held. Results of Work Phase 2 shall be presented in the FAT Report (CDRL EN-17).

3.3.4.1 Installation Site Preparations

The RCM Transponder Team will prepare the SHUB installation site and (option) the Ottawa (TBC) installation site.

The responsibilities of the RCM Transponder Team regarding preparations for the SHUB installation site and (option) for the Ottawa (TBC) installation site will be:

- Perform the decommissioning (removal) and disposal of the existing transponder system prior to Work Phase 3 (see Section 3.3.5); and
- Provide support structures in the ground and all necessary infrastructures including, but not limited to, power supply and data communication links required to operate the

transponder system as specified by the Contractor in the System Design Document (CDRL EN-6).

If the option on the second transponder system is exercised, the RCM Transponder Team will not perform the decommissioning of both existing transponder systems at the same time to ensure uninterrupted calibration operations for the CSA's currently supported SAR missions.

3.3.4.2 Verification and Validation (V&V)

The Contractor shall develop a Verification, Validation and Test Plan (CDRL EN-8) to verify the baseline requirements.

Testing shall be the preferred approach except where there is a clear justification accepted by the RCM Transponder Technical Team that testing will not be effective.

All requirements shall be verified on the entire system.

3.3.4.3 Tests, Test Procedures and Test Reports

The RCM Transponder Technical Team or its representative(s) may witness tests. Access to the Contractor's and subcontractor's (if applicable) facilities shall not be unreasonably withheld.

The Verification, Validation and Test Plan (CDRL EN-8) shall detail the schedule and test methods for preliminary test(s), FAT, OSAT1 and (option) OSAT2.

Test procedures (CDRL EN-14), the FAT Procedure (CDRL EN-16) and the OSAT Procedure (CDRL EN-18) shall be developed to demonstrate that the system and all subsystems meet all technical and operational design parameters and the requirements of the specifications. The system requirements verification and compliance matrix (as part of the Verification, Validation and Test Plan (CDRL EN-8)) and the system requirements traceability matrix (as part of the System Requirements Specification (CDRL EN-1)) shall connect each requirement to an appropriate verification method and test procedure (CDRL EN-14) for requirements verified by test. Proof of compliance may be fulfilled by one of the approaches defined in the Systems Engineering Methods and Practices [Document RD-3]:

The Contractor shall be responsible for all Contractor's expenses including equipment repairs and re-design necessary to correct test failures, to cover his associated transportation and shipping costs, and to re-test the system.

Any hardware fixture or tool (HW-3), that may or may not be integrated in the transponder system hardware, and any software feature or function (SW-4) that may or may not be integrated in the Transponder Control Software, and that is useful for monitoring transponder system issues for troubleshooting purposes shall be provided for retention by the RCM Transponder Team. This shall also include any specialized test software and routines developed for the transponders as detailed in Section 3.1.3.2.

The Contractor should perform unit tests, sub-assembly tests and subsystem tests prior to system tests as part of Work Phase 2 as described in Section 3.3.4.

3.3.4.4 Factory Acceptance Test (FAT) Readiness Review Meeting

The FAT readiness review meeting shall occur according to the approved master project schedule (CDRL PM-2) upon completion of the transponder system MAIT activities, as close as

possible to the FAT and shall serve as a wrap-up of all testing performed on the system before the system undergoes the FAT.

Objectives of the FAT readiness review meeting are presented in Table 3-2.

The Contractor is responsible for summarizing all issues and AIs raised at this meeting and preparing responses (either at the meeting or afterwards) for approval by the RCM Transponder Team. Issues and AIs arising from the FAT readiness review meeting shall be resolved prior to the FAT.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the FAT readiness review confirms that the test preparations are complete, and constitutes formal authorization to proceed with factory acceptance test initiation.

3.3.4.5 Factory Acceptance Test (FAT)

The FAT shall occur according to the approved master project schedule (CDRL PM-2).

Objectives of the FAT are presented in Table 3-2. The FAT shall also serve as the pre-shipment review to determine if the transponder system for SHUB and (option) the transponder system for Ottawa (TBC) are ready to be shipped to the SHUB installation site and (option) to the Ottawa (TBC) installation site, rather than conducting another technical review to discuss shipment.

The FAT shall serve as a verification activity against the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and shall be conducted in the manner that was defined in the Verification, Validation and Test Plan (CDRL EN-8), with the transponder system set up, to the extent reasonably possible, as it would be configured at the transponder installation site. All, or part, of the testing will be observed and the test results will be reviewed by the RCM Transponder Team. The RCM Transponder Team also reserves the right to access the Contractor's facility, witness and take photographs of the acceptance test, to which end the Contractor shall give the RCM Transponder Team at least one week's notice prior to starting the test.

At the portion of the acceptance tests that the RCM Transponder Team observes, all contract deliverables shall be available for inspection.

Problems encountered and test failures during the FAT shall be corrected and the corrections will be demonstrated to, and accepted by, the RCM Transponder Team, who reserves the right to demand performing regression testing and/or re-doing the full tests in event of test failure. Re-test shall be performed when necessary prior to proceeding to the next phase of work.

Central to the FAT set of procedures shall be measurements for the transponder system end-to-end calibration and calibration stability.

All test results shall be recorded in the FAT Report (CDRL EN-17) and certified by the Contractor as an accurate record of the test results. Test data shall also be a deliverable under the FAT Report (CDRL EN-17).

3.3.4.6 Factory Acceptance Test (FAT) Data Review Meeting

The FAT data review meeting shall occur according to the approved master project schedule (CDRL PM-2) upon completion of the FAT, as soon as possible after the FAT, after the test results from the FAT are compiled and available.

Objectives of the FAT data review meeting are presented in Table 3-2.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the FAT data review confirms that the test data has been validated and verified.

3.3.5 Work Phase 3 – Shipping, Installation and On-Site Test

Unless otherwise directed by written confirmation from the TA, Work Phase 3 shall begin only after the successful completion of all activities of Work Phase 2, the delivery of all deliverables from Work Phase 2 and the approval of all deliverables by the RCM Transponder Team for a specific transponder system (i.e. the Contractor shall start Work Phase 3 of the transponder system in SHUB as soon as all activities of Work Phase 2 for the transponder system in SHUB and all deliverables from Work Phase 2 associated with the transponder system in SHUB are delivered and approved by the RCM Transponder Team).

The Contractor shall perform the following tasks during Work Phase 3:

- Verify that adequate shipping containers (HW-4), packaging material, procedures and instructions are used and that they provide for protection of articles and materials prior to shipment, during transportation and after arrival at destination;
- Ship the transponder system equipment to the designated location using shipping containers (HW-4) built to guarantee the safe shipment of the equipment. Each container shall be marked in accordance with instructions to be provided by the RCM Transponder Team and shall be inspected prior to each use. The Contractor shall replace all items which do not arrive at their destination in usable condition;
- Confirm that all equipment and other material being supplied for the transponder system have been received at the installation site in satisfactory condition (all items shall be delivered in an undamaged and fully serviceable condition);
- Install the transponder system and using the right equipment, integrate the equipment into a complete functional system and perform any tasks required to make the functionality of the system optimal for operational requirements according to the Installation Plan and Installation Procedure (CDRL EN-9);
- Deliver the Remote Access software (SW-2) and perform the installation, configuration, test and compliance demonstration on one (1) external computer delivered as a GFE item (refer to Section 5);
- Finalize the actual source code for the dome control portion of the Transponder Control Software (SW-1), fine-tune and test manual and scheduled dome control with the actual dome at the SHUB installation site;
- Demonstrate the performance and operational capabilities of the transponder system based on the Verification, Validation and Test Plan (CDRL EN-8). CSA will, on a best effort basis, provide support in the request for data acquisition and data delivery of the identified SAR system for demonstration;
- Test the interface between the transponder system installed in SHUB and the IQS, provided by the RCM Prime Contractor, using RADARSAT-2 or any other identified SAR satellite;

- Prepare the OSAT1 data package (CDRL PM-10) and hold the OSAT1 readiness review meeting (see Section 3.3.5.2), the OSAT1 (see Section 3.3.5.3) and the OSAT1 data review meeting (see Section 3.3.5.4);
- (Option) Prepare the OSAT2 data package (CDRL PM-10) and hold the OSAT2 readiness review meeting (see Section 3.3.5.2), the OSAT2 (see Section 3.3.5.3) and the OSAT2 data review meeting (see Section 3.3.5.4);
- Develop/update and deliver the documents as identified to be delivered at the OSAT1 readiness review meeting, the OSAT1 or the OSAT1 data review meeting in Appendix A.3; and
- (Option) Develop/update and deliver the documents as identified to be delivered at the OSAT2 readiness review meeting, the OSAT2 or the OSAT2 data review meeting in Appendix A.3.

Due to operational constraints described in Section 3.3.4.1 and if the option on the second transponder system is exercised, the Contractor shall expect that both transponder systems will not be able to be installed at the installation sites concurrently. If the option is exercised, the Contractor shall install the transponder system in SHUB in priority.

The Contractor shall reflect any changes done during the installation of the transponder system into the applicable manuals, drawings and documentation.

Work Phase 3 shall be completed upon successful completion of the OSAT1 and after the OSAT1 data review meeting is held and (option) the successful completion of the OSAT2 and after the OSAT2 data review meeting is held. Results of Work Phase 3 shall be presented in the OSAT Report (CDRL EN-19) for the OSAT1 and (option) for the OSAT2.

3.3.5.1 Installation Requirements

The Contractor shall perform all installation work for the transponder system. Refer to Section 1.3 for more information on the operational sites.

The purpose of this section is to establish installation effort required from the Contractor, and to establish procedures and standards which both the Contractor and the RCM Transponder Team should follow during the installation of the transponder system.

The RCM Transponder PA Team reserves the right to inspect work in progress.

3.3.5.1.1 Pre-Installation

The Contractor may conduct on-site detailed inspections of the SHUB installation site and/or (option) the Ottawa (TBC) installation site to gather site specific information necessary to prepare the Installation Plan and Installation Procedure (CDRL EN-9) and drawings.

As required, the Contractor should consult with the RCM Transponder Team to arrange site visits and anything else pertaining to the installation of the transponder system.

3.3.5.1.2 RCM Transponder Team's Installation Responsibilities

A member of the RCM Transponder Team will accompany Contractor personnel at the SHUB installation site and (option) at the Ottawa (TBC) installation site, during normal working hours if access without escort cannot be permitted.

The RCM Transponder Team will be responsible for providing the GFE items specified in Table 5-1, as well as the following:

- On-site technical representation and the participation required to assist the Contractor installation staff to complete the installation; and
- Pre-installation and installation access to sites, as required.

3.3.5.1.3 Contractor's Installation Responsibilities

The Contractor shall, as a minimum, be responsible, for the transponder system in SHUB and (option) the transponder system in Ottawa (TBC), for:

- Site security and safety as well as security of the equipment required during installation of the transponder system (refer to Section 3.4.5 for more details on the safety requirements defined for the contract);
- Undamaged equipment delivery to the installation site;
- Providing in advance a foundation to transponder system mating template;
- Pulling the transponder system cables through the conduit;
- Mounting the GPS antenna, necessary to synchronize the time used by the transponder system, on the roof of the building which houses the Transponder Control Unit (TCU) subsystem. The antenna mounting shall be such that there are no significant obstructions surrounding the antenna. The supporting mast shall be sufficiently rigid to accommodate the specified system wind load;
- Providing the Installation Plan and Installation Procedure (CDRL EN-9), installation schedule, documentation and system drawings for all Contractor and subcontractors supplied equipment;
- Providing detailed installation instructions for the equipment hardware and software;
- Providing any material, software, special tools and calibrated test equipment required for the installation, including any lifting equipment needed for the unloading of the equipment on site and for the installation of the transponder system;
- Performing the complete installation of the transponder system;
- Conducting installation inspection prior to system integration and on-site testing;
- Leaving the installation site safe and clear by disposing all garbage and excess material;
- Providing any unspecified item required for the complete transponder system; and
- Providing final "as-built" drawings, including a configuration list, for the installation site.

3.3.5.2 On-Site Acceptance Test (OSAT) Readiness Review Meeting

The Contractor shall hold an OSAT readiness review meeting for each OSAT to be performed (in SHUB and (option) in Ottawa (TBC)).

The OSAT readiness review meeting shall occur according to the approved master project schedule (CDRL PM-2) upon completion of the transponder system on-site installation,

integration and testing activities, as close as possible to the OSAT1 and (option) OSAT2 and shall serve as a wrap-up of all testing performed on the transponder system before its acceptance by the RCM Transponder Team.

Objectives of the OSAT readiness review meeting are presented in Table 3-2.

The Contractor is responsible for summarizing all issues and AIs raised at this meeting and preparing responses (either at the meetings or afterwards) for approval by the RCM Transponder Team. Issues and AIs arising from the OSAT readiness review meeting shall be resolved prior to the OSATs.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the OSAT readiness review confirms that the test preparations are complete, and constitutes formal authorization to proceed with on-site acceptance test initiation.

3.3.5.3 On-Site Acceptance Test (OSAT)

An OSAT shall occur according to the approved master project schedule (CDRL PM-2), typically the OSAT1 for the transponder system installed in SHUB and (option) the OSAT2 for the transponder system installed in Ottawa (TBC).

Objectives of the OSAT are presented in Table 3-2.

The Contractor shall be responsible for all associated shipping costs of the transponder system equipment to the installation site.

The transponder system shall be tested upon completion of installation, integration and optimization. Testing shall be conducted in accordance with the Verification, Validation and Test Plan (CDRL EN-8). Any failure during testing shall be resolved prior to proceeding to the next phase of work. The RCM Transponder Team reserves the right to demand performing regression testing and/or re-doing the full test in event of failure during testing. The RCM Transponder Team also reserves the right to witness and take photographs of the testing, including test equipment and setup, to which end the Contractor shall give the RCM Transponder Team reasonable notice prior to starting the test.

The OSAT shall consist of proof of performance of the total transponder system according to the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1], as well as on-site requirements and on-site operations (e.g. dome opening requirements) exercised to the maximum extent possible from the site (operations, communications, etc) with the remote login system installed and operating.

The Contractor shall document all test results in the OSAT Report (CDRL EN-19). All test results shall be recorded in the report and certified by the Contractor as an accurate record of the test results. Test data shall also be a deliverable under the OSAT Report (CDRL EN-19).

The transponder system will not be accepted until it has been completely verified and found to be functioning on-site as required by the contract, and all associated documentation has been received and accepted.

3.3.5.4 On-Site Acceptance Test (OSAT) Data Review Meeting

The Contractor shall hold an OSAT data review meeting for each OSAT performed (in SHUB and (option) in Ottawa (TBC)).

The OSAT data review meeting shall occur according to the approved master project schedule (CDRL PM-2) upon completion of the OSAT, as soon as possible after the OSAT, after the test results from the OSAT are compiled and available.

Objectives of the OSAT data review meeting are presented in Table 3-2.

As specified in the CSA SE Technical Reviews Standard [Document RD-1], successful completion of the OSAT data review confirmed that the test data has been validated and verified.

3.3.6 Work Phase 4 – Training

Unless otherwise directed by written confirmation from the TA, Work Phase 4 shall begin only after the successful installation of the transponder system in SHUB and the OSAT1 during Work Phase 3.

During Work Phase 4, the Contractor shall update, as a minimum, the following key training documents, as identified in Appendix A.3:

- System Maintenance Concept (CDRL OPS-2);
- Training Plan (CDRL OPS-3);
- Training Course Material (CDRL OPS-5);
- Transponder User's Manual (CDRL OPS-6); and
- Transponder Maintenance Manual (CDRL OPS-7).

The transponder system installed in SHUB will be routinely operated from SHUB. (Option) The transponder system installed in Ottawa (TBC) will be routinely operated remotely from SHUB. It is anticipated that personnel local to the installation site or CSA personnel will conduct regular preventative maintenance visits to the transponder system and report back on the status of the transponder system and site. Corrective maintenance will be coordinated by CSA designated personnel as required.

The Contractor shall provide training to personnel who will perform preventative and corrective maintenance on the transponder system in sufficient detail so as to enable maintenance to be carried out to allow the system to be used efficiently and knowledgeably in an operational environment. Typically, the personnel will be composed of technicians who will have at least 5 years of experience in standard electronics maintenance and basic knowledge of transponder system fundamentals and repair. The RCM Transponder Team reserves the right to add observers.

One of the goals of the training shall be to ease the hand-over process of the transponder system and shall emphasize on complementing the information provided in the Transponder User's Manual (CDRL OPS-6) and the Transponder Maintenance Manual (CDRL OPS-7) to ensure a better efficiency in troubleshooting the transponder system. The training shall, as a minimum, address the following:

- Overview of the nominal operations of the transponder system;
- The most common problems that may arise during operations;

- Fault recognition, location and diagnostic techniques on the RF path using built-in testing features and external test equipment which shall be primarily hands-on, practical training on fully functional equipment;
- Remote performance monitoring;
- Procedures for adjustment and/or replacement of modules, major components or equipment;
- Providing the ability to recognize equipment faults and take appropriate action to protect the equipment involved and to reconfigure remaining equipment to minimize the effect on overall system availability (a quick reference fault finding check list shall be provided as part of the training package); and
- Key subsystems that may require more frequent maintenance due to their sensitivity to minor environmental changes or manual adjustments.

Training material, instructor travel, lodging and expenses shall be the responsibility of the Contractor. For efficiency purposes, the Contractor may negotiate with the TA to give online training using a medium approved by the TA.

The language of all course notes, training materials, classroom instructions and practical demonstrations shall be English.

At the time of delivery of each of the courses, a complete set of training course materials (CDRL OPS-5) shall be provided to and retained by each of the students, in addition to all system documentation required elsewhere in the contractual documents.

The Contractor shall provide equipment needed during training. The RCM Transponder Team reserves the right to use this material and the training materials to conduct subsequent training.

The Contractor should complete the training within 30 days of the successful installation of the transponder system in SHUB and after the OSAT1. Course scheduling shall facilitate continuous operations during training and will be scheduled at a mutually convenient time.

3.3.7 Work Phase 5 – Commissioning Operations

Unless otherwise directed by written confirmation from the TA, Work Phase 5 shall begin only after the successful completion of all activities of Work Phase 3, the delivery of all deliverables from Work Phase 3 and the approval of all deliverables by the RCM Transponder Team. Work Phase 4 and Work Phase 5 may be done concurrently.

The Contractor shall perform the following tasks during Work Phase 5:

- Perform the commissioning of the transponder system in SHUB and (option) the transponder system in Ottawa (TBC) using in-orbit earth observation satellites, such as RADARSAT-2; and
- Develop and deliver the End Item Data Package (EIDP) (CDRL PA-8) associated with the transponder system.

Work Phase 5 shall be completed upon successful completion of the transponder system GAR and shall culminate with the project closeout meeting at the conclusion of the commissioning and final acceptance of the transponder system.

3.3.8 Work Phase 6 – Operations and Technical Support

The objective of Work Phase 6 is to provide a calibration reference to the RCM satellites with the use of the transponder system.

During Work Phase 6, the Contractor shall be prepared to provide on-call and on-site technical support to the RCM Transponder Team for the transponder system for any unplanned problems, modifications to the transponder system, improvements, etc. for the period between the GS Factory Qualification Test (FQT) and the GS Final Acceptance Review (FAR) as described in Table 3-3. This support is intended for the provision of enhancements to the transponder system operations and not for the correction of faults covered under the warranty. The levels of this support shall be agreed in advance with the TA through specific work orders.

The TA will generate work orders for the support to be provided during Work Phase 6, identifying the type and level of support required. These work orders will be reviewed and agreed in advance with the Contractor. The Contractor shall provide the agreed support.

The duration of Work Phase 6 is planned for the period between the GS FQT and the GS FAR, up to a maximum of one (1) year after delivery, commissioning and acceptance of the transponder system.

The Contractor may be asked to provide maintenance of the system for hardware and/or software components of the transponder system beyond Work Phase 6 to ensure that the transponder system will continue to operate nominally. The tasks related to such maintenance is beyond the scope of the work described in this SOW.

3.4 SAFETY & MISSION ASSURANCE (S&MA)

Product Assurance (PA) requirements are described in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and supplemented herein.

3.4.1 Quality Assurance

The Contractor shall have in place Quality Management Systems (QMS) certified to ISO 9001:2008 - Quality Management Systems - Requirements [Document AD-3]. The Contractor shall implement, update and maintain a Quality Assurance Plan (QAP) (CDRL PA-1) which meets the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and this SOW. The Contractor shall provide PA Management with an independent line of reporting and access to senior management separate from that of the project.

3.4.1.1 Software PA

The Contractor shall implement a Software PA (SPA) program. The SPA program will establish and monitor requirements for the analysis, design, development, test and verification of all software including the software components of firmware. The Contractor shall ensure that software tools used in the development, support, verification and validation of software are evaluated by the software development team and the Contractor's Quality Assurance (QA) representative before use to confirm that they perform as documented.

Software development shall be based on, and traceable to, IEEE 12207.0 - IEEE Standard for Information Technology - Software Life Cycle Processes [Document RD-4], MIL-STD-498 - Software Development and Documentation [Document RD-5], or equivalent as defined in the

QAP (CDRL PA-1). The selected standards may be tailored, to the extent allowed by the approved standard, as appropriate to the software under development.

3.4.1.2 Audits

The Contractor shall grant the right of access to the RCM Transponder PA Team, or a delegated representative of the Government of Canada, to perform audits of the Contractor to assess compliance to the PA requirements and to witness testing. Data and documentation generated by the Contractor, including design and test data and PA program documentation are subject to review, evaluation and inspection by the RCM Transponder PA Team or a delegated representative of the Government of Canada.

3.4.1.3 Inspections

The Contractor shall conduct inspections throughout the receipt of material and parts from suppliers, fabrication, processing, assembly and test operations to verify product compliance to engineering documentation. The Contractor's QA representative shall perform end-item inspections to verify configuration, test results and workmanship.

3.4.1.4 Storage, Transport and Handling Procedures

The Contractor shall implement and update the Storage, Transport and Handling Procedures (CDRL PA-6). The Contractor shall define requirements for preservation, packaging, handling, storage and shipping of articles and materials in engineering documentation and/or manufacturing instruction sheets. Special handling and shipping considerations such as vibration, shock, Electrostatic Discharge (ESD) and cleanliness shall also be considered.

3.4.1.5 Alerts

The Contractor shall review and disposition all alerts and problem advisories from alert repositories, part manufacturers and Canadian Standards Association (CSA) applicable to the proposed parts in the transponder system.

3.4.1.6 Non-Conformance Review Board (NCRB)

The Contractor's QA representative shall provide for the identification, segregation and documentation of articles, materials or software that do not conform to contractual requirements, to engineering documentation or whose acceptability is suspect for any other reason. The Contractor shall convene and conduct Non-Conformance Review Board (NCRB) meetings to classify and document in Non-Conformance Reports (NCRs) (CDRL PA-3) the proper dispositions of non-conforming items.

The failure tracking and corrective action system shall have a closed loop control for collecting, analyzing and recording all failures that occur during in-plant testing and those that occur during assembly, integration and testing. During testing, the Contractor shall record anomalous behaviour that is not necessarily out of specification, but could add knowledge relating to idiosyncrasies of the equipment. A failure includes unusual or unexpected behaviour within limits or of characteristics not covered by the specifications and any instances of potentially harmful over-stress to the deliverable item due to external causes.

A Non-Conformance (NC) is a suspected or proven departure of a characteristic or feature of an item from the specified requirement. A non-conforming item is an item with one or more proven

or suspected NCs. A Class I NC is defined as an item which has one or more NCs including those revealed as a result of inspection and test (in itself or its component items) of an end-item (or as part of an end-item) and would not meet the specified end item performance with respect to safety, performance, interfaces with other Project requirements, reliability or failure occurring during or subsequent to acceptance testing. The Contractor shall notify the TA within 48 hours of all Class I NCs.

A Class II NC is an item that is not covered by the Class I NC definition.

Authorized NCRBs shall analyze NCs and determine the appropriate disposition of NCs. The CSA RCM Transponder PA Team will participate in the NCRB for all Class I NCs and failure reviews. The CSA RCM Transponder PA Team has the right to review all Class II NCRs for concurrence to classification.

3.4.1.7 Deviations and Waivers

A variance approved for a planned departure from requirements is known as a deviation prior to manufacture. A variance approved for an item found to depart from specified requirements in an unplanned manner during or after manufacture, but nevertheless considered suitable for use "as is" or after repair by an approved method, is known as a waiver.

A Request for Deviation (RFD) or a Request for Waiver (RFW) (CDRL PA-2) consists of a NC or departure to the requirements or specifications that affects a system end item.

In the event that a requirement cannot be complied with, the Contractor shall make a formal request to the RCM Transponder Team for an RFD or RFW. The onus for obtaining such a concession lies with the Contractor. Without such an RFD/RFW, the RCM Transponder Team will consider that the Contractor will comply with all the requirements.

3.4.2 Configuration and Data Management (CADM)

The Contractor shall implement Configuration Management (CM) and Data Management (DM) systems for hardware, software and documentation. Documents and data shall be submitted in accordance with DID-0000 described in Appendix B. The Contractor shall maintain product identification and tracking system.

The RCM Transponder Team may request to see changes from one revision of a document deliverable to another during updates; the Contractor shall thus ensure that Engineering Change Notices (ECNs) (CDRL PA-7) or redlines of a given document are available.

When specified in Appendix A.3, documents may be prepared in the Contractor's Format (CF); however they shall also meet the requirements stated in this section.

The Contractor shall perform the following CM/DM-related tasks:

1. Interface with the TA on CM matters and deliverable transfer (hardware, software and documentation);
2. Control the electronic files and hard copies of CADM released documents; and
3. Distribute hard and digital copies of documentation, drawings and other deliverables as required by this SOW.

The RCM Transponder Team has the right to re-use, in part or in totality, the contents of any documentation generated in relation to this contract.

3.4.3 End Item Data Package (EIDP)

The Contractor shall deliver an EIDP (CDRL PA-8) for the transponder system.

3.4.4 Reliability, Maintainability and Availability (RMA)

The Contractor shall prepare the Reliability, Maintainability and Availability (RMA) Report (CDRL PA-5) in accordance with the requirements and the expected use of the transponder system.

Data sources for reliability estimates shall be identified (e.g. failure rates, repair times) and justified. Part failure rate data may be derived from MIL-HDBK-217 - Reliability Prediction of Electronic Equipment [Document RD-6], MIL-HDBK-781 - Reliability Test Methods, Plans, and Environments for Engineering, Development Qualification, and Production [Document RD-7], Nonelectronic Parts Reliability Data (NPRD) [Document RD-8], original equipment manufacture field or life test data and/or reliability data from similar COTS hardware which has a proven track record and for which the reliability data is known within the subject environment.

3.4.5 Safety

The Contractor shall ensure that work is conducted in accordance with the Safety Program per the QAP (CDRL PA-1). Where required by safety program planning, the Contractor shall organize and conduct safety/hazard reviews to verify that safety hazard controls are addressed. The Contractor shall ensure that each hazard report is closed prior to the expected occurrence (as identified in each hazard report) of its respective hazard and update the Safety Assessment Report (CDRL PA-4). The transponder system shall be such that personnel and equipment are not exposed to hazards which have not been adequately mitigated during storage, transport, installation/removal, operations and maintenance activities.

The Contractor shall perform the following in accordance with the applicable governing safety standard:

- Ensure compliance to all local and national standards for safety; the safety requirements are dictated by the Canadian and provincial occupational health and safety legislation applicable at the end-use facility;
- Identify test, installation/removal, operations and maintenance procedures that are potentially hazardous to personnel and/or deliverable hardware and implement mitigating features;
- Identify and evaluate embedded software that is required for safety critical functions; and
- Identify the effects of inadvertent operation of subsystems to allow the operator to take appropriate actions to ensure the safety of personnel and equipment.

4 OPTIONAL FUNCTIONALITY

The items listed below are options to the work requirements described in Section 3. Separate costs are requested for each of these options.

4.1 SECOND TRANSPONDER SYSTEM

The Contractor may be requested to deliver, install and test a transponder system in Ottawa, Ontario, Canada (TBC), in addition to the transponder system in SHUB already part of the work requirements. Details on the installation site for this second transponder system is available in Section 1.3.

Work requirements related to this second transponder system are identified as "(Option") throughout Section 3. It is assumed by the RCM Transponder Team that the second transponder system will use the same design as the transponder system in SHUB and will be built using the same types of hardware and software components.

The Contractor shall provide the cost for a second transponder system.

The cost for the second transponder system will be part of the bid evaluation.

4.2 DUAL-CHANNEL DESIGN

The Contractor may be requested to deliver a dual-channel design (RF and/or Digital Signal Processing (DSP)) to receive both H and V channels simultaneously and independently on the transponder system, in conjunction with dual-polarization (H and V) antennas.

The Contractor shall provide the cost for the dual-channel design.

The cost for the dual-channel design will not be part of the bid evaluation.

4.3 REMOTE CONTROL OF ANTENNA POLARIZATIONS

The Contractor may be requested to design, implement and test a remote control functionality of the receive and transmit antenna polarizations of the transponder system, which would then both be settable at H, V and 45°.

The Contractor shall provide the cost for the remote control functionality of antenna polarizations.

The cost for the remote control of antenna polarizations will not be part of the bid evaluation.

4.4 PROCUREMENT OF SPARES

The Contractor may be requested to procure the spares parts for which requirements, envisaged spares philosophy and spares procurement plan over the forecasted system life shall be detailed in the System Maintenance Concept (CDRL OPS-2). Procurement of spares shall ensure maintainability of the transponder system.

The Contractor shall provide separate cost proposals for the following 3 levels of spares to meet the reliability requirement of the transponder system throughout its life expectancy as specified in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1]:

1) Level 1: Subsystems;

2) Level 2: Cards; and

3) Level 3: Components.

Refer to Section 3.3.3 for more details on the timeframe forecasted to confirm if this option will be exercised or not.

The cost for the procurement of spares will not be part of the bid evaluation.

4.5 EXTENDED WARRANTY

The Contractor may be requested to provide an extended warranty of 5 years parts and labour, including on-site support within a maximum of one-week delay (TBC) of response to the service call.

The Contractor shall provide the cost for the extended warranty.

The cost for the extended warranty will not be part of the bid evaluation.

4.6 MAINTENANCE CONTRACT

The Contractor may be requested to provide maintenance for the new transponder system to be delivered under the work described in Section 3 beyond the period covered by the standard warranty.

The Contractor shall provide annual rates or cost structure for the following types of technical support throughout the life expectancy of the transponder system as specified in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1]:

1) Remote technical support (email or phone);

2) On-site technical support; and

3) Level 2 repair at the Contractor's facilities.

Level 2 repair includes repair of the transponder system cards at the Contractor's facilities and shipment of the fully functional cards back to CSA. CSA will pay for all fees, including shipping of faulty cards to the Contractor's facilities, purchase of new hardware, software upgrades, labor, troubleshooting, verification (test) and shipping of the repaired cards from the Contractor's facilities back to CSA. The Contractor may reserve the right to repair or replace the cards, but the form, fit and function of the cards shall remain the same.

The cost for the maintenance contract will not be part of the bid evaluation.

4.7 TRANSLATION OF DOCUMENTATION

The Contractor may be requested to translate some or all of the deliverables submitted to the RCM Transponder Team in either official languages of Canada (French and English). The translated deliverables shall be of equal quality compared to the deliverables submitted in their original language.

The Contractor shall provide the cost per page for the translation of documentation.

The cost per page for the translation of documentation will not be part of the bid evaluation.

5 GOVERNMENT FURNISHED EQUIPMENT (GFE) ITEMS AND INFORMATION (GFI)

The TA will provide the Contractor with the GFE items, GFI and services listed in Table 5-1, at the times specified therein.

TABLE 5-1: GFE ITEMS AND GFI

ID	Description	Quantity	Supplier	Delivery Date
1.	All ADs listed in Section 2.1.	1	CSA	Contract Award
2.	Arrangements for access to the transponder site in SHUB.	1	CSA	Contract Award
3.	(Option) Arrangements for access to the transponder site in Ottawa (TBC).	1	CSA	KOM
4.	Shelter to house components of the transponder system indoor unit at the SHUB installation site, including TCU space and complete with primary power and distribution wiring, heating, ventilation, lighting and phone and network utilities required for the transponder system installation, testing and operation. Detailed information on utilities available at both installation sites is available in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].	1 (SHUB)	CSA	FAT
5.	(Option) Shelter to house components of the transponder indoor unit at the Ottawa (TBC) installation site, including TCU space and complete with primary power and distribution wiring, heating, ventilation, lighting and phone and network utilities required for the transponder system installation, testing and operation. Detailed information on utilities available at both installation sites is available in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].	1 (Ottawa) (TBC)	CSA	FAT
6.	Dome to house components of the transponder system outdoor unit at the SHUB installation site. See RCM and Multimission Precision	1 (SHUB)	CSA	FAT

ID	Description	Quantity	Supplier	Delivery Date
	Transponder Requirements Specification [Document AD-1].			
7.	Existing concrete base for mounting the transponder system outdoor unit at the SHUB installation site. See RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].	1 (SHUB)	CSA	FAT
8.	(Option) Existing concrete foundation for mounting the transponder system outdoor unit at the Ottawa (TBC) installation site. See RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].	1 (Ottawa) (TBC)	CSA	FAT
9.	Cable conduit from the concrete base of the dome structure (second floor) to the shelter (first floor) for the transponder system indoor unit at the SHUB installation site.	1 (SHUB)	CSA	FAT
10.	(Option) Cable conduit from the outdoor foundation to the shelter for the transponder system indoor unit at the Ottawa (TBC) installation site.	1 (Ottawa) (TBC)	CSA	FAT
11.	Local Area Network (LAN) in the shelter at the SHUB installation site.	1 (SHUB)	CSA/SSC	CDR
12.	(Option) Local Area Network (LAN) in the shelter at the Ottawa (TBC) installation site.	1 (Ottawa) (TBC)	CSA/SSC/NRC	CDR
13.	The following documents from the RDs listed in Section 2.1: • Systems Engineering Technical Reviews Standard [Document RD-1]; • CSA Software Coding Standards [Document RD-2]; • Systems Engineering Methods and Practices [Document RD-3].	1	CSA	Contract Award
14.	Dome control software and Dome Scheduler User Manual [Document RD-9] for the SHUB installation site. Basically, the interface of the dome control software is serial and the instruction set is limited to a few instructions and flags to be	1 (SHUB)	CSA	FAT

ID	Description	Quantity	Supplier	Delivery Date
	sent to, and received from, the dome system.			
15.	Temporary equipment storage area (space required is to be provided by the Contractor (refer to Section 3.3.4)) at the SHUB installation site.	1 (SHUB)	CSA	FAT
16.	(Option) Temporary equipment storage area (space required is to be provided by the Contractor (refer to Section 3.3.4)) at the Ottawa (TBC) installation site.	1 (Ottawa) (TBC)	CSA/NRC	FAT
17.	Test passes from other earth observation satellites operating at the same frequency.	As Required	CSA	FAT OSAT1 (Option) OSAT2 Work Phase 5
18.	RCM transponder data relevant to the interface compatibility test.	1	CSA	CDR
19.	External computer required to run the Remote Access software (SW-2).	1 (SHUB)	CSA	FAT
20.	Necessary operating license for the SHUB installation site.	1 (SHUB)	CSA	FAT
21.	(Option) Necessary operating license for the Ottawa (TBC) installation site.	1 (Ottawa) (TBC)	CSA	FAT

6 ACRONYMS AND ABBREVIATIONS

This list contains the acronyms and abbreviations contained in this document. Those not contained in this list may be categorised as trademark or standard names used in the software industry.

A	Approval
AD	Applicable Document
AI	Action Item
AIAA	American Institute of Aeronautics and Astronautics
ANSI	American National Standards Institute
BCF	Backup Control Facility
BIP	Background Intellectual Property
C of C	Certificate of Conformance
C&DH	Command and Data Handling
CA	Contracting Authority
CAD	Computer-Aided Design
CADM	Configuration and Data Management
CAGE	Commercial and Government Entity
CD	Compact Disc
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CF	Contractor's Format
CGRP	Controlled Goods Registration Program
CI	Configuration Item
CIDL	Configuration Items Data List
CM	Configuration Management
COTS	Commercial Off-The-Shelf
CSA	Canadian Space Agency
CSA	Canadian Standards Association
CSCI	Computer Software Configuration Item
DFL	David Florida Laboratory
DID	Data Item Description
DM	Data Management
DSP	Digital Signal Processing
DVD	Digital Versatile Disc
ECN	Engineering Change Notice
ECP	Engineering Change Proposal

EIDP	End Item Data Package
EMC	Electromagnetic Compatibility
EN	Engineering
ESD	Electrostatic Discharge
FAR	Final Acceptance Review
FAT	Factory Acceptance Test
FIP	Foreground Intellectual Property
FPGA	Field Programmable Gate Array
FQT	Factory Qualification Test
FTP	File Transfer Protocol
GAR	GFE Acceptance Review
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GoC	Government of Canada
GPS	Global Positioning System
GS	Ground Segment
H	Horizontal
H&S	Health and Safety
HW	Hardware
ICD	Interface Control Document
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
IP	Intellectual Property
IQS	Image Quality Subsystem
IT	Information Technology
IR	Initial Release
ITAR	International Traffic in Arms Regulations
IV&T	Integration, Verification and Test
KOM	Kick-off Meeting
LAN	Local Area Network
LLI	Long-Lead Item
MAIT	Manufacturing, Assembly, Integration and Test
MS	Microsoft
N/A	Not Applicable
NC	Non-Conformance
NCR	Non-Conformance Report

NCRB	Non-Conformance Review Board
NPRD	Nonelectronic Parts Reliability Data
NRC	National Research Council Canada
OPI	Office of Prime Interest
OPS	Operations
OSAT	On-Site Acceptance Test
PA	Product Assurance
PCF	Primary Control Facility
PDF	Portable Document Format
PDR	Preliminary Design Review
PHA	Preliminary Hazard Analysis
PM	Project Management / Project Manager
PMO	Project Management Office
PMP	Project Management Plan
PRM	Progress Review Meeting
PT	Product Tree
PWGSC	Public Works and Government Services Canada
QA	Quality Assurance
QAP	Quality Assurance Plan
QMS	Quality Management System
QSR	Qualification Status Report
R	Review
RCM	RADARSAT Constellation Mission
RCS	Radar Cross Section
RD	Reference Document
RF	Radio Frequency
RFD	Request For Deviation
RFP	Request For Proposal
RFW	Request For Waiver
RID	Review Item Discrepancy
RMA	Reliability, Maintainability and Avaiability
ROM	Read-Only Memory
S&MA	Safety and Mission Assurance
SAR	Synthetic Aperture Radar
SCD	Source Control Drawing
SE	Systems Engineering

SHUB	St-Hubert
SI	System International
SOW	Statement of Work
SPA	Software Product Assurance
SRR	System Requirements Review
SSC	Shared Services Canada
SW	Software
TA	Technical Authority
TBC	To Be Confirmed
TBD	To Be Determined
TCU	Transponder Control Unit
TIM	Technical Interchange Meeting
USB	Universal Serial Bus
UML	Unified Modeling Language
V&V	Verification and Validation
VDD	Version Description Document
V	Vertical
WBS	Work Breakdown Structure
XML	Extensible Markup Language

APPENDICES

A DELIVERABLES

This appendix lists all the deliverables (hardware, software, documentation) expected from the Contractor.

A.1 HARDWARE DELIVERABLES

The delivery location of each hardware deliverables listed in Table A-1 is specified in brackets beside the quantity.

TABLE A-1: HARDWARE DELIVERABLES

Item	Deliverable Name	Quantity	Milestone
HW-1	Precision transponder system (including all systems, antenna, subsystems and devices purchased, built, configured, installed and commissioned to meet the technical and contract requirements).	1 (SHUB) (Option) 1 (Ottawa) (TBC)	OSAT1 (Option) OSAT2
HW-2	Control computer and related accessories (mouse, keyboard, screen, etc.).	2 (prime and spare units) (SHUB) (Option) 1 (Ottawa) (TBC)	OSAT1 (Option) OSAT2
HW-3	Test hardware, spares kit and tools (all hardware built and purchased under the contract to support the development of the system's software and hardware as recommended by the Contractor and approved by the RCM Transponder Team).	1 lot (SHUB)	FAR / Project closeout meeting
HW-4	Shipping containers (for each transponder system, all test and support equipment and tools).	1 lot (SHUB) (Option) 1 lot (Ottawa) (TBC)	FAT (Option) FAT

A.2 SOFTWARE DELIVERABLES

TABLE A-2: SOFTWARE DELIVERABLES

Item	Deliverable Name	Quantity	Milestone	Delivery Form
SW-1	Transponder Control Software (including all software running on the internal and external control computers required to control and operate the transponder system: source files, compiled files, configuration and parameter files, command files as required).	2 lots (SHUB) (Option) 1 lot (Ottawa) (TBC)	OSAT1 (Option) OSAT2	Electronic, source code for Contractor-developed software, COTS software library and executable as configured at OSAT1.
SW-2	Remote Access Software.	1 lot (SHUB)	OSAT1	Electronic, source code for Contractor-developed software, COTS software library and executable as configured at OSAT1.
SW-3	Installed, pre-installation package, and license(s) of the third-party software development platform required to execute, debug, enhance and build SW-1. It is assumed that the third-party software licenses required to execute the Transponder Control Software are also the ones used to code, debug and enhance that same Transponder Control Software). If not, SW-3 deliverable shall also include these third-party licenses and software required to debug, enhance and rebuild SW-1.	1 lot (SHUB)	OSAT1	Delivery form depends on the software development platform used to create the Transponder Control Software: software key delivered electronically in a text file or any other format compatible to access and use the licenses.
SW-4	Test diagnostic software executables or functions routines useful to monitor parts of the transponder system for diagnostic	2 lots (SHUB) (Option) 1 lot (Ottawa)	OSAT1 (Option) OSAT2	Electronic, source code files and binaries, including build and configure instructions.

	purposes, integrated or not in the Transponder Control Software (SW-1). Such test diagnostic routines shall be installed by default on each Control computer (HW-2) delivered.	(TBC)		

Note: A lot includes everything developed, built and tested relative to the listed item, including build and configure instructions.

A.3 DOCUMENT DELIVERABLES

Approval Categories:

- A = Document for Approval
- R = Document for Review

DID #

- Refer to Appendix B
- CF = Contractor's Format

If the documents identified in the Table A-3 are not convenient for the Contractor, alternate documents may be accepted upon the TA and CA approval.

TABLE A-3: DOCUMENT DELIVERABLES

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
Project Management						
PM-1	Project Management Plan (PMP)	Proposal Submission KOM + 10 days CDR	Initial Release Update Final Release	A A A	3.1.3.3 3.2.1 3.2.4 Table 3-2	0001
PM-2	Master Project Schedule	Proposal Submission KOM – 5 days Every 3 months	Initial Release Update Update	A A A	3.2.3 3.3.1 Table 3-2 3.3.1.6 3.3.3 3.3.3.1 3.3.3.2 3.3.3.3 3.3.4.4 3.3.4.5 3.3.4.6 3.3.5.2 3.3.5.3	0002

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.5.4 DID-0001 DID-0003	
PM-3	Progress Report	Every month	Update	R	3.2.4 3.2.5 3.2.7.1.3 3.2.7.1.4 3.3.1.3	0003
PM-4	Meeting Agenda	Meetings, reviews and teleconferences – 10 days	Initial Release	R	3.2.7.1.1 3.3.1.1.1 DID-0007	0004
PM-5	Minutes of Meeting	Meetings, reviews and teleconferences + 10 days	Final Release	R	3.2.7.1.2	0005
PM-6	Technical Review Plan	Technical reviews – 15 days	Initial Release	A	3.3.1 3.3.1.1.1	0007
PM-7	Technical Review Presentation	Technical reviews – 15 days	Initial Release	A	3.3.1 3.3.1.1.1	CF
PM-8	PDR Data Package	PDR – 15 days	Initial Release	R	3.1.3.3 3.3.3 3.3.3.2	0008
PM-9	CDR Data Package	CDR – 15 days	Initial Release	R	3.1.3.3 3.3.3 3.3.3.3	0008
PM-10	Other Technical Review Data Package	Technical reviews – 15 days	Initial Release	R	3.1.3.3 3.3.1.2 3.3.3 3.3.3.1 3.3.4 3.3.5	0008
PM-11	Crown Assets List	SRR PDR	Initial Release Update	A A	3.2.6 3.3.3	0110

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
		CDR FAR / Project Closeout Meeting	Update Final Release	A A		
PM-12	BIP/FIP Report	PDR OSAT1	Initial Release Final Release	R R	3.2.6 3.3.3 3.3.5	0326
Product Assurance						
PA-1	Quality Assurance Plan (QAP)	Proposal Submission KOM	Initial Release Final Release	A A	Table 3-2 3.4.1 3.4.1.1 3.4.5	CF
PA-2	Request For Deviation (RFD) / Request For Waiver (RFW)	As Required	Update	A	3.4.1.7	0014
PA-3	Class I Non-Conformance Report (NCR)	As Required	Update	A	3.4.1.6	CF
PA-4	Safety Assessment Report	PDR CDR As Required	Initial Release Final Release Update	R R R	3.3.3 3.4.5	0115
PA-5	Reliability, Maintainability and Availability (RMA) Report	PDR CDR As Required	Initial Release Final Release Update	R R R	3.3.3 3.4.4	CF
PA-6	Storage, Transport and Handling Procedures	CDR FAT	Initial Release Final Release	R R	3.3.3 3.3.4 3.4.1.4	CF
PA-7	Engineering Change Proposals (ECPs) and Class I Engineering Change Notices (ECNs)	As Required	Initial Release	A	3.4.2	CF
PA-8	End Item Data Package (EIDP)	OSAT1 OSAT2 GAR	Initial Release Initial Release Final Release	A A A	3.3.7 3.4.3	0010
Engineering						
EN-1	System Requirements Specification	SRR PDR	Initial Release Final Release	A A	3.3.1.6 3.3.3	0220

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.4.3	
EN-2	Product Tree	SRR PDR CDR FAR / Project Closeout Meeting	Draft Initial Release Update Final Release	R R R R	3.3.3	0210
EN-3	Documentation Tree	SRR PDR CDR FAR / Project Closeout Meeting	Draft Initial Release Update Final Release	R R R R	3.3.3	0211
EN-4	Drawing Tree	SRR PDR CDR FAR / Project Closeout Meeting	Draft Initial Release Update Final Release	R R R R	3.3.3	0212
EN-5	Long-Lead Items (LLIs) List	SRR PDR	Initial Release Final Release	R R	3.3.3	0213
EN-6	System Design Document	PDR CDR	Initial Release Final Release	R R	3.3.3 3.3.4.1	0260
EN-7	Engineering and Error Budget Document	PDR CDR	Initial Release Final Release	A A	3.3.3	CF
EN-8	Verification, Validation and Test Plan	PDR CDR	Initial Release Final Release	A A	3.3.1.6 3.3.3 3.3.4 3.3.4.2 3.3.4.3 3.3.4.5 3.3.5 3.3.5.3	0204
EN-9	Installation Plan and Installation Procedure (on-site assembly instructions)	SRR CDR	Draft Initial Release	R R	3.3.3 3.3.5	0264

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
		FAT – 3 months	Final Release	R	3.3.5.1.1 3.3.5.1.3	
EN-10	Technical Notes	As Required	Initial Release	R	3.3.3	0227
EN-11	Engineering Analyses	As Required	Initial Release	R	3.3.3 3.3.3.2 DID-0010	0228
EN-12	Software Version Description Document (VDD)	FAT OSAT1 OSAT2 FAR / Project Closeout Meeting	Initial Release Update Update Final Release	R R R R	3.1.3.2 3.3.4 3.3.5	0324
EN-13	Mechanical, electrical drawings (both original electronic file and hard copy)	PDR CDR FAR / Project Closeout Meeting	Initial Release Update Final Release	R R R	3.3.3 3.3.3.3	CF
EN-14	Test Procedure	CDR Test – 10 days	Initial Release Final Release	A A	3.3.3 3.3.4 3.3.4.3	0280
EN-15	Test Report	Test + 10 days	Initial Release	R	3.3.4 3.3.4.3 DID-0010	0285
EN-16	Factory Acceptance Test (FAT) Procedure	CDR FAT – 3 months	Initial Release Final Release	A A	Table 3-2 3.3.3 3.3.4 3.3.4.3	0280
EN-17	Factory Acceptance Test (FAT) Report	FAT + 10 days	Initial Release	R	3.3.4 3.3.4.5 DID-0010	0285
EN-18	On-Site Acceptance Test (OSAT) Procedure	CDR OSAT – 3 months	Initial Release Final Release	A A	Table 3-2 3.3.3 3.3.4.3	0280

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.5	
EN-19	On-Site Acceptance Test (OSAT) Report	OSAT1 + 10 days (option) OSAT2 + 10 days	Initial Release (option) Initial Release	A (option) A	3.3.5 3.3.5.3 DID-0010	0285
Operations						
OPS-1	System Concept of Operations	SRR PDR CDR	Initial Release Update Final Release	A A A	3.3.3	0300
OPS-2	System Maintenance Concept	SRR PDR CDR FAR / Project Closeout Meeting	Initial Release Update Update Final Release	A A A A	3.3.3 3.3.4 3.3.6 4.4	0309
OPS-3	Training Plan	CDR	Initial Release	R	3.3.3 3.3.6	0311
OPS-4	System Calibration Procedures	PDR CDR FAR / Project Closeout Meeting	Initial Release Update Final Release	A A A	3.3.3 3.3.4	0310
OPS-5	Training Course Material	Beginning of training – 10 days FAR / Project Closeout Meeting	Initial Release Final Release	R R	3.3.6	0323
OPS-6	Transponder User's Manual	FAT OSAT1 FAR / Project Closeout Meeting	Initial Release Update Final Release	A A A	3.3.4 3.3.5 3.3.6	0320
OPS-7	Transponder Maintenance Manual	FAT OSAT1 FAR / Project Closeout Meeting	Initial Release Update Final Release	A A A	3.3.4 3.3.5 3.3.6	0321

B DATA ITEMS DESCRIPTIONS (DIDS)

DID-0000 – General Preparation Instructions

PURPOSE:

This DID specifies:

a. format requirements for project documents and data delivered by the supplier in compliance with the Contract Data Requirements List (CDRL);

b. document and data delivery methods and communication of submission and receipt;

c. document and data structure requirements;

d. document and data identification requirements; and

e. metadata requirements for all document and data submissions.

PREPARATION INSTRUCTIONS:

1. GENERAL INSTRUCTIONS

1.1. Electronic Copies

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

Electronic documents and data or notifications of their availability on Contractor's repositories shall be sent to: the CSA CM Receipt Desk: CM_Receipt@asc-csa.gc.ca

If deliverables contain ITAR content, notifications of their availability on Contractor's repositories shall be sent to: the CSA CM ITAR Receipt Desk: CSA-CM-ITAR@asc-csa.gc.ca

Emails are to contain the project/program acronym or equivalent identifier in the "Subject" line and include the CDRL identifier under which deliverable documents are being submitted. The email body shall contain the CDRL identifier under which the deliverable document or data item is being submitted, the document identifier (document number and revision identifier) and the document title, as a minimum.

Hard copy and media deliverables are to be addressed to:

CM Library, 6A-100
Attention: CSA RCM Precision Transponder Project
Canadian Space Agency
6767, Route de l'Aéroport
Longueuil, QC, J3Y 8Y9
CANADA

The DVD/CD-ROM label shall present the following information:

a) Contractor Name;

b) Contractor CAGE Code;

c) Document Title;

d) Document Number and Revision Status;

e) Document Release Date;

f) Contract Number;

g) CDRL Identifier (see requirements in Appendix C);

h) Sub-CDRL Identifier (if applicable – see requirements in Appendix C); and

i) Security Designation of the contents (indicate if contents are subject to ITAR, when applicable).

Media or hard copy deliverables containing classified information, protected information or ITAR information are to be in compliance with the Canadian Government Security Policy, Access to Information Act and the Privacy Act.

1.2. Electronic Documents Format

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

1.2.1. Page Numbering

General format of documents shall include page numbers and may be formatted according to the Contractor's normal standard. If the document in divided into volumes, each such volume shall restart the page numbering sequence.

1.2.2. Document Identifiers

All pages shall contain the full document identifier at the top of the page. Document identifiers shall include the document number, revision identifier and volume identification (when applicable).

2. DOCUMENT STRUCTURE AND CONTENT

2.1. Overall

Except as otherwise specified, all documents shall have the following structure:

a) Cover/Title Page;

b) Table of Contents;

c) Scope;

d) Applicable and Reference Documents;

e) Body of Document; and

f) Appendices.

2.2. Cover/Title Page

The title page shall contain the following information:

- Document number;
- Volume x of y (if multivolume);
- Revision identifier and date of revision;
- Document Title;
- Project Name;
- Contract No.;
- CDRL Item Identifier (see requirements in Appendix C);
- Sub-CDRL Identifier (if applicable – see requirements in Appendix C);
- ITAR label, if applicable;
- Prepared for: Canadian Space Agency;
- Prepared by: Contractor name, CAGE Code, address, and phone number;
- Product tree identifier, if applicable; and
- © HER MAJESTY THE QUEEN IN RIGHT OF CANADA [YEAR].

2.3. Table of Contents

The table of contents shall list the title and page number of each titled paragraph and subparagraph, at least down to the third level inclusive. The table of contents shall then list the title and page number of each figure, table, and appendix, in that order.

2.4. Scope

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

a) Identification (number, title) of the system, hardware, or software to which the document applies;

b) A brief overview of the system to which the document applies; and

c) A summary of the purpose and content of the document.

The requirements specified in the following DIDs are the minimum expected. The Contractor shall include in all documents all additional information required in order to ensure that the document provided will achieve its purpose as stated in the DID.

2.5. Applicable and Reference Documents

This section shall list by Document Number and title, all applicable and reference documents. This section shall also identify the source of all applicable and reference documents and the revision indicator.

2.6. Body of Document

The body of the document shall be prepared in accordance with the content and format requirements defined in the specific DID.

2.7. Appendices

Appendices may be used to provide information published separately for convenience of document maintenance.

3. SUBMISSION OF DATA

Documents and data items shall be submitted via Letter of Transmittal (or an electronic equivalent as mutually agreed by the TA and the Contractor), and acknowledged. The Letter of Transmittal shall be in electronic format and will contain as a minimum, the project identifier, the Contract Serial Number, the CDRL Number (in conformance with the requirements in Appendix C), the Document Identifier (Document number, volume identifier (if applicable) and revision identifier) and the Document Title. The Letter of Transmittal and the acknowledgement of its receipt may be in email format if mutually agreed by the TA and the Contractor.

If physical media are involved, a printed copy of the Letter of Transmittal shall be enclosed in addition to the electronic notification. A copy of the Letter of Transmittal shall be signed as acknowledgement of receipt and a scanned copy will be returned to the Contractor.

DID-0001 – Project Management Plan (PMP)

PURPOSE:

The Project Management Plan (PMP) is used to guide both project execution and project control.

The PMP is used by the GoC to assess the adequacy of the Contractor's plan for management of the work and to provide a basis on which to monitor and assess the progress of the work.

PREPARATION INSTRUCTIONS:

The PMP shall contain the following information, as a minimum:

1) A project organization section that clearly defines the reporting structure, responsibility and authority of each position, and the personnel within the project team for the complete project and their associated coordinates. For key (core) positions identified in the contract, the background and experience of each key team member shall be provided.
2) A financial management section that shall include a detailed description of how the Contractor proposes to control financial expenditure during the Contract so as to meet the requirements of the SOW within the proposed schedule and within the terms of the financial proposal as well as a detailed description of how the money is to be allocated and a detailed description of how funds are allocated throughout the project.
3) A higher-level project schedule than what is presented in the master project schedule (CDRL PM-2) that shall reflect the contract schedule for all of the work. Variance shall be presented in monthly report as required.
4) A WBS indicating which tasks will be performed and the level of effort required. The WBS serves as a basis for work planning, responsibility assignment, work authorization, problem identification, scheduling, budgeting and performance management and analysis of the project. The WBS should go down to a level sufficient for the Contractor to monitor and report on the progress of the system and subsystems.
5) A section on project management control and tracking system that will be implemented for the project.
6) A section on Configuration and Data Management (CADM) for the process used by the Contractor to perform documentation control and for the systematic review cycle process.
7) A section on risk management explaining how the Contractor intends to maintain, define, update and report on risk items for the complete project.
8) A section on systems engineering management wherein the Contractor shall explain the development process to be followed, the management of design reviews, the management of technical exchanges with the customer, the process for disposition of problems identified at the end of each phase, the management of component and system testing, the management of system documentation development and the process for resolving problems discovered after delivery. The Contractor shall also describe how subsystem integration will be managed, paying special attention to subcontractor duties where applicable.

9) A section on subcontractor management (if applicable). If the Contractor intends to subcontract, the Contractor shall detail their roles, duties, responsibilities and the process that will be implemented with the subcontractor in order to meet its obligation as a prime. The subcontractor's expertise must be demonstrated for the work they will be engaged to do. Previous relevant and similar work experience shall be demonstrated and supporting documentation by means of reports and, or publications should be provided.

DID-0002 – Master Project Schedule

PURPOSE:

To provide a schedule planning and control system for the project and to provide visibility to the TA of the program progress and status.

PREPARATION INSTRUCTIONS:

The master project schedule shall be detailed enough to demonstrate each task to be performed, and shall contain the following information, as a minimum:

1) Dependencies;
2) Resource requirements;
3) Start and end date of each task (baseline and actual);
4) Task duration;
5) Completion status in percentage;
6) Deadlines and milestones; and
7) Comprehensible critical path.

DID-0003 – Progress Report

PURPOSE:

The progress report records the status of the work in progress during the previous calendar period. The progress report is used by the GoC to assess the Contractor's progress in performance of the work.

PREPARATION INSTRUCTIONS:

The progress report shall include status data and information summarizing project management, technical and schedule progress and accomplishment for each element of the Contractor's WBS. The report shall address the major activities of the reporting period and shall emphasize major achievements and events of special significance. Difficulties and/or problems that have affected the work progress, proposed corrective actions, and project impact expected, shall also be reported.

Each progress report shall answer the following three questions:

1) Is the project on schedule?
2) Is the project within budget?
3) Is the project free of any areas of concern in which the assistance or guidance of the RCM Transponder Team may be required?

Each negative response shall be supported with an explanation.

The progress report shall include the following information, as a minimum:

1) *Summary of progress this month*: a summary of main activities accomplished during the reporting period.
2) *Discussion of planned activities not accomplished*: a summary of main activities not accomplished during the month, the reasons why and the potential impact on the project plan.
3) *Planned work next month*: a summary of the planned important accomplishments for the following month, and shall be limited to half a page.
4) *Brief discussion of problems/concerns*: a summary of the current problems/concerns, their impact on the current plan, the plan to mitigate them and expected support from the RCM Transponder Team to help resolve the situation.
5) *Schedule status reports*: a narrative explanation of the critical path progression shall be provided and shall be rationalized for deviation from baseline (if applicable). For any slippage of milestones identified in Table 3-2, a recovery plan shall be presented. An update of the master project schedule (CDRL PM-2) shall be provided as per Appendix A.3.
6) *Equipment*: a list of equipment ordered, received, made and assembled.
7) *Risks*: a risk status report including Contractor's and subcontractors' (if applicable) previous issues resolved, status of ongoing risks (changes, likelihoods and impacts) and identification of new risks, their likelihood and impact and proposed mitigation actions.

8) *PA reporting*: a narrative section describing significant accomplishments during the reporting period, audits performed, significant problems, recommended solutions and corrective action status, significant changes in the PA organization and project related organizations.

9) *Action Items (AIs) Log*: a log of all AIs from previous review(s) and meeting(s). Each AI shall contain the following information: ID, title, description of the action, open date (usually the meeting date), meeting name, originator, Office of Prime Interest (OPI), assignee (person responsible for taking action), due date, progress update, rationale for closure, closure date, status (e.g. “Open” or “Closed”), remarks / additional comments. Note that the due date will be the target date as long as the item is open.

10) *Invoicing*: A list of invoicing planned or anticipated for the coming month.

DID-0004 – Meeting Agenda

PURPOSE:

To clarify the purpose and content of a technical or programmatic meeting.

PREPARATION INSTRUCTIONS:

The meeting agenda shall contain the following information, as a minimum.

1) DOCUMENT HEADER:

a) Title;

b) Type of meeting;

c) Project title, project number, and contract number;

d) Date, time and place;

e) Chairperson;

f) Proposed attendee list (mandatory and optional); and

g) Expected duration.

2) DOCUMENT BODY:

a) Introduction, purpose, objective;

b) Opening Remarks: CSA;

c) Opening Remarks: Contractor;

d) Review of previous minutes and all open AIs;

e) Project technical issues;

f) Project management issues;

g) Other topics;

h) Review of newly created/closed AIs, decisions, agreements and minutes; and

i) Set or confirm dates of future meetings.

DID-0005 – Minutes of Meeting

PURPOSE:

Minutes of meetings provide a record of decisions, summary of discussions, AIs and agreements reached during the meeting.

PREPARATION INSTRUCTIONS:

Minutes of meeting shall include the following information, as a minimum:

1) Header containing the following:
   a) Title, type of meeting, date, location, time and duration; and
   b) Project title, project number, and contract number.
2) List of the attendees by name, position, phone numbers and e-mail addresses as appropriate.
3) Purpose and objective of the meeting.
4) Agreed upon meeting agenda.
5) Summary of the discussions, decisions and agreements reached.
6) Listing of open AIs including a description, assignee and a due date for each AI to be implemented as a result of the meeting.
7) Other data and information as mutually agreed.
8) Space for signatures of the designated representatives of the Contractor and the TA for reviews attached to milestone payments.
9) The minutes must include the following statement:

"All parties involved in contractual obligations concerning the project acknowledge that minutes of a review/meeting do not modify, subtract from, or add to the obligations of the parties, as defined in the contract."

DID-0007 – Technical Review Plan

PURPOSE:

The technical review plan is used by the Contractor to give general information about a specific formal technical review (SRR, PDR, CDR, etc.).

PREPARATION INSTRUCTIONS:

The technical review plan shall include the following information, as a minimum:

1) Technical objectives of the review.
2) Entry and exit criteria for the review.
3) Review timeline associated with the review (deadline for the delivery of CDRLs, deadline for the delivery of presentation material, goal timeline for the receipt of CDRL RIDs, etc.).
4) Review organization (where the review will be held, how much time will the review last, review board members, etc.).
5) RID process for the review.
6) List of CDRLs submitted to the review.
7) Proposed agenda (optional as it may be delivered separately under Meeting Agenda (CDRL PM-4)).

DID-0008 – Technical Review Data Package

PURPOSE:

The technical review data package is a collection of all documents to be presented by the Contractor for a specific formal technical review (SRR, PDR, CDR, etc.).

PREPARATION INSTRUCTIONS:

Each review data package shall contain the documents identified in the Milestone column of the CDRL table presented in Appendix A.3 as due for that review, plus the presentations made at the meeting, the agenda, the minutes, open RIDs, open RFDs/RFWs, open QSRs and the AI list.

DID-0010 – End Item Data Package (EIDP)

PURPOSE:

To provide the historical record and documentation of an end item.

PREPARATION INSTRUCTIONS:

The EIDP shall provide, in a single document, the information necessary to accept the end item. The EIDP shall contain all the documentation that provides visibility over the configuration, manufacture, assembly and test operations performed on the equipment delivered.

Each EIDP shall be initiated and maintained during all stages of assembly, inspection and acceptance test for each unit and will contain the traveler sheets.

The interface control documentation/drawings provided in the EIDP shall reflect the latest design status.

The EIDP shall contain the following information, as a minimum:

1. Title Page. The cover page of the deliverable data package will identify the item delivered. a. Item part name, number and serial number; b. Model number (if applicable); c. Contract number (if applicable); and d. Contractor/supplier name (if applicable).
2. Index (Table of Contents).
3. Certificate of Conformance (C of C) with Requirements Verification Compliance Matrix: The C of C shall state the item is verified and provide the following: a. Identification of applicable specification requirements document(s) (document number and revision level); b. Identification of applicable ICD document(s) (document number and revision level); c. Unit or item description, part number (vendor part number of Contractor part designation if applicable) and serial number; and d. Approval and signature by the Contractor/supplier PA and Technical Lead.
4. RFD/RFW listing. TA-approved waivers and deviations to the contract authorizing hardware acceptance with existing variations, as applicable to the physical/functional parameters of the item qualified (i.e. form, fit, function).
5. NCs and NCRB reports: All Class I NCRs or NCRB reports and problem reports shall be included along with a list of the Class II NCs by NCR number including description and the final disposition.
6. List of temporary items and open work.
7. Handling, transportation and storage procedures.
8. Identification of the as-designed and as-built Configuration. An indentured parts list of the

hardware being delivered, at the unit and major sub-assembly levels, shall define the difference between the assigned as-designed configuration and the as-built configuration and supporting rationale for differences.
9. Interface control drawings for the deliverable end item.
10. Configuration Items Data List (CIDL) containing a listing of all documents, including specifications, drawings, schematics, ICDs, software description documents, etc, including revision level, that are part of the deliverable end item.
11. Test procedures.
12. Test reports.
13. Calibration data summarizing the calibration results reported in the FAT report (CDRL EN-17), as well as measurement results validating the main specifications from test reports (CDRLs EN-15, EN-17 and EN-19) and/or engineering analyses (CDRL EN-11).
14. End-item inspection report.

DID-0014 – Request for Deviation / Waiver (RFD/RFW)

PURPOSE:

A Request for Deviation/Waiver (RFD/RFW) shall be submitted for NCs to the project requirements and/or for equipment performance Class I NCs.

PREPARATION INSTRUCTIONS:

An RFD or RFW shall contain the following information, as a minimum:

ID	Data	Description	Deviation	Waiver
RFD/RFW Identification				
1.	Organization	Identification of the organization originating the RFD/RFW	**X**	**X**
2.	Number	Unique identification and register number	**X**	**X**
3.	Revision	Revision status of the RFD/RFW	**X**	**X**
4.	Date	Issue date of the RFD/RFW	**X**	**X**
5.	Classification	Classification (i.e. major or minor)	**X**	**X**
6.	Project	Project under which the non-conforming item is supplied	**X**	**X**
7.	Business agreement / contract identifier	Business agreement / contract identification under which the non-conforming item is supplied (if applicable)	**X**	**X**
8.	Order	Order number under which the non-conforming item is supplied (if applicable)	**X**	**X**
9.	Originator site	Location of the RFD/RFW originator (if applicable)	**X**	**X**
Identification of Affected Item and Affected Documents				
10.	Item designation	Identification of the nonconforming item per name, manufacturer, part number and serial number (for a waiver), according to its configuration item data list	**X**	**X**
11.	Affected item(s)	Identification of the CI(s) (number and name) affected by the deviation or waiver	**X**	**X**

ID	Data	Description	Deviation	Waiver
12.	Effectivity	Model or serial number (or batch / lot number) of the deviating or non-conforming item	**X**	**X**
13.	Affected document(s)	Identification of the document(s) (specification, design drawing, etc.) to which the item does not conform (document number and revision/issue, paragraph or requirement ID)	**X**	**X**
14.	Short description	Title or short description of the RFD/RFW (consistent with the title of the related non-conformance report)	**X**	**X**
15.	Detailed description	Description of the deviation from the relevant requirement or design feature. / Description of the non-conformity, supported by sketches and attachments as appropriate. Include information on the origin of the deviation/waiver (design difficulties, non-conformance observed, procurement difficulties, ambiguous specifications, schedule constraints, etc.)	**X**	**X**
16.	NC Report	Identification number of the NC Report related to the RFW		**X**
17.	NCRB	Identification of the minutes of meeting of the NCRB which decided to raise the RFW		**X**
Technical and Programmatic Impact Assessment and Decision				
18.	Impact Assessment	Impact on cost, schedule, functionality, performance, reliability and safety	**X**	**X**
19.	Consequences of non-approval	Project impact if the deviation/waiver is not approved (cost and schedule)	**X**	**X**
20.	Rationale for acceptance	Reason why the proposed deviation/non-conformity can be accepted (supporting analyses, drawings, etc.)	**X**	**X**
21.	Adverse effects	Item characteristics affected by the deviation or non-conformity	**X**	**X**
22.	Limitation of use	Regarding the intended use		**X**

ID	Data	Description	Deviation	Waiver
23.	Approval	Decision (Approval or Disapproval), names, date and signatures of the relevant authorities (Project Manager, Systems Manager, S&MA Manager)	**X**	**X**

DID-0110 – Crown Assets List

PURPOSE:

The purpose of the Crown Assets List is to record formally the inventory of all Crown property produced and/or acquired under the contract by the Contractor and any of its subcontractors.

PREPARATION INSTRUCTIONS:

This document shall list all the material produced under the contract. For each item, the following shall be listed:

1) Contractor's identifier (part number).
2) CSA inventory number.
3) Name.
4) Manufacturer's model number.
5) Manufacturer's serial number.
6) Description.
7) Controlling specification, such as drawing number, source control drawings, etc.
8) Date item was produced and/or acquired by the Contractor.
9) Current location.
10) Recommended disposal: delivery to Crown location, delivery to third party, storage at Contractor location, storage at subcontractor location or other recommendation.

DID-0115 – Safety Assessment Report

PURPOSE:

To provide visibility of the safety program status with respect to hazard identification, control, verification and compliance with project requirements.

PREPARATION INSTRUCTIONS:

The Safety Assessment Report shall identify all safety features of the hardware and software, and system design, as well as procedural, hardware and software related hazards present in the system. It shall include the results of the Preliminary Hazard Analysis (PHA) as well as any other safety analyses performed on the equipment, system, interface with other systems. The PHA and other hazard analyses shall identify equipment design, integration and test, operational site processing safety hazards and proposed hazard controls early in the design phase. The Safety Assessment Report shall include a hazards list with hazard controls that meet the safety requirements. The Safety Assessment Report shall be updated throughout the development effort.

The Safety Assessment Report shall include the safety analysis and hazard log in accordance with the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1] and shall also include the following data, as a minimum:

1) Safety criteria and methodology used to classify hazards.
2) Hazard reports documenting the results of the safety program analysis.
3) List of hazardous materials generated or used in the system.
4) Recommendations applicable to hazards at the interface of the system.
5) Conclusion with a signed statement that all identified hazards have been eliminated or controlled to an acceptable level.

DID-0204 – Verification, Validation and Test Plan

PURPOSE:

The verification, validation and test plan is used to:

- Identify and describe the activities planned to verify that the system or a unit conforms to its requirements;
- Provide the system requirements verification and compliance matrix that traces the requirements to each activity; and
- Describe the activities to validate a system within its operating environment.

PREPARATION INSTRUCTIONS:

NOTE: In the case of a unit verification and validation plan, the requirements below shall be adapted as necessary.

The verification, validation and test plan shall, as a minimum:

1) Include an identification number, title and brief overview of the system to which the verification, validation and test plan applies.
2) Describe the relationship of this plan to other project management and engineering plans (if applicable).
3) Provide an overview of the approach to verification and validation methodology to be employed on the project.
4) Identify the organizations and individuals responsible for verification and validation, including roles and responsibilities of the parties.
5) Provide a system requirements verification and compliance matrix that shall contain, for each requirement, as a minimum:
   a) The requirement document number and requirement identifier;
   b) The requirement description;
   c) Other relevant requirement references;
   d) Verification method for each requirement, indicating level-of-assembly;
   e) Requirement compliance based on verification data presented at the current phase;
   f) For quantitative requirements, the actual predicted or achieved performance and the margin over the requirement;
   g) Link to the verification data that justifies the compliance and the quantitative value (document, page and paragraph);
   h) Comments as required (e.g. on plans to rectify non-compliances).
6) Define the verification and validation activities that will prove, at each phase, that the system and subsystems progressively meet all the specified requirements, including functional, performance, interface and environmental requirements. NOTE: For the precision

transponder system being developed under this contract, the demonstration of the performance and operational capabilities shall be performed using RADARSAT-2, or any other identified SAR satellite, with adequate radar signal characteristics.

7) Describe the methods and techniques to be used to measure, evaluate, verify and validate the system (this is to include characterization of the system behaviour that is not controlled by requirements and but is important for understanding of the system, and establishing the actual values of parameters that exceed requirements).

8) Describe the methods and techniques to be used to calibrate the system.

9) Show how requirements verification progresses up the hierarchical tree from item and subsystem verification and validation to system verification and validation, and show that every requirement is verified using a verification matrix.

10) Explain how requirements verification and validation will be traced from the upper level requirements through all mid-level documents to the closure documents (test results, analyses, similarity reports).

11) Define the requirements for supporting facilities, analysis tools and test equipment, both existing and needing to be constructed; assumptions on the use of GFE in testing are to be documented, including:

    a) The specific equipment and materials needed;

    b) The configuration of the equipment to be used;

    c) Any requirements on modification or upgrade of the GFE; and

    d) The location in which it is to be used.

12) Define the schedule for verification and validation activities (especially high-impact items such as full-system testing), and the schedule requirements for the government furnished facilities (e.g. DFL) (if applicable).

13) Contain a filled-out copy of the system requirements traceability matrix.

14) Validation policy.

15) Validation approach – outline of the strategy for validating the system within its operating environment, in accordance with CSA and government standards, procedures and methodologies.

16) Planning and scheduling of verification and validation activities.

17) Acceptance criteria to confirm that the system meets defined requirements.

18) Compliance requirements for the system, including how the system will meet these requirements.

DID-0210 – Product Tree (PT)

PURPOSE:

To establish the hierarchical structure of the products that defines a system.

PREPARATION INSTRUCTIONS:

1) TYPE OF OUTPUT INFORMATION

The Product Tree (PT) shall be prepared in the form of a diagram tree or tabular format and shall describe the hierarchical breakdown of the system into lower-levels as necessary to fully define the system. It shall be structured as a "natural" breakdown of the system. It shall be strictly product oriented, that is a systematic subdivision of the product into discrete and related elements of the product to be provided. It shall provide a complete graphical overview of the entire system by its defined product items and their relationships. The PT is a structure on its own, but forms the basis for other structures.

2) LEVEL OF DETAIL

The subdivision shall go down to the items of every program contract/subcontract (hardware and software shall be identifiable).

a) A hierarchical address code shall be used;

b) The PT shall identify the items' specification; and

c) The PT shall identify the responsible supplier.

The subdivision shall be limited to items where management control is required for the following aspects:

a) Configuration control;

b) Cost;

c) Engineering;

d) Product assurance; and

e) Operations and logistics.

DID-0211 – Documentation Tree

PURPOSE:

To establish the hierarchical structure of the documents developed to design, build and test a system and to manage the project.

PREPARATION INSTRUCTIONS:

The documentation tree shall be prepared in the form of a diagram tree or tabular format, establishing traceability from the highest-level documents to the lowest. The applicability of each document to others shall be shown. A hierarchical address code shall be used.

DID-0212 – Drawing Tree

PURPOSE:

To establish the hierarchical structure of the drawings developed to design and build a system.

PREPARATION INSTRUCTIONS:

The drawing tree shall be prepared in the form of a diagram tree or tabular format and shall identify the breakdown of assemblies from the top level to the lowest assembly level. For each assembly, all detailed drawings shall be identified. Parts lists, electrical schematics and wiring diagrams at all shall be identified in the tree.

For each drawing identified in the tree, the title and number shall be specified.

DID-0213 – Long-Lead Items (LLIs) List

PURPOSE:

To identify hardware and software items with long procurement schedules. It supports cash flow planning by the Government of Canada.

PREPARATION INSTRUCTIONS:

The long-lead items (LLIs) list shall identify, as a minimum:

1) All LLIs.
2) The timeframe, relative to the project schedule, when these items need to be ordered/fabricated.
3) The estimated cost of all identified items.

DID-0220 – Requirements Specification

PURPOSE:

To define the functional, performance, environmental and other requirements for a given system, subsystem, unit, module or assembly and to provide the basis on which the requirements specification will be developed.

NOTE: Requirements specifications are sometimes called “Requirements Document”. This DID applies to them as well.

PREPARATION INSTRUCTIONS:

The requirements specification shall define the requirements on the subject item (system, subsystem, etc.) as a whole and shall not contain specific requirements on subitems. All requirements shall be verifiable on the item as integrated.

The Requirements Document shall contain the requirements as subsequently refined or modified during contract negotiations from what is defined in the SOW and in the RCM and Multimission Precision Transponder Requirements Specification [Document AD-1].

The Requirements Document shall comprise a number of sections, each defining a specific set of requirements. The document shall address all of the following requirement areas, as a minimum:

1) Functional requirements.
2) Performance requirements.
3) External interface requirements (unless done in a separate document).
4) Design requirements.
5) Construction requirements.
6) Qualification and/or verification requirements.
7) Packaging requirements, if any.
8) External stowage requirements, if any.
9) Ground support equipment requirements, if any (unless done in a separate document).
10) Other applicable requirements types.
11) System requirements traceability matrix which shall, as a minimum:
    a) Contain all requirements in the project, down to Source Control Document (SCD) requirements;
    b) Show how requirements are allocated to subsystems and how they are decomposed and derived before application to subsystems;
    c) Point to analysis or budgeting documents as sources of requirements based on derivation and decomposition; the analysis is a step in between the parent requirement and the derived child requirement.

Environmental requirements should address the following, as appropriate:

1) Environmental test factors.
2) Protoflight and qualification testing, philosophy and factors.
3) Environmental design and test requirements:
    a) Structural/mechanical design requirements;
    b) Thermal design requirements;
    c) Electrostatic and EMC design requirements;
    d) Atmospheric environment;
    e) Radiation Environment;
    f) Meteoroid and orbital debris environment (not applicable for this project);
    g) Contamination (not applicable for this project); and
    h) Transport and ground environments.
4) Subsystem and component requirements Item 3) applied to subsystem and units.

Requirements shall conform to the following standards for quality:

a) They shall be unambiguously clear to the intended readership;
b) Each requirement shall have a unique identifier (e.g. an ID number or paragraph number);
c) They shall not define design solutions;
d) They shall be verifiable, preferably by test;
e) They shall specify the conditions under which they apply; and
f) Performance requirements shall be quantified.

Requirements documents shall cite applicable standards and parent requirements (e.g. requirements from manufacturers), and shall make clear the priority sequence of the applicable documents.

Requirements documents shall contain a copy of all system manuals, operator manuals and administration manuals, as applicable, and as available for all COTS subsystems.

DID-0227 – Technical Notes

PURPOSE:

To document and exchange information on the progress of work addressing and resolving technical problems.

PREPARATION INSTRUCTIONS:

Technical notes shall be prepared as engineering reports, in the Contractor's format, that are required to address and resolve technical problems that occur during the contract.

DID-0228 – Engineering Analyses

PURPOSE:

To document analysis work that is performed in support of the design.

PREPARATION INSTRUCTIONS:

The analysis material shall be sufficiently detailed that, in combination with the delivered models, CSA or an external reviewer can reproduce the results. The analysis shall establish feasibility and verification of the design to meet the requirements.

The data shall include references to sources such as equations, material values, parameters and properties.

Engineering analyses shall be prepared in the Contractor's format for summary analyses.

Critical engineering analyses impacting the design and end performance of the transponder system shall contain the following information, as a minimum:

1) Objectives of the analysis.
2) Reference to the relevant requirements.
3) Description of the analysis tools used.
4) Description of the model developed to aid the model user. CAD models (if applicable) shall be delivered in the following formats:
   a) Mechanical design: STEP AP203 (.stp);
   b) Electrical design: .dsn, .sch, Pspice and Gerber formats; and
   c) Software design: UML 2.0 or XML.

   In cases where a different tool is used from the one CSA uses, the model and outputs shall be supplied in native format in addition to the required format. For generic modeling and analyses that don't use a specialty tool, CSA will accept Matlab, Excel and MathCad format data. Where a highly specialized tool is used, the delivery format shall be negotiated with CSA. Translation from the Contractor's tool to the required format is only acceptable where the results can be repeated in CSA's tool. Translation that corrupts the model, loses data, or produces data that is interpreted differently, is not acceptable.

   Delivered models shall contain at least example outputs so that the user can check their function, and should contain the main outputs used in the analysis documents.
5) Identification of the assumption(s) made.
6) Description of the main analysis steps and intermediate results.
7) Results of the analysis and compatibility with the requirement.
8) Identification of potential problem areas and presentation of alternative design solutions.
9) Conclusion.

DID-0260 – Design Document

PURPOSE:

To describe the features and capabilities of the item as designed and the software architectural design. The item could be a system or subsystem.

PREPARATION INSTRUCTIONS:

The design document acts as an "answer" to the requirements document for the system or subsystem: the requirements document state what is needed, and the design document describes what is provided to meet these needs. The design document serves as the main reference text for users after delivery of the item, describing the full range of performance and functional capabilities of the item, as verified during the test/verification program.

The design document shall contain the following information, as a minimum:

1) Scope:
    a) System overview;
    b) Document overview; and
    c) Acronyms.
2) Operational Concepts:
    a) Operational environment;
    b) Support environment;
    c) System architecture; and
    d) Operational modes.
3) System Design:
    a) Design philosophy;
    b) System and equipment functional block diagram;
    c) External interfaces, including, as applicable to the system:
        i) Power requirements including size and type of cabling, over current protection, distribution, voltage requirements and tolerances;
        ii) Network (data communication) requirements to transfer products to and from the system;
        iii) Telecommunications requirements (e.g. phone lines);
        iv) Any additions or modifications required to the site and/or site equipment, to allow interconnection of the transponder to the site facility and/or equipment (foundation, cables, GPS antenna, phone panel, etc.).
    d) Internal interfaces, including, as applicable to the system:
        i) Interface diagrams;

ii) Physical / mechanical interfaces;

iii) Structural / mechanical interfaces;

iv) Thermal / fluids interfaces;

v) Electrical power interfaces;

vi) Electromagnetic Compatibility (EMC);

vii) Command and Data Handling (C&DH);

viii) Environmental interfaces: any environmental factors not addressed elsewhere (e.g. radiation, atmosphere, illumination, etc.);

ix) Materials and processes interfaces;

x) Human factors interfaces;

xi) Propulsion interfaces;

xii) Pyrotechnic interfaces;

xiii) Fire prevention;

xiv) Ground Operations;

e) Subsystems descriptions;

f) Production drawings and schematics;

g) Parts list of all equipment;

h) Rationale for developing custom design for hardware (where applicable);

i) Functional description.

4) Mechanical description.

5) Electrical description.

6) Operating modes and states.

7) Data flow for each functional mode (with the aid of a flowchart and narrative as appropriate).

8) Information to substantiate successful meeting of the equipment specifications (e.g. test data).

9) Software architectural design that shows how all the requirements will be addressed by the software design. In particular:

a) Software architectural design model(s) shall be delivered in UML 2.0 or XML. In cases where a different tool is used from the one CSA uses, the model and outputs shall be supplied in native format in addition to the required format.

b) Delivered models shall contain at least example outputs so that the user can check their function.

c) The software UML 2.0 model shall represent the software requirements and decompose them into elemental requirements, which will then be implemented by software objects defined within the model.

d) The UML 2.0 model shall be used to perform analyses of the software to ensure high quality.

e) The software architectural design shall contain the following information, as a minimum:

i) Activity diagrams;

ii) Class diagrams;

iii) Sequence diagrams;

iv) Interaction diagrams;

v) State diagrams;

vi) Component / deployment diagrams;

vii) Display graphics designs;

viii) Status / control menu designs.

DID-0264 – Installation Plan and Installation Procedure

PURPOSE:

To provide a detailed plan on the overall approach to the installation of the transponder at the operational site, as well as the installation procedure (on-site assembly instructions).

PREPARATION INSTRUCTIONS:

The installation plan and installation procedure shall contain the following information, as a minimum:

1) A system block diagram with a functional description of all subsystems.
2) An equipment list and an installation parts list.
3) A physical description of all equipment required for the installation and the maintenance of the system, including size, weight, mounting details, clearance requirements, cable entries, etc.
4) Wiring and interconnect diagrams.
5) A list of cables, connectors and pin layouts.
6) Detailed work plan including installation methods, activities and procedures and interfaces required for installation.
7) Installation schedules.
8) Identification of any special requirements from the RCM Transponder Technical Team.
9) A configuration list.
10) Assembly and installation procedures, as appropriate, including:
    a) Mechanical interfaces;
    b) Electrical interfaces;
    c) C&DH interfaces;
    d) Scenario setup instructions (software and hardware); and
    e) Scenario analysis instructions.

DID-0280 – Test Procedure

PURPOSE:

To define the procedure to be followed for each test to be performed, at unit level and higher (e.g. FAT and OSAT). This DID is applicable to systems, hardware and software.

PREPARATION INSTRUCTIONS:

The test procedure shall contain the following information, as a minimum:

1) **SCOPE**: This section shall include a brief description of the test and the objectives of the test.
2) **TEST REQUIREMENTS**: This section shall define the measurements and evaluations to be performed by the test.
3) **TEST ARTICLE**: This section shall define in detail the test article configuration that is to be tested.
4) **TEST FACILITIES**: This section shall identify the test facilities to be used, including their physical location, coordinates and contact points.
5) **PARTICIPANTS REQUIRED**: This section shall provide a listing of the individuals (position titles, trade or profession) required to conduct or witness the test.
6) **TEST SET-UP AND CONDITIONS**: This section shall include description / sketches of test articles in test configuration illustrating all interfacing test / support equipment. Instrumentation / functional logic must be shown where applicable. The section must include any environmental and cleanliness requirements.
7) **INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE**: This section shall provide a listing of the instrumentation, test equipment and software that is to be used during the test.
8) **PROCEDURE**: This section shall define the step-by-step procedure to be followed, starting with the inspection of the test article, and describing the conduct of the test up to and including post-test inspection. Each test activity shall be defined in sequence and task-by-task, including test levels to be used and measurements / recordings to be made. It shall include any necessary malfunction and abort procedure.
9) **DATA ANALYSIS**: This section shall define the methods to be used in the analysis of the results, along with the uncertainty range in the results. Data presentation format shall be defined.
10) **ACCEPTANCE / REJECTION CRITERIA TABLE**: This section shall provide data sheets needed during execution of the test specifying acceptance / rejection criteria, including identification of the associated requirements from the requirements documents or specification. These sheets will be in a tabular form allowing columns for measured values and deviations to be recorded. A computer printout generated by test software is acceptable provided it supplies the same information, however the test criteria must be stated in the test procedure.

DID-0285 – Test Report

PURPOSE:

To document the results of all tests done on a system, at unit level and higher (e.g. FAT and OSAT). This DID is applicable to systems, hardware and software.

PREPARATION INSTRUCTIONS:

The test report shall document all tests performed to verify that the system or unit will meet the functional and operational requirements specified in the requirements documents or specification applicable to the system or unit.

The test report shall contain the following information, as a minimum:

1) **APPLICABLE DOCUMENTS**: This section shall include test procedures and system requirements / specification being tested.
2) **TEST ARTICLE OR SYSTEM UNDER TEST**: This section shall define in detail the test article configuration tested.
3) **PURPOSE**: This section shall describe the purpose of the test and the specific requirements / specification that it is intended to verify.
4) **SUMMARY OF TEST RESULTS**: This section shall present a summary of test results, including non-conformances, where applicable.
5) **TEST FACILITIES**: This section shall identify the test facilities used, including their physical location, coordinates and contact points.
6) **TEST SET-UP AND CONDITIONS**: This section shall include descriptions / photos / sketches of test articles in test configuration illustrating all interfacing test / support equipment. Instrumentation / functional logic must be shown where applicable. The section shall describe the environmental and cleanliness conditions present, as well as operating conditions (e.g. supply voltage).
7) **INSTRUMENTATION, TEST EQUIPMENT AND TEST SOFTWARE**: This section shall provide a listing of the instrumentation, test equipment and software used during the test.
8) **DETAILED TEST RESULTS**: This section shall record actual test data obtained on tabular sheets prepared in the test procedure (or software-generated) during the test performance and deviations from the criteria.
9) **TEST DATA ANALYSIS**: This section shall document analyses required to relate the detailed results to the requirements to be verified. A filled-out copy of the system requirements verification and compliance matrix should be provided for high-level tests (e.g. FAT and OSAT).
10) **NON-CONFORMANCES**: This section will provide all NCRs generated during the tests. The NCRs will be dated and stipulate the latest NCRB dispositions.

11) **CONCLUSIONS AND RECOMMENDATIONS**: This section shall identify deficiencies, limitations or constraints and propose alternative design solutions to be evaluated in order to resolve problems encountered in testing.

DID-0300 – System Concept of Operations

PURPOSE:

To define the overall system operations concept at the level of major entities in line with the system characteristics.

PREPARATION INSTRUCTIONS:

The system concept of operations shall contain the following information, as a minimum:

1) System operations requirements and constraints:
   a) System description;
   b) End-users;
   c) Programmatic and operational constraints;
   d) Relationship with other systems / missions / projects; and
   e) External dependencies or interfaces with other organizations.
2) System operations concepts:
   a) Planning processes;
   b) Operations execution processes;
   c) Evaluation processes;
   d) System exploitation processes;
   e) Support processes; and
   f) System operations team.
3) Operational scenarios.

This document shall be prepared in accordance with standard ANSI/AIAA G-043-1992 – Guide for the Preparation of Operational Concept Documents.

DID-0309 – System Maintenance Concept

PURPOSE:

To describe the concept for maintaining and calibrating the system, hardware and software, on-ground and in-space (if applicable).

PREPARATION INSTRUCTIONS:

The system maintenance concept document shall contain the following information, as a minimum:

1) System maintenance general concepts.
2) Identification of all required nominal and non-nominal activities and procedures for maintaining the in-space (if applicable) and on-ground databases and software throughout the system life.
3) Identification of activities and process to manage the configuration of the in-space (if applicable) and on-ground databases and software throughout the system life.
4) Description of all processes adopted for preventive and corrective maintenance, including level of repair undertaken by operational personnel, source of any external support and schedules for maintenance activities.
5) List of parts of the transponder system that need to be shipped, from the installation site to and from the Radar Cross Section (RCS) calibration site where repeat transponder system RCS calibration measurements will be performed.
6) Decomposition sequence of the transponder system into shipping assemblies, from the installation site to and from the RCS calibration site where repeat transponder system RCS calibration measurements will be performed.
7) Hardware / software preventive maintenance procedures.
8) Hardware / software corrective maintenance procedures.
9) Requirements for spares and consumables.
10) Envisaged spares philosophy and spares procurement plan (over the forecast system life).
11) Recommended equipment, tools and spare parts list supplied during the development of the project at the system, subsystem and module levels (levels 1, 2 and 3 respectively) and required for the operations and maintenance of the system over the duration of its lifetime. This spare parts list should be arranged for equipment so that relationships of parts to modules, modules to subsystems, etc. up to the system level are easily discerned. The list should be to the lowest level of replaceable part of module according to the maintenance philosophy of the item. The spare parts list should preferably be provided in Microsoft Excel and shall contain the following information, as a minimum, for each system, subsystem and module:
    a) Part or model number;
    b) Name;

c) Description;

d) Manufacturer / vendor;

e) Procurement lead time (at present);

f) Unit cost;

g) A configuration list;

h) Revision level;

i) Production date; and

j) Date and site in which installed/used/stored.

12) Software administration processes and procedures.

13) Description of each individual process identified above, including required resources and constraints for its execution.

14) References to items in the technical library pertinent to each activity.

15) Appropriate procedures to address IT security concerns.

16) Plan to calibrate the system to keep optimum performances, including calibration requirements and methodology.

DID-0310 – Calibration Procedures

PURPOSE:

To describe the calibration procedures for the system and to identify the calibration resources required.

PREPARATION INSTRUCTIONS:

The calibration procedures shall describe the procedures to be used for calibration of the system during the routine operational phase, the requirements for their execution, their place in the operational schedule, and all other information needed to plan for keeping the system functioning accurately.

The calibration procedures shall contain the following information, as a minimum:

1) Calibration procedures.
2) Calibration tests.
3) Hardware and software requirements.
4) Conclusion.

DID-0311 – Training Plan

PURPOSE:

To define plans for training the system routine operations team.

PREPARATION INSTRUCTIONS:

This document shall provide a detailed description of the training of the system operations staff. It shall describe the material, the in-class training and the hands-on training required to bring operational staff to an adequate level of readiness for the routine operation of the system.

The training plan shall contain the following information, as a minimum:

1) An analysis of the required skills for the personnel, including interfaces with other parties, tools that need to be used and assumptions about prior knowledge and experience.
2) Final drafts of all information to be provided during the courses.
3) List of all associated training activities as described in Section 3.3.6, including but not limited to:
    a) Instructor's name;
    b) Training materials developed/purchased;
    c) Vendor;
    d) Complete course outlines (high-level sections defined by a short description) and objectives;
    e) Training module description;
    f) Target audience;
    g) Projected duration;
    h) Trainee prerequisites; and
    i) Evaluation methods.
4) List of test equipment and facilities required to conduct the operations and maintenance course.

DID-0320 – User's Manual

PURPOSE:

To provide detailed step-by-step procedures and guidance for the operation of the system. The user's manual should be generic in nature and shall address each and every piece of equipment that requires actions to operate.

PREPARATION INSTRUCTIONS:

The user's manual shall include drawings and pictures, not in separate documents and shall contain the following information, as a minimum:

1) Purpose.
2) Scope and target audience / requirements for users (operators).
3) System overview:
   a) Description of the functions of the entire system and each equipment;
   b) Functional block diagrams, mechanical drawings, electrical schematics, parts lists, control layouts and menus;
   c) Identification of the hardware and software that are part of each subsystem; and
   d) Description of the theory of operation of the equipment to the level needed for the repair of the equipment by technical staff, in accordance with the maintenance philosophy defined for the system.
4) How it works, getting started – concept of execution:
   a) Power and power-up/down requirements and initiation of the software and termination of system operation;
   b) Operations – routine, off nominal procedures and rules;
   c) Products (inputs or outputs) structure;
   d) Analysis;
   e) Configuration; and
   f) Security.
5) System and subsystem architecture and capabilities, including operational modes.
6) System and subsystem links with other subsystems (internal and external interfaces).
7) System and subsystem runtime environment.
8) Software user procedure:
   a) Information and user instructions necessary for user interaction with the CSCI(s); and
   b) Listing of all error messages including definition and action to be taken.
9) C&DH procedures:

a) Methods of commanding the system and/or experiment (computer, manual, other); and

b) Methods of collecting and disposing of H&S data.

10) System and subsystem operator's responsibilities:

a) Operations;

b) Analysis;

c) Configuration; and

d) Security.

11) Environmental requirement / constraints:

a) Operation; and

b) Storage.

12) Identification and documentation of any changes made to original equipment manufacturer manuals.

13) Quick reference section.

14) All and any other relevant system and subsystem information.

15) An overall index of all the documentation provided.

16) Appendices as required to provide information unique to each transponder being installed at each site.

DID-0321 – Maintenance Manual

PURPOSE:

To provide detailed step-by-step procedures and guidance for the maintenance of the system, including its calibration. The maintenance manual should be generic in nature and shall address each and every piece of equipment that requires actions to maintain.

PREPARATION INSTRUCTIONS:

The maintenance manual shall include drawings and pictures, not in separate documents and shall contain the following information, as a minimum:

1) Purpose.
2) Scope and target audience / requirements for maintainers.
3) Disassembly procedure.
4) Test, maintenance and troubleshooting procedures and management of the system (including frequency):
    a) Actions to be taken when an error or anomalous behaviour has been detected (detection, analysis and correction);
    b) Recovery from faults or interrupts including restart and the collection of information concerning the fault;
    c) Description of diagnostic features available to the operator of the system, including available tools and step-by-step diagnostic procedures;
    d) Backup and recovery process;
    e) Upgrade process;
    f) Security updates;
    g) Preventive maintenance;
    h) Adaptive maintenance;
    i) Corrective maintenance;
    j) Perfective maintenance;
    k) Replacing hardware;
    l) Installation and configuration detailed instructions;
    m) Administration instructions;
    n) Utilities tools;
    o) Troubleshooting table;
    p) Adding network stations;
    q) System version control;

r) Degraded modes of operation; and

s) Problem isolation and system level testing.

5) Identification and documentation of any changes made to original equipment manufacturer manuals.

6) An overall index of all the documentation provided.

7) Appendices as required to provide information unique to each transponder being installed at each site.

DID-0323 – Training Course Material

PURPOSE:

To collect training materials in support of on-going RCM training activities.

PREPARATION INSTRUCTIONS:

This document shall provide a reference material in support of the execution of RCM training courses as outlined in the training plan.

The training course material shall contain the following information, as a minimum:

1) A course agenda, including:
   a) Course schedule and location;
   b) Course outline, including delineation between classroom and hands-on components; and
   c) Expected audience.
2) Hard and/or soft copy training reference materials, which may include in Contractor's format:
   a) Presentation slides;
   b) Custom course handbooks or manuals;
   c) Hands-on demonstration examples or walkthroughs; and
   d) Reference reading lists.
3) Video recordings of any training presentation sessions.

DID-0324 – Version Description Document (VDD)

PURPOSE:

To identify the contents of a software CSCI release and to record the details of all aspects of the system, support software and hardware required to regenerate this CSCI.

PREPARATION INSTRUCTIONS:

The VDD shall contain the following information, as a minimum:

1) Scope:
   a) Identification; and
   b) System overview.
2) Documents:
   a) Applicable documents; and
   b) Reference documents.
3) Version Description:
   a) Inventory of materials released:
      i) CSCI Source File Listing;
      ii) Materials;
      iii) Hardware tools;
      iv) Software tools; and
      v) Documentation: This section shall list all relevant documents revisions associated with this build version (requirements, system architecture, ICDs, user's manual, …);
   b) Inventory of software content;
   c) Summary of changes: This section shall list all new functionalities that were added, and/or all problems that were corrected in this version. A list of all modified and created files with the rationale shall be included;
   d) Installation instructions;
   e) Build procedures and development environment setup information. The procedure shall provide step-by-step actions with screen shots whereas appropriate to document the complete build process for third party modification of the software as necessary;
   f) Validation test scripts, data and results; and
   g) Known issues.
4) Notes.

DID-0326 – Background and Foreground Intellectual Property (BIP/FIP) Report

PURPOSE:

To document and report the Background and Foreground Intellectual Property (BIP/FIP) generated under the work of the contract.

PREPARATION INSTRUCTIONS:

The BIP/FIP report shall contain the following information, as a minimum:

1) Introduction:
   a) Purpose; and
   b) Scope.
2) Summary description of types of BIP.
3) Summary description of types of FIP.
4) CDRL list. For each CDRL, provide the following data in tabular format:
   a) Document number;
   b) Document name;
   c) CDRL number;
   d) Release milestone;
   e) BIP and FIP (identify each CDRL as one of the following: BIP, FIP, BIP and FIP); and
   f) Comments.

C DELIVERABLE REQUIREMENTS IDENTIFICATION (INFORMATIVE)

The Contract Data Requirements List (CDRL) identifies the document and data deliverables of projects. The CDRL Identifier enables:

1) tracking individual document/data requirements;
2) linking deliverables submitted by the contractor to the documents/data requirements;
3) determining evaluator roles and responsibilities;
4) deliverable distribution and evaluation; and
5) determining project status and actions required.

CDRL and sub-CDRL identification requires a consistent format. This format shall not be altered by the Contractor or subcontractors. Should there be a need for the Contractor to use additional identifiers to manage the allocation of CDRL items to subcontractors, then a separate identifier may be used but it shall not be concatenated with the CDRL and sub-CDRL identifier.

The following CDRL and sub-CDRL identification requirements are mandatory for CSA, PWGSC and contractors when writing SOWs, RFPs, proposals and contracts:

CDRL Identifier format: AANNN

Where AA = two alpha characters defining the CDRL category e.g. EN, PA, PM, etc.

Where NNN = three (3) digits sequentially issued within the CDRL category e.g. EN001, EN002

Sub-CDRL Identifier: NN

Where NN = two (2) digits denoting multiple, different deliverables under the same CDRL identifier (if required) e.g. 01, 02, 03, etc.

Deliverables are to have a one-to-one relationship with the combined CDRL Identifier and sub-CDRL Identifier. If required, the CDRL Identifier and sub-CDRL Identifier can be concatenated and joined by a dash ("-"). e.g. EN001-02

If the Contractor requires subcontractor identification for each CDRL + sub-CDRL combination, then this should be managed in a look-up table and not added to the CDRL identifier. The Contractor's document identifier can be linked when known. For example:

CDRL	Sub-CDRL	Sub-contractor	Sub-contractor CAGE Code	Contractor's Document Identifier
EN018	01	MDA-R		RCM-SP-52-7640
EN024	03	CDV		CDV TN 35011-043
PA001	01	MSCI		NEO-PL-0146

All revisions of a deliverable are to relate to the same CDRL and sub-CDRL combination. The status of each revision is to be tracked as: Submitted, Approved, Disapproved, Superseded, etc. Approved deliverables will be added to the project baseline. Later revisions resulting from approved change requests will supersede earlier approved versions.

CSA-RC-RD-0010

CANADIAN SPACE AGENCY

RCM and Multimission Precision Transponder Requirements Specification

Revision A

13 May 2014

FOR CANADIAN SPACE AGENCY USE ONLY
This document and the information contained herein are not to be disclosed or transferred in whole or in part, to any third party without the prior written consent of the Canadian Space Agency.

© HER MAJESTY THE QUEEN IN RIGHT OF CANADA 2014

Canadian Space Agency
Agence Spatiale Canadienne

This Page Intentionally Left Blank

PREFACE

This document and all changes to it shall be approved by the Canadian Space Agency (CSA)'s Satellite Operations Planning Manager and Radar and Antenna Manager. Proposed changes to the currently approved baselined version of this document shall be forwarded to the CSA Configuration Management (CM) Receipt Desk for evaluation and submission for approval. Approved changes shall be incorporated in the next revision.

Prepared by: /s/ Stéphane Côté

Stéphane Côté
Data Quality Manager
Satellite Operations and Ground Infrastructure
Space Utilization, CSA

Date

Prepared by: /s/ Michaël Labib

Michaël Labib
Safety and Mission Assurance Engineer
Safety and Mission Assurance
Space Science and Technology, CSA

Date

Reviewed by: /s/ Patrice Côté

Patrice Côté
RCM Ground Segment GFE Systems Engineer
Engineering Development
Space Science and Technology, CSA

Date

Reviewed by: /s/ Luc Lefebvre

Luc Lefebvre
RCM Ground Segment Project Officer
Earth Observation Projects
Space Utilization, CSA

Date

Approved by: /s/ Satish Srivastava

Satish Srivastava
Operations Planning Manager
Satellite Operations and Ground Infrastructure
Space Utilization, CSA

Date

Approved by: /s/ Nicodemo Giurleo

Nicodemo Giurleo
Project Mission Assurance Manager
Safety and Mission Assurance
Space Science and Technology, CSA

Date

Approved by: /s/ Ralph Girard

Ralph Girard
Radar and Antenna Manager
Mission Engineering & Applications
Space Utilization, CSA

Date

REVISION HISTORY

Rev.	Description	Initials	Date
IR Draft1	Reformatage + déplacement de requis + commentaires	PC	29 May 2012
IR Draft2	Modifications selon commentaires précédents et révision de certains requis + introduction	SC	21 June 2012
IR	Initial Release Per the out-of-board Configuration Control Board (CCB) approval of Draft2	SC	10 August 2012
A Draft 1	Refinement and update of requirements based on information obtained during the precision transponder trade-off analysis and addition of PA requirements for the Request For Information	SC	19 November 2013
A	CSACR1270 Refinement and update of requirements based on information obtained during the Request for Information for the Request For Proposal	SC, ML	13 May 2014

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE PAGE

LIST OF TABLES

TABLE PAGE

1 INTRODUCTION

Precision transponders are automatic devices that, on schedule, receive the radar signal of a satellite SAR, which is then amplified and retransmitted as a calibrated response to the satellite, for evaluation of imaging performance through analysis of the visible instrument response (Figure 1). A transponder basically is a controllable, calibrated active radar target which can also store radar signal data for further analysis.

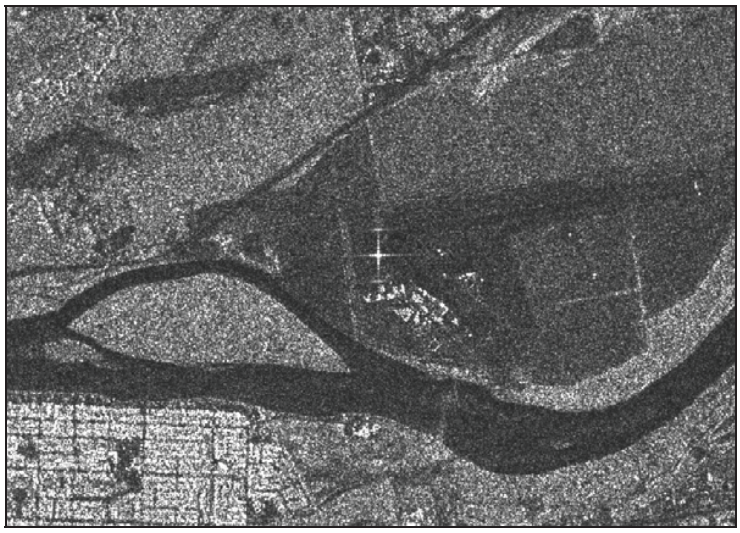


Figure 1 Response of a transponder installed on the Prince Albert (SK) airport grounds, visible in a RADARSAT-1 scene.

Transponder systems perform direct measurements of radiometric, polarimetric and geometric calibration parameters, and other measurements required to monitor SAR image quality performance: radiated power, SAR antenna azimuth pattern, and individual radar pulses.

The nature of SAR remote sensing information, the technologies available for present and future SAR missions similar to RCM, as well as the calibration operations experience within the RADARSAT Program, concur to recommend the inclusion of RCM-dedicated precision transponders, with transmit and receive polarimetric diversity. With such polarimetric capabilities, the instruments could also be exploited for RADARSAT-2, and other EO SAR missions to the extent that their main RF characteristics match those of RCM.

One central rationale for the operations of a controllable, precision point target for SAR calibration resides in its absolute radiometric accuracy, which is the attainment of a specified level of accuracy against some absolute scale of scattering cross-section defined by a well-characterized reference.

The CEOS WGCV defines calibration as [RD-1]: "the process of quantitatively defining the system responses *to known, controlled signal inputs*". Calibration therefore entails a comparison between measurements, and assumes the following 2 principles:

1. One measurement is of known magnitude or correctness, and is made with one device designated as the *standard*, generating the known, controlled information input. The other measurement is made in as similar a way possible, with *another* device, the one to be calibrated;
2. The standard *has less than ¼* of the measurement uncertainty of the device being calibrated [RD-2].

A transponder RCS is calibrated through a known process very similar to radar remote sensing, based on a known physical standard, generally a circular plate [RD-3], while not involving the SAR sensor that the transponder intents to calibrate, ensuring compliance to 1. above.

Compliance to 2. prescribes transponder calibration measurements of sufficient accuracy which, along with the instrument's radiometric stability, provides the required ¼ (or less) uncertainty margin. This principle defines the relationship between the precision transponder absolute accuracy performance, and the absolute radiometric accuracy of the RCM SAR system it intends to calibrate [AD-1]: the absolute radiometric accuracy requirement is set at ±1 dB for RCM.

1.1 PURPOSE

This document specifies the technical requirements for a precision transponder instrument for the purpose of calibration and validation operations for the RCM, and other similar space-based SARs operating in C-band, to the extent that their main RF characteristics match those of RCM.

1.2 SCOPE

This document covers the technical requirements only, including performance, functional, facility, environmental, and Product Assurance (PA) requirements.

The requirements herein mostly originate from the RADARSAT Program experience of operating the four RADARSAT-1 precision transponders [RD-4] (of which two were later upgraded to function with RADARSAT-2), with consideration towards interoperability with ESA's Sentinel-1.

1.3 CONVENTIONS

For convenience:

- *Accuracy* or *precision* requirement values in this document are specified as 3σ numbers;
- *Peak-to-peak* requirement values are explicitly specified as such in the requirements, and can essentially be considered as 6σ;
- "SHALL" is used to indicate a mandatory requirement;
- "SHOULD" indicates a goal or preferred alternative. Such goals or alternatives must be treated as requirements on a best efforts basis, and verified as for other requirements. The

actual performance achieved must be included in the appropriate verification report, whether or not the goal performance is achieved.

1.4 DEFINITIONS

The following definitions intend to situate the technical and logistical contexts surrounding the technical requirements herein.

1.4.1 RCS Terminology

The conventional notion of Radar Cross Section (RCS) is utilized in this document. It is however understood that in practice SAR technology entails the integration of multiple radar inputs with angular and frequency variations which do not result in direct notional relationship between the RCS of an object, and its corresponding pixel intensity in a SAR image.

Considering the anticipated bandwidths and angular variations of the SAR imaging modes to be involved with the Transponder System specified herein, it is assumed that the distortion between the conventional RCS of an object and its corresponding integrated radar cross section on a SAR image pixel is marginal in practice.

However, should a design authority deem that the difference be considered significant with respect to the radiometric requirements herein, then 'RCS' in this document should be interpreted as the aggregate, integrated RCS as detected through SAR processing, encompassing frequency and angular variations.

1.4.2 Transponder System

For the purpose of this document, by 'Transponder System' is understood a system comprising an indoor unit and an outdoor unit, as well as the interface and software for remote control through Ethernet, from an off-site computer. The Transponder System with both indoor and outdoor units is conceptualized, as in Figure 2, into the following subsystems:

- Transponder Instrument, composed of the Antenna Subsystem and RF Subsystem. The RF Subsystem is assumed to be equipped with the necessary electronics for recording the received SAR signal;
- Pedestal Assembly, composed of the Positioner and Pedestal;
- Transponder Control Subsystem, composed of the GPS, Control Computer, Positioner Controller, UPS and spare Control Computer.

This segmentation into subsystems and components is utilized in this document to scope the Transponder System requirements. However, no restriction is imposed on a direct correspondence between the final design and this subsystem architecture. For example, parts of the Transponder Control Subsystem could be integrated in the outdoor unit.

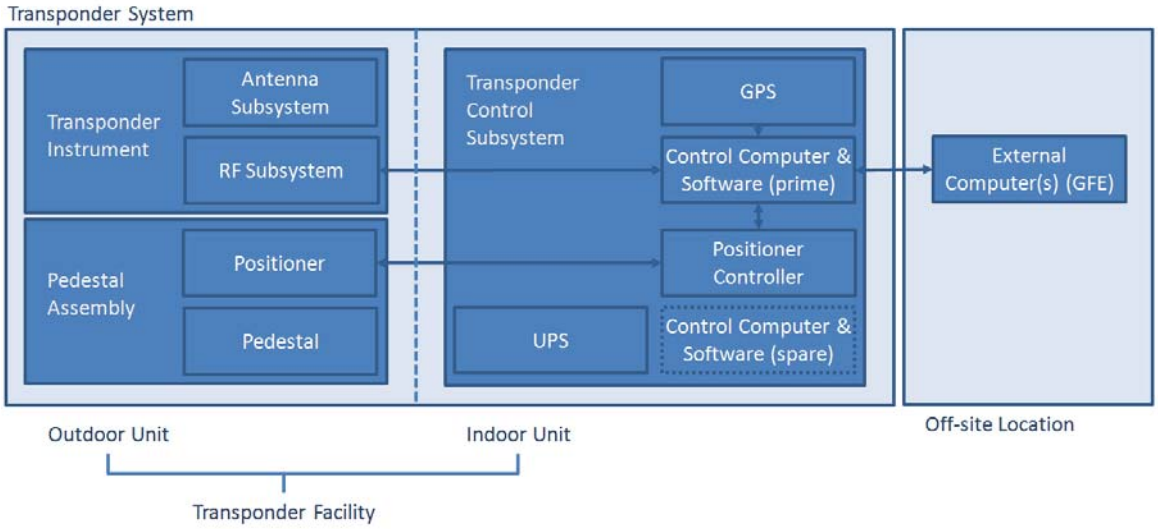


Figure 2 Transponder System block diagram

1.4.3 Transponder Facility

A Transponder Facility is composed of the Transponder System's Outdoor and Indoor units deployed at a remote location, with an assumed remote connectivity available (Internet, phone access).

For RCM, two sites in Canada are envisaged to precision transponder deployment: at the CSA headquarters, in Longueuil, Quebec (designated as the John H. Chapman Space Centre), and at a facility owned by the National Research Council (NRC), at 709 Greenbank Road, Ottawa, Ontario. In both cases, the External Computer shown in Figure 2 would essentially be a typical workstation with image analysis software, installed at the Satellite Operations Centre, in the main building of the CSA JHC Space Centre.

1.4.3.1 National Research Council Site (Ottawa)

This location has been hosting a precision transponder instrument since 1994 for the RADARSAT Program, as it was part of the four initial precision transponder sites selected for the RADARSAT-1 calibration plan.

As shown in Figure 3, this site offers a conventional installation for the Outdoor Unit, which rests on an unsheltered concrete platform directly on the ground, and equipped with a pedestal fixture (an identical fixture is present at the JHC Centre site). At the centre of the pedestal fixture, a conduit leads to an underground pipe, allowing cables to reach the Indoor Unit some 40 metres away in an existing NRC building on site.

Figure 3 Pictures of the NRC transponder site, Ottawa (with RADARSAT-1/-2 precision transponders).

1.4.3.2 John H. Chapman Space Centre Site (Longueuil)

While the Outdoor Unit of the Transponder System shall be designed to sustain Canadian Outdoor environmental constraints, a sheltered calibration facility currently exists at the CSA JHC Space Centre which hosts the current RADARSAT transponder instrument. A rendering of the facility is shown in Figure 4.

Figure 4 Rendering of the transponder facility at the CSA JHC Space Centre, Longueuil

The transponder facility at the JHC Space Centre consists of a two-floor building with heat/ventilation available for the first floor, designed to accommodate the Indoor Unit of a transponder system. In this GoC-furnished facility, the Outdoor Unit would be installed at the second floor, which is a platform sheltered by a retractable dome opened during transponder satellite data acquisitions, and equipped with a fixture for the instrument's pedestal (described in this document). A conduit in the centre of the fixture allows cables to run between the two floors.

At this site, a pedestal extender, as shown in Figure 5, had to be inserted below the base of the RADARSAT-1/-2 transponder instrument, raising it above the dome side panels to allow

complete field-of-view clearance at 0° pointing elevation. This was necessary since the side panels are still approx. 1830 mm high when the dome is open.

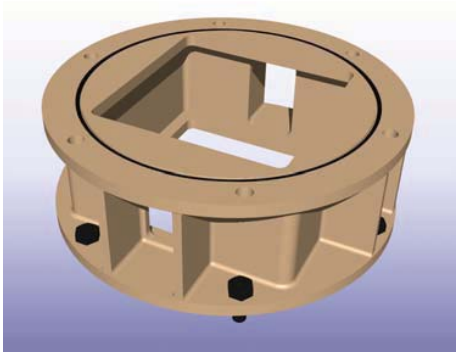


Figure 5 Pedestal extender utilized to raise the Outdoor Unit of a Transponder at the JHC dome facility site, Longueuil

Note: The pedestal extender is compliant with the bolt pattern shown in Figure 6 ***Error! Reference source not found.****.*

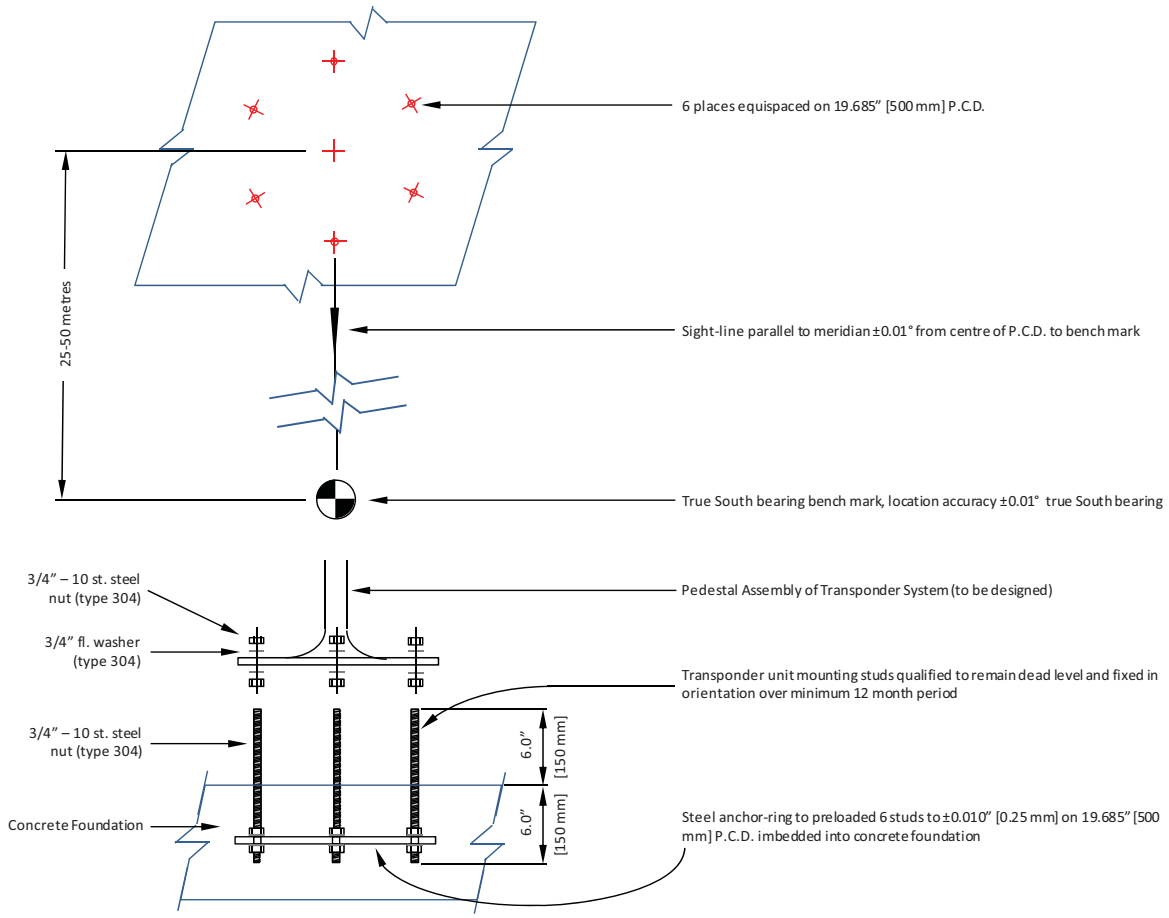


Figure 6 Mechanical interface (fixture): bolt pattern on concrete platform for Transponder Outdoor Unit (pedestal) installation (reproduction from drawing in [AD-5])

The dome facility is situated approximately 200 m away from the CSA JHC Space Centre main building. The location of the facility on the JHC premises was motivated by considerations related to the nearby clutter-free areas North-East and North West of the Space Centre, which consist in an airfield and agricultural areas. With a transponder delay of approx. 1.8 to 2.8 μs, the transponder response to beams of incidence angle between 15° to 50° can be shifted to these areas to facilitate transponder image analysis [AD-2] in clutter free environments.

2 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents of the exact issue date and revision level shown are applicable and form an integral part of this document to the extent specified herein. Unless otherwise indicated, the latest issue in effect at the time of contract award applies.

Table 2-1: Applicable Documents

AD #	Document Number	Revision	Title
AD-1.	RCM-SP-52-3987		RCM System Requirement Specification
AD-2.	RS2CSA-TN0015	NC	Location Assessment of a RADARSAT Precision Transponder on CSA Property
AD-3.	849513		RCM Payload Engineering Budget
AD-4.	849543		RCM Central Electronics Specification
AD-5.	RCM-IC-53-4527	1/1	RCM Precision Transponder ICD
AD-6.	RS2CSA-ML0007	IR	Dome Scheduler User Manual
AD-7.	UL-94		Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances testing
AD-8.	CSA-RC-SOW-0005		Statement of Work (SOW) for the RCM and Multimission Precision Transponder
AD-9.	MIL-T-152		Treatment, Moisture and Fungus Resistant, of Communications, Electronic and Associated Electrical Equipment
AD-10.	MIL-STD-889		Dissimilar Metals
AD-11.	IPC-6011		Generic Performance Specification for Printed Boards
AD-12.	IPC-6012		Qualification and Performance Specification for Rigid Printed Boards
AD-13.	IPC-A-610		Acceptability of Electronic Assemblies
AD-14.	J-STD-001		Requirements for Soldered Electrical and Electronic Assemblies
AD-15.	ANSI/ESD S20.20		Protection of Electrical and Electronic Parts, Assemblies and Equipment
AD-16.	IPC-CC-830		Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

AD-17.	IPC-WHMA-A-620		Requirements and Acceptance for Cable and Wire Harness Assemblies
AD-18.	IEEE C95.1		IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

2.2 REFERENCE DOCUMENTS

The following documents provide additional information or guidelines that either may clarify the contents or are pertinent to the history of this document. Unless otherwise indicated, the latest issue in effect at the time of contract award applies.

Table 2-2: Reference Documents

RD #	Document Number	Revision	Title
RD-1.	http://www.ceos.org/		CEOS WGCV (Working Group on Calibration Validation) website
RD-2.	MIL-STD-45662A		Handbook 52, US Department of Defense metrology program specification
RD-3.	IEEE Trans. On Microwave Theory and techniques, Vol. 40, No. 6	June 1992	H. Jackson, A. Woode, *Development of the ERS-1 Active Radar Calibration Unit*
RD-4.	Advances in space Research, Vol. 19, No. 9	1997	R.K. Hawkins, L.D. Teany, S. Srivastava, S.Y.K. Tam, *RADARSAT Precision Transponder*
RD-5.	RSMPB-SP0003-a	1994	Radarsat Precision Transponder Mounting and Foundation Requirements Document
RD-6.	MIL-HDBK-454	B	Department of Defense Handbook: General Guidelines for Electronic Equipment
RD-7.	SAE AMS 2770		Heat Treatment of Wrought Aluminum Alloy Parts
RD-8.	SAE AMS 2771		Heat Treatment of Aluminum Alloy Castings
RD-9.	SAE AMS 2772		Heat Treatment of Aluminum Alloy Raw Materials
RD-10.	SAE AMS H 7199		Heat Treatment of Wrought Copper-Beryllium Alloys, Process for (Copper Alloys: Numbers C17000, C17200, C17300, C17500, and C17510)
RD-11.	SAE AMS H 6875		Heat Treatment of Steel Raw Materials

RD #	Document Number	Revision	Title
RD-12.	SAE AMS H 81200		Heat Treatment of Titanium and Titanium Alloys
RD-13.	MIL-STD-1285		Marking of Electrical and Electronic Parts
RD-14.	MIL-STD-130		Identification Marking of U.S. Military Property
RD-15.	MIL-STD-1472		Design Criteria Standard: Human Engineering

3 CONCEPT OF OPERATIONS

This section is a descriptive account of the normal operational sequences of a precision transponder in monitoring the calibration of a space-based SAR. Requirements related to these functions are listed in section 0 .

When a precision transponder instrument has been calibrated, tested, and integrated within the mission operations GS, its typical activity consists in monitoring the calibration and image quality indicators as retrieved from activation of the transponder instrument while a SAR imaging activity is executed by the satellite at the transponder site. In this document, such activity is designated by “data acquisition event”.

The sequence of steps for the preparation, execution and exploitation of a data acquisition event is as follows:

1. **Schedule Generation:** A SAR image is planned over the transponder site. In parallel, a data acquisition schedule is generated and transmitted to the Transponder System. This schedule contains the required parameters for transponder activation: date, time, pointing values, receive and transmit polarizations of the transponder, etc. The schedule file is typically generated automatically by the SAR mission GS systems, when planning a SAR image associated with a transponder event, or can be generated manually;

2. **Schedule Transmission:** The schedule file is sent by an External Computer, generally a unit connected to the mission GS, and dedicated to the scheduling and reporting of transponder events, and the reception of Transponder System status (see Figure 7). The schedule is automatically received by the Transponder System;

3. **Acquisition Preparation:** Minutes prior to the scheduled date and time of the satellite pass, the Transponder System is activated for warming up and internal calibration. Then, an alarm and flashing light are activated and the transponder moves to a fixed pointing position for the duration of the data acquisition. This position basically corresponds to the point of closest approach of the satellite. At the JHC facility, the dome is opened prior to these steps, which are then only executed if a status is returned confirming the dome is completely open;

4. **Acquisition:** At the scheduled time, under normal conditions the SAR is activated and an image of the transponder site is acquired. Upon detection of the radar pulses, the Transponder Instrument then:

    - Records the incoming radar pulses, reconstructs the received azimuth beam pattern, measures the power flux density;

    - Amplifies, delays and retransmits the received radar signal to the SAR satellite;

    - The delayed response causes a range shift of the radar signal, generally to ensure the response is located in a nearby clutter-free area.

5. **Post-Acquisition:** After the satellite pass, the Transponder System returns to its original state, and resting position. Alarm and lights are activated during transponder movement. At the JHC facility, the dome is then closed once the transponder is confirmed to have returned to its final resting position;

6. **Report Preparation:** The recorded data is transferred from the electronics of the RF Subsystem to the Control Computer. Then, a report detailing the data acquisition event is created from the recorded data.

7. **Report Transmission:** The data acquisition report is transferred to the External Computer, to be utilized in conjunction with the analysis of the processed image of the site to derive calibration and image quality parameters using GS subsystems dedicated to calibration monitoring.

8. **Data Analysis:** On the image, the Transponder Instrument response, resulting from time-delay and amplification of the radar signal, can be seen in a nearby clutter-free area as a bright, cruciform artifact suitable for the determination of end-to-end image quality indicators such as actual resolution, focus, and absolute radiometric accuracy/stability of the SAR.

Steps 2 to 7 are assumed to be automated as far as the Transponder System is involved.

4 REQUIREMENTS

The requirements in this section detail the performance, criteria and subsystem functions required to fulfill three main needs:

1. Execute satellite SAR data acquisition events;
2. Allow local and remote system configuration, control, status monitoring and testing;
3. Allow external RCS characterization measurement.

4.1 OPERATIONAL REQUIREMENTS

[TXPD-OPER-0010] Design Lifetime: The Transponder System shall be designed for a lifetime of a minimum of 10 years, measured relative to the successful completion of the RCS characterization.

[TXPD-OPER-0015] Design Lifetime Goal: The Transponder System should be designed for a lifetime of a minimum of at least 15 years, measured relative to the successful completion of the RCS characterization.

[TXPD-OPER-0020] Applicable Licensing Regulations: The Transponder Instrument radio-frequency emitter(s) shall conform to applicable licensing regulations.

[TXPD-OPER-0030] Operational Sequence for Acquisition Events: The Transponder System shall assume the following typical operational sequence for acquiring satellite data, in an automated fashion:

1. To accept automatic calibration schedule file(s) from an external computer linked to the ground segment;
2. To perform Transponder System setup, in preparation for the event;
3. To perform internal calibration of the Transponder Instrument;
4. To sound an alarm and flashing light prior to Positioner movement towards the target;
5. To receive and capture data from, and retransmit the SAR signal;
6. To return the Transponder System to its initial state, after the event;
7. To sound an alarm and flashing light prior to Positioner movement back to resting position;
8. To provide and record event fault indicators, if applicable;
9. To calculate SAR data summary parameters;
10. To record event status and generate an event calibration report;
11. To send calibration report file(s) to an external computer linked to the ground segment.

[TXPD-OPER-0040] Transponder Facility Dome Control – JHC Space Centre: The Transponder System shall be able to automatically operate the full opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site, before and after scheduled transponder operations.

Note TXPD-OPER-0040: Information can be found in AD-6, which can be used for example as a concept for a dome control function within the Transponder Control Software.

[TXPD-OPER-0050] Manual Dome Control – JHC Space Centre: The Control Computer & Software shall enable manual opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site.

Note TXPD-OPER-0050: by manual dome control it is meant a software function on the Control Compute (for ex., part of the Control Computer Software), enabling to open or close the dome at will (for example for maintenance and tests), outside of its normal, scheduled operation sequence.

[TXPD-OPER-0060] Manual Dome Remote Control – JHC Space Centre The Control Computer & Software shall enable manual opening and closing of the dome of the calibration facility at the CSA JHC Space Centre site, from an external computer.

Note TXPD-OPER-0060: see above comment. This requirement could be satisfied through a remote login capability giving access to the functions of the Control Computer & Software.

4.2 FUNCTIONALITY REQUIREMENTS

[TXPD-FUNC-0010] Function Modes: The Transponder System shall have the following modes:

- **Measurement Modes:**
  - **Constant RCS:** The Transponder Instrument retransmits a signal to the SAR with a calibrated, very stable gain, to allow external calibration of the SAR;
  - **Receiver:** The Transponder Instrument detects and measures the amplitudes and the received SAR pulses, for the recording of incoming radar pulses, reconstruction of the azimuth pattern, and determination of power flux density;
  - **Transmit-Receive:** The Transponder Instrument performs the two above-mentioned Modes simultaneously.
- **Support Modes:**
  - **Off:** All Transponder System elements are off with no power consumption;
  - **Standby:** Power consumption is minimized while maintaining the control computer and software running. This mode constitutes the default when no acquisition is planned in the near future. In this mode, Transponder Instrument and/or Pedestal Assembly subsystems can be activated/deactivated for maintenance and troubleshooting.;
  - **Pre-op:** Transition Mode typically between Standby and any of the Measurement Modes, where all required subsystems are activated prior to an actual Acquisition

(possible ex. are pre-heating, internal calibration) , Pre-op can also be initiated between any of the measurement modes, or between a Measurement Mode and Standby;

- **Test:** Allows built-in tests to be executed to support fault tracing. Can be launched from the Standby Mode

Note TXPD-FUNC-0010: Support Modes can be grouped differently as long as the objectives of each of the above mentioned Modes are preserved.

- **Calibration Modes:**
  - **Internal Calibration:** Transponder System gain stability is achieved through an internal calibration of the transponder instrument;
  - **External Calibration:** Mode to be utilized to measure the RCS of the Transponder Instrument itself.

[TXPD-FUNC-0012] Measurement Modes Access: The Control Computer & Software shall allow a user to switch the Transponder System in any of the Measurement Modes specified in [TXPD-FUNC-0010] for the upcoming acquisition event(s).

[TXPD-FUNC-0014] Support Modes Access: The Control Computer & Software shall allow a user to put the Transponder System into any state that will reproduce the Support Modes specified in [TXPD-FUNC-0010].

[TXPD-FUNC-0016] Test Access: The Control Computer & Software shall allow a user to activate Calibration Modes specified in [TXPD-FUNC-0010].

[TXPD-FUNC-0020] Time Delay Setting: The Control Computer & Software shall allow setting of the adjustable time delay (between the received satellite signal and the retransmitted transponder signal) of the Transponder Instrument for any given scheduled acquisition.

[TXPD-FUNC-0030] Time Delay Default Value: The Control Computer & Software shall allow setting of a default time delay (between the received satellite signal and the retransmitted transponder signal) value for acquisitions for which a specific time delay has not been entered.

[TXPD-FUNC-0040] Generate Data Acquisition Report: After each Transponder System operation in any of the measurement modes, the Control Computer & Software shall generate a report with the following information:

- Mission ID;
- Satellite ID;
- Point Target (transponder) ID ;
- Schedule ID;
- Time and date;
- Transponder status;

- Transponder measurement mode;
- Transponder delay;
- Activation/deactivation times;
- Achieved pointing values as reported from the positioner (azimuth, elevation);
- Point target position (lat, lon, elevation);
- Nominal Radar Cross Section;
- Tx and Rx instrument polarizations;
- Data acquisition event status (success or failure; if failure, all subsequent parameters are NULL or zero)
- Absolute power flux density (in unit W/m^2);
- Azimuth data (array of dB values vs time);
- Azimuth data measurement start time;
- Number of azimuth samples (azimuth data sampled at the PRF, for a duration of the order of 2 to 90 seconds, see TXPD-FUNC-0185);
- Number of chirp data blocks (containing as a minimum 10 chirp data pulses, including the 5 strongest pulses from the main azimuth pattern lobe, containing one radar pulse each);
- For each chirp data block (of one chirp pulse):
  - Chirp pulse power (envelope) data(array of values vs time);
  - Chirp data measurement start time;
  - Number of chirp data samples (2 000 samples per 50 μs pulse, see TXPD-FUNC-0205)).

Note TXPD-FUNC-0040: For RCM, Data Acquisition Report format is described as Transponder Activity Report in [AD-5].

[TXPD-FUNC-0050] Data Acquisition Report Transfer: The Control Computer & Software shall have the capability to provide the Data Acquisition Report, via a communications unit, to an off-site, external computer.

[TXPD-FUNC-0060] Automatic Scheduling: The Control Computer & Software shall be capable of automated scheduling of the Transponder System, upon reception of a schedule file originating from an off-site, external computer.

[TXPD-FUNC-0065] Automatic Scheduling Update: The Control Computer & Software shall be capable of automated updating an already existing schedule, upon reception of a schedule file originating from an off-site, external computer.

Note TXPD-FUNC-0065: For RCM, Schedules of data acquisitions from an external computer of the RCM Ground Segment are described as Transponder Schedule in [AD-5].

[TXPD-FUNC-0070] Schedule Content: For purposes of scheduling of the Transponder System, the Control Computer & Software shall be able to input the following scheduling information from the off-site external computer [AD-5]:

- Mission ID;
- Schedule ID;
- Schedule Generation Time (UTC);
- Schedule Coverage Interval
- For each acquisition in the schedule:
  - Acquisition ID
  - Satellite ID;
  - Start and end scheduling times;
  - Transponder ID;
  - Pointing values (azimuth, elevation);
  - Time Delay
  - Tx and Rx instrument polarizations;
  - Transponder measurement mode.

Note [TXPD-FUNC-0070]: For RCM, Acquisition ID is described as Activity ID in [AD-5].

[TXPD-FUNC-0080] Automatic Schedule Update: The Control Computer & Software shall be capable of automatically updating the previous scheduling of the Transponder System, upon reception of a new schedule file whose time period overlaps the previous schedule.

[TXPD-FUNC-0090] Manual Scheduling: The Control Computer & Software shall enable manual scheduling of the Transponder System, through entry, by human-machine interface, of the parameters used for automatic scheduling.

[TXPD-FUNC-0100] Schedule Management: The Control Computer & Software shall enable manual editing, or cancelling of currently scheduled Transponder System operations, by human-machine interface.

[TXPD-FUNC-0110] Acquisition Rejection Message: For each acquisition specified in a schedule that is unsupportable (conflict with another scheduled acquisition), the Control Computer & Software shall be able to generate a rejection message with the following information:

- Mission ID;

- Schedule ID;
- Acquisition ID;
- Satellite ID;
- Activity Start Time (UTC);
- Rejection Reason (string).

Note [TXPD-FUNC-0110]: Acquisition ID is designated by Activity ID in [AD-5].

[TXPD-FUNC-0120] Acquisition Rejection Message Transfer: The Control Computer & software shall the capability to send the Acquisition Rejection Message, via a communications unit, to an off-site, external computer.

[TXPD-FUNC-0130] Function Mode Operation: The Control Computer & Software shall enable access to all Function modes of the Transponder System, by human-machine interface.

[TXPD-FUNC-0140] System Diagnostics: The Control Computer & Software shall perform Transponder system tests and diagnostics, display the results on the Control Computer screen, and be capable of recording the results.

[TXPD-FUNC-0150] System Status Indicators: The Control Computer & Software shall display status indicators of Transponder Instrument subsystems or components on the Control Computer screen.

[TXPD-FUNC-0160] Generate System Status Report: The Control Computer & Software shall routinely generate system status reports with the following information:

- General message header;
- Point Target (transponder) ID;
- System RCS;
- Present date and time tag;
- Azimuth and elevation at time of reporting;
- Subsystem temperatures;
- Subsystem operational health indicators (ex.: GPS, RF Subsystem, Positioner, SAR pulse recording functions, etc.).

[TXPD-FUNC-0170] System Status Report Transfer: The Control Computer & Software shall have the capability to provide the System Status Report, via a communications unit, to an off-site, external computer.

[TXPD-FUNC-0180] Azimuth Beam Pattern Record: The Control Computer & Software shall record the RCM azimuth beam pattern, in compliance with dynamic range and accuracy requirements of the RF and Antenna Subsystem section.

Note TXPD-FUNC-0180: The Data Acquisition Report (TXPD-FUNC-0040) will be populated with data provided by this record.

[TXPD-FUNC-0185] Azimuth Beam Pattern Record Sampling Rate: The minimum sampling of the RCM azimuth beam pattern record shall be the PRF of the RCM imaging mode being used during Transponder data acquisition.

[TXPD-FUNC-0190] Azimuth Beam Pattern Plots: The Control Computer & Software shall be able to plot previously recorded azimuth patterns as a function of time.

[TXPD-FUNC-0200] Radar Pulse Record: The Control Computer & Software shall record a minimum number of 10 RCM individual signal pulse envelopes (power).

Note TXPD-FUNC-0200: The Data Acquisition Report (TXPD-FUNC-0040) will be populated with data provided by this record.

[TXPD-FUNC-0205] Radar Pulse Record Sampling Rate: The sampling of the RCM individual signal pulse envelopes (power) shall be performed at a minimum rate of 40 MHz.

[TXPD-FUNC-0210] Radar Pulse Plots: The Control Computer & Software shall be able to plot previously recorded radar pulses as a function of time.

[TXPD-FUNC-0220] Calculate Flux Density: The Control Computer & Software shall record and calculate the flux density.

[TXPD-FUNC-0230] DELETED.

[TXPD-FUNC-0240] DELETED.

4.3 PERFORMANCE REQUIREMENTS

4.3.1 Time

[TXPD-TIME-0010] Time Accuracy: For the purpose of recording data measurement acquisitions, the Transponder System shall maintain an internal time, which shall be synchronized to UTC time with a precision of or better than 5 μs (3σ).

[TXPD-TIME-0020] DELETED.

4.3.2 Pass Support

The section on Constellation Geometry in [AD-1] can be used as a reference for overpass timings. The three consecutive RCM satellites are expected to pass over the same point every four days. The shortest consecutive overpass time over an area, from one RCM satellite to the next, is 32 min. approx.:

$$\frac{12\,\text{days}}{179\,\text{orbits}}\frac{24\,\text{h}}{3\,\text{satellites}} = 0.53\,\text{h} = 32\,\text{min}\,11\,\text{sec}$$

[TXPD-PASS-0010] Pre-pass Readiness: The Transponder System shall be ready for operations in any of the measurement modes 10 minutes before the expected satellite SAR overpass.

Note TXPD-PASS-0010: An internal calibration can be performed during the pre-pass readiness period.

[TXPD-PASS-0020] Availability Swath: The Transponder System shall be able to operate over the complete range of swaths and incidence angles of the RCM SAR imaging modes, in any of the measurement modes [AD-3].

[TXPD-PASS-0030] Overpass Visibility: The Transponder System shall be able to operate for all RCM satellite overpasses within visibility of the transponder.

[TXPD-PASS-0040] Consecutive Overpasses: The Transponder System shall be able to operate with the same performance for consecutive overpasses separated by no less than 15 minutes between the end of a pass and the beginning of the next.

4.3.3 Radiometry

[TXPD-RADM-0010] RCS: The maximum effective RCS of the Transponder System, as seen by the RCM satellites shall be 60 dBm^2 with a design goal of 62dBm^2, assuming that the polarization of the Transponder System receive and transmit antennas are set to ±45° from horizontal.

Note TXPD-RADM-0010: An estimate of the maximum received power density is provided in Appendix B.

[TXPD-RADM-0020] RCS Adjustment: The effective RCS of the Transponder System shall be adjustable from 55-60 dBm^2, with a design goal of 55-62 dBm^2, upon the Crown's request and/or Contractor's recommendations considering RCM specifications.

Note TXPD-RADM-0020: Absolute radiometric calibration of the Transponder System is expected to be performed at the maximum RCS.

TXPD-RADM-0030] Absolute Calibration Accuracy in Constant RCS mode: The Transponder Instrument shall have an absolute uncertainty in the calibrated RCS value at its centre frequency, of ±0.2 dBm^2 (1σ).

Note TXPD-RADM-0030: Absolute Calibration Accuracy is the uncertainty with respect to a reference of known and characterized RCS, when a calibration of the Transponder Instrument is performed using that reference.

[TXPD-RADM-0040] Radiometric Stability in Constant RCS mode: The Transponder Instrument shall have a maximum excursion in RCS value at the centre frequency of ±0.1 dB (3σ) over the system design lifetime.

Note TXPD-RADM-0040: To ensure this level of RCS stability, regular recalibrations are assumed.

4.3.4 RF and Antenna Subsystem

Considering the requirements below, those concerning time delay and polarization in particular, a two-antenna solution for the Transponder Instrument is preferred.

[TXPD-RFAS-0010] Centre Frequency: The Transponder Instrument operating frequency shall be 5.405 GHz.

[TXPD-RFAS-0020] Bandwidth: The bandwidth of the Transponder Instrument shall be at least 100 MHz.

[TXPD-RFAS-0030] Frequency response: The Transponder Instrument gain shall vary by no more than 0.5 dB peak-to-peak over a bandwidth of ±50 MHz from its centre frequency.

[TXPD-RFAS-0040] Out of Band Rejection: The Transponder Instrument shall have a minimum out-of-band rejection of 70 dB over the following frequency ranges: from 0.2 to 5.255 GHz and from 5.545 to 15 GHz.

[TXPD-RFAS-0050] Pulse Width and Pulse Repetition Frequency: The Transponder Instrument shall function with Pulse Repetition Frequencies (PRFs) of up to 7000 Hz with pulses durations from 10 μs to 50 μs [AD-4].

[TXPD-RFAS-0060] Transmit Capability: The Transponder Instrument shall transmit delayed replicas of the acquired radar signals back to the originating SAR instrument.

[TXPD-RFAS-0070] Time Delay Adjustment: The Transponder Instrument shall permit an adjustable/programmable time delay from 1.0 to 1000 μs in increments of 0.1 μs, representing the total time delay affecting the transponder signal from receive to transmit.

[TXPD-RFAS-0080] Time Delay Variation: The Transponder Instrument shall provide a maximum peak-to-peak group delay variation of 8 ns over a bandwidth of ±50 MHz from its centre frequency.

[TXPD-RFAS-0090] Phase Stability: The Transponder Instrument shall have a maximum phase excursion of 2° RMS as seen by an observer in the far field range, within a minimum period of 12 days.

[TXPD-RFAS-0100] DELETED.

[TXPD-RFAS-0105] Independent Transmit and Receive Polarizations: The Transponder Instrument shall have the capability to independently select transmit and receive polarizations.

[TXPD-RFAS-0110] Receive Polarizations: The Transponder Instrument shall have the capability to select the receive polarizations for either H or V or ±45°.

[TXPD-RFAS-0120] Transmit Polarizations: The Transponder Instrument shall have the capability to select the transmit polarizations for either H or V or ±45°.

Note: for TXPD-RFAS-110 and TXPD-RFAS-120, a single channel transponder design is assumed. In the case of a dual-channel design, receive and transmit polarization at ±45° is not required.

[TXPD-RFAS-0130] Polarization Accuracy: The RCS error budget shall consider the effect of mechanical alignment to polarization accuracy.

[TXPD-RFAS-0140] Transmit H-V Imbalance: The Transponder Instrument shall have a transmit amplitude imbalance of less than 0.05 dB and a transmit phase imbalance of less than ±5° when the transmit polarization is at ±45°.

Note TXPD-RFAS-0140.1: This requirement assumes a single-channel transponder design. In the case of the dual-channel design, the equivalent imbalance shall be derived for when the transmit channels are orthogonal.

[TXPD-RFAS-0150] Polarization Crosstalk - Transmit: On transmit, the energy transmitted from the Transponder Instrument with polarization perpendicular to the selected polarization shall be at least 35 dB less than the energy transmitted with the selected polarization.

[TXPD-RFAS-0160] Polarization Crosstalk - Receive: On receive, the energy received by the Transponder Instrument with polarization perpendicular to the selected polarization shall be at least 35 dB less than the energy received by the selected polarization.

[TXPD-RFAS-0170] Internal Calibration Functionality: The Transponder Instrument shall have an internal calibration functionality in order to provide a continuous reference for instrument gain variation monitoring and related continuous corrections before and after the radar signal acquisition.

[TXPD-RFAS-0180] Internal Calibration Path: The internal calibration of the Transponder Instrument should cover as much as possible the signal path of the whole instrument.

[TXPD-RFAS-0190] Internal Calibration Path Design: The characterization and stability requirements of the signal routing elements that are not included within the internal calibration path shall be considered in the design of the internal calibration functionality.

[TXPD-RFAS-0200] Internal Calibration Pulse: The Transponder Instrument shall utilize an internal calibration pulse or pulses to achieve internal calibration stability.

[TXPD-RFAS-0202] Internal Calibration Pulse, Power Level: When the Transponder Instrument uses the internal calibration pulse or pulses to achieve internal calibration stability, the nominal power level of the calibration pulse should be within ±3 dB of the expected power level from RCM.

[TXPD-RFAS-0205] Internal Calibration Pulse Selection: When the Transponder Instrument is using the internal calibration pulse or pulses to achieve internal calibration stability, the pulse width and PRF of the internal calibration pulse or pulses should be selectable.

[TXPD-RFAS-0210] Receiver Failure in Transmit-Receive Mode: In the dual, Transmit-Receive mode, in case of failure of the sub-systems associated with the Receive Mode, the Transponder Instrument shall still be able to execute the functions of the Constant RCS Mode.

[TXPD-RFAS-0220] Dynamic Range in Receiver Mode: The Transponder Instrument shall have a minimum dynamic range of 30 dB to enable azimuth pattern sidelobes to be detected.

[TXPD-RFAS-0230] Acquisition of Radar Signals: The Transponder Instrument shall acquire and store the incoming pulse train originating from any of the RCM SARs for reconstruction of chirp pulses, and reconstruction of the SAR antenna azimuth pattern.

[TXPD-RFAS-0240] Absolute Accuracy in Receiver Mode, Main Lobe: The Transponder Instrument should have an absolute accuracy of ±0.5 dB in the main lobe of the received azimuth pattern.

[TXPD-RFAS-0250] Relative Accuracy in Receiver mode, Main Lobe: The Transponder Instrument shall have an accuracy of ±0.1 dB in the main lobe (top 3 dB of azimuth pattern) of the received azimuth pattern, relative to the peak value.

[TXPD-RFAS-0260] Relative Accuracy in Receiver mode, -20 dB from Peak: The Transponder Instrument shall have an accuracy of ±0.5 dB at -20 dB relative to the peak value of the main lobe of the received azimuth pattern.

4.3.5 Antenna Mounting and Alignment

[TXPD-ANTA-0010] Antenna Mounting Structure: The Contractor should incorporate into the Transponder System design a mounting and alignment structure for the Antenna Subsystem and RF Subsystem onto the Positioner.

[TXPD-ANTA-0020] Antenna Adjustment Capability: The antenna mounting structure should allow ±0.5° adjustment in azimuth and ±0.5° adjustment in elevation to allow precise alignment of antenna boresights.

[TXPD-ANTA-0030] Dismount Capability: The antenna mounting structure should provide the capability to dismount the RF and Antenna Subsystems from the Positioner, if the Contractor determines this to be a Transponder System Transportability requirement.

[TXPD-ANTA-0040] Elevation Clearance: The structure of the antenna mounting shall allow sufficient clearance to adjust the boresight elevation adjustment angles from -5°to 90°.

[TXPD-ANTA-0050] DELETED.

[TXPD-ANTA-0060] Rigidity: The total antenna mounting structure assembly shall have a rigidity to maintain the pointing command accuracy of ±0.1° with operational windloading as specified in **[TXPD-ENVR-0120]**.

[TXPD-ANTA-0070] Antenna Boresight Alignment: Each of the Transponder System antennas shall include a sighting telescope which is factory preset to align with the electrical antenna boresight, to allow routine adjustments of transmit and receive antenna boresight using local targets.

*Note TXPD-ANTA-0070**:** The two sighting telescopes are needed for maintenance and verification of boresight alignment for when the Transponder System is installed and operational. The approach for factory boresight alignment is left to the designer.*

[TXPD-ANTA-0080] Antenna Boresight Alignment Telescopes: Each telescope shall be delivered with the associated alignment hardware and insertion markings, which allow the scope to be removed from the antenna when ready for operations.

4.3.6 Positioner Subsystem

[TXPD-POSI-0010] Pointing Capability: The Positioner shall be capable of pointing the Transponder Instrument toward the expected satellite position, at the point where the SAR beam is expected to peak.

[TXPD-POSI-0020] Boresight Elevation Adjustment: The Positioner shall have the capability to adjust the boresight elevation in the range –3° to +85°.

[TXPD-POSI-0030] Boresight Azimuth Adjustment: The Positioner shall have the capability to adjust the boresight azimuth in the range ±180°.

[TXPD-POSI-0040] DELETED.

[TXPD-POSI-0050] DELETED.

[TXPD-POSI-0060] DELETED.

[TXPD-POSI-0070] DELETED.

[TXPD-POSI-0075] Azimuth and Elevation Pointing Command Accuracy: The accuracy of the azimuth and elevation pointing commands shall allow compliance to the RCS absolute accuracy [TXPD-RADM-0030] and stability [TXPD-RADM-0040].

[TXPD-POSI-0080] Absolute Alignment Calibration: Given that power outages may be frequent at the transponder installation site, the requirement to perform an absolute alignment calibration of the Positioner requiring human intervention shall not exceed twice per year.

[TXPD-POSI-0090] Manual Control Switches: There shall be a means to manually control the selection of azimuth and elevation, forward and reverse motion, and fine and coarse adjustment, when in close proximity of the Positioner or Pedestal,

Note TXPD-POSI-0090: this requirement aims to avoid going back and forth between the Transponder Instrument and the Control Computer during service maintenance. An implementation example of this requirement could be a manual control panel on the Pedestal, with removable cover, which contains control switches for selection of azimuth and elevation control, forward and reverse motion, with fine and coarse adjustment.

[TXPD-POSI-0100] Positioner Alarm and Light: The Transponder System shall include an audible alarm and flashing light which shall activate prior positioner movement, as a warning to personnel local to the site.

4.3.7 Transponder Control Subsystem Equipment

[TXPD-CTRL-0010] DELETED.

[TXPD-CTRL-0020] DELETED.

[TXPD-CTRL-0030] Absolute Location Knowledge: There shall be provision of absolute location knowledge of the Transponder System boresight at power up of the Positioner Controller.

Note TXPD-CTRL-0030: An automated homing run is permitted in order to get an absolute reference.

[TXPD-CTRL-0040] GPS: The Transponder System design shall incorporate a GPS, used to provide an accurate time tag reference for all scheduled calibration events and calibration data.

[TXPD-CTRL-0050] GPS Mounting: The GPS shall include all components necessary to obtain the required functionality, plus all mounting hardware and structure.

[TXPD-CTRL-0060] UPS: The Transponder System shall include a UPS with the required UPS capacity to power the Transponder System, in whole or in part, such that when commercial power is reestablished, there is minimal or no corrective action required to get the Transponder System operational again.

[TXPD-CTRL-0070] Equipment Rack: The Transponder System shall include a ruggedized equipment rack with wheels and a front cover, providing an enclosure of all Transponder Control Subsystem equipment.

[TXPD-CTRL-0080] Equipment Rack Storage Capacity: The equipment rack should have a miscellaneous storage drawer of approximately 15 cm height.

[TXPD-CTRL-0090] Equipment Rack Power Bar: The equipment rack should have a power bar with a minimum of two spare receptacles.

4.4 INTERFACE REQUIREMENTS

An overview of the required interfaces to the Transponder System is illustrated in Figure 7. Interfaces can be grouped in three categories: electronic (information exchange involving an external computer), mechanical and C-band (radar signals).

To and from an External Computer, four set of electronic interface services are required:

1. Data acquisition scheduling to the Transponder System;
2. Reporting from the Transponder System;
3. System status reporting from the Transponder System;
4. Remote access to the Transponder Control Subsystem.

The first three electronic interfaces are to be typically related to an External Computer linked to the RCM GS subsystems for mostly automated scheduling and reporting tasks. Of these, the first two interfaces are to be connected to the RCM GS Image Quality Subsystem. The Crown will provide to the Contractor the interface control information pertaining to the RCM GS subsystems as their development move forwards [AD-5].The content of the Data Acquisition Schedule, Data Acquisition Report and System Status Report are detailed by requirements of section 4.2 Functionality Requirements.

The fourth electronic interface, which may or may not be linked to the same External Computer, or which may be linked to more than one External Computer, concerns a more interactive remote access to the Transponder Control Subsystem software.

Requirements regarding the mechanical interface (fixture) between the instrument platform and the Pedestal Assembly of the Transponder System are described in this section.

Interface with the RCM radar signals is implicit through requirements of section 4.3.4 RF and Antenna Subsystem.

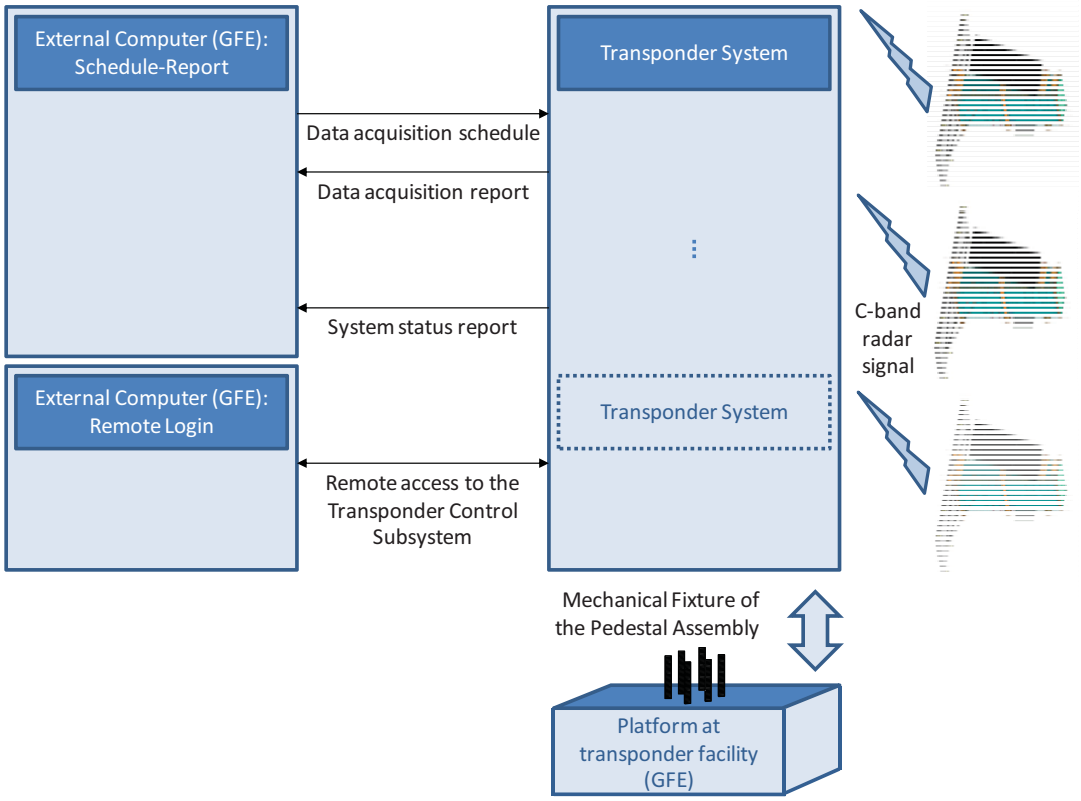


Figure 7 External interfaces to the Transponder System(s)

[TXPD-INTF-0010] Interface Data Flow: The Transponder System shall interface with one or more External Computer(s) (GFEs) according to the data flow illustrated in Figure 7, with four interface capabilities for:

1. Data acquisition scheduling ;
2. Data acquisition reporting;
3. System status reporting, and;
4. Remote access to the Transponder Control Subsystem.

[TXPD-INTF-0015] Interface to RCM Ground System: The Transponder System shall exchange schedules, reports and messages with the RCM Ground Segment as per the interface concepts, formats and conventions described in [AD-5].

[TXPD-INTF-0020] Interface Infrastructure: All interface services shall be implementable either through cabled or wireless infrastructure.

[TXPD-INTF-0030] Single-Multiple External Computer(s): All interface services shall be implementable to a single External Computer (GFE).

[TXPD-INTF-0040] Single-Multiple Transponder Systems: All interface services shall accommodate multiple Transponder Systems connected to External Computer(s) (GFE).

[TXPD-INTF-0050] Data Acquisition Schedule: The Transponder System shall include an interface that allows ingestion of RCM data acquisition schedules from an External Computer (GFE) generating or updating a transponder acquisition schedule as per the Automatic Scheduling and Scheduling Update requirements: [TXPD-FUNC-0060] and [TXPD-FUNC-0065].

[TXPD-INTF-0060] Data Acquisition Report: The Transponder System shall provide an interface that allows the Data Acquisition Reports, generated as per the Generate Data Acquisition Report requirement [TXPD-FUNC-0160], to flow to an External Computer (GFE).

[TXPD-INTF-0070] Acquisition Rejection Message: The Transponder System shall provide an interface that allows the Acquisition Rejection Messages, generated as per the Acquisition Rejection Message requirement [TXPD-FUNC-0120], to flow to an External Computer (GFE).

[TXPD-INTF-0080] System Status Report: The Transponder System shall routinely generate system status reports, with an anticipated daily frequency, as per the Generate System Status Report requirement herein, in a manner conducive to allowing transfer of these reports from the Transponder System to an External Computer (GFE).

[TXPD-INTF-0090] Transfer Readiness of Data Acquisition Reports: The Data Acquisition Report, generated by the Transponder System as per the Generate Data Acquisition Report requirement [TXPD-FUNC-0160], shall be created and ready for file transfer to an External Computer (GFE) within 10 minutes of the end of the data acquisition event.

[TXPD-INTF-0100] Transfer Latency of Data Acquisition Reports: The Transponder System shall accommodate the transfer of the Data Acquisition Report within 15 minutes of the data acquisition event.

[TXPD-INTF-0110] Transfer Readiness of Acquisition Rejection Messages: The Acquisition Rejection Message, generated by the Transponder System as per the Acquisition Rejection Message requirement [TXPD-FUNC-0120], shall be generated and ready for file transfer to an External Computer (GFE) within 10 minutes of receiving the data acquisition schedule.

[TXPD-INTF-0120] Transfer Latency of Acquisition Rejection Messages: The Transponder System shall accommodate the transfer of the Acquisition Rejection Message within 15 minutes of receiving the data acquisition schedule.

[TXPD-INTF-0130] Remote Access to Control Computer: The Control Computer of the Transponder Control Subsystem shall provide an interface capability for remote-accessing all the functions, schedules, reports and messages of Section 4.2 as well as system status indicators from an off-site, External Computer (GFE) as though the user were locally operating the Transponder System.

[TXPD-INTF-0140] Remote Access from Multiple External Points: The interface capability for remote access to the Control Computer of the Transponder Control Subsystem shall be available to more than one External Computer (GFE), in a non-simultaneous fashion.

[TXPD-INTF-0150] DELETED.

[TXPD-INTF-0160] Pedestal Mounting: The Pedestal shall be installed on the GFE: cement foundation using the bolt pattern fixture as detailed in Figure 6**Error! Reference source not found.**, for both sites.

[TXPD-INTF-0170] DELETED.

4.5 FACILITY REQUIREMENTS

At both sites in Longueuil and Ottawa, there is approximately 70 sq. ft for storage and for hosting the Control Computer and Software system.

At the Longueuil CSA headquarters site: an assembly area is proposed in the shipping area of the CSA main building, from which an assembled unit could then be transported to the Dome facility and hoisted into place. For both power (110 VAC) and network, standard, domestic connectors are available in close proximity of where the Control Computer and Software system shall be installed.

At the NRC site in Ottawa, the building that will be hosting the Control Computer and Software system has larger rooms that may accommodate assembling activities. However, door sizes are standard domestic width (about 1 m). On the NRC site there is also a storage shed that accommodates free floor space (approximately another 70 sq. ft) for assembling activities. This storage shed has larger service doors (approximately 6 ft wide). An eventual alternative may be CSA's David Florida Laboratory, situated some 16 km from the site. For power and phone, standard domestic connectors are available in the NRC main building, in close proximity of where the Control Computer and Software system shall be installed. For network access, a fibre connection is currently utilized for other purposes in the building. If the contractor deems it necessary, it would be possible for CSA to have access to that connection for remote transponder control and data exchange.

Both sites are easily accessible for hoisting equipment between April and November, that is, outside of the snow season (end of November to end of March). The immediate surroundings to the platforms are essentially free space that has been used in the past for boom trucks and tow vehicles to access the premises and service the RADARSAT-1 and -2 transponder units.

[TXPD-PHYS-0010] Unit Separation: The Transponder System design shall accommodate a physical separation of assemblies between the Indoor Unit and the Outdoor Unit up to a maximum separation distance of 50 m.

Note TXPD-PHYS-0010: This is a design provision to accommodate non-sheltered deployment of the Outdoor Unit at a distance to the Indoor Unit.

[TXPD-PHYS-0020] Power Requirements: The Transponder System shall require no more than 110 VAC, 30 A (3.3 kVA) at 60Hz.

[TXPD-PHYS-0030] Weight Requirement: The Outdoor Unit of the Transponder System together shall weigh less than 1600 lbs (727 kg).

[TXPD-PHYS-0040] Transponder Control Subsystem Location – JHC Space Centre: At the JHC Space Centre site, the Indoor Unit shall be located on the first floor of the Transponder Facility.

[TXPD-PHYS-0050] Transponder Instrument and Pedestal Assembly Location – JHC Space Centre: At the CSA JHC Space Centre site, the Outdoor Unit shall be installed on the second floor of the Transponder Facility, which consists in a dome equipped with an opening/closing mechanism.

[TXPD-PHYS-0060] Outdoor Unit Height – JHC Space Centre: The height of the Outdoor Unit, from the base of the pedestal assembly, shall allow full field-of-view clearance of the Transponder antennas at 0° elevation.

Note: This is to allow routine verification of boresight alignment of transmit and receive antennas using local targets. These local targets are generally slightly above horizon.

[TXPD-PHYS-0070] Envelope Requirement, Rest Azimuth and Elevation – JHC Space Centre: As a minimum, the Transponder Instrument and Pedestal Assembly shall fit inside the dome of the transponder facility of the CSA JHC Space Centre in St Hubert, for rest azimuth and elevation values.

[TXPD-PHYS-0080] Envelope Requirement, All Azimuth and Elevation – JHC Space Centre: The Transponder Instrument and Pedestal Assembly should, for all azimuth and elevation values, fit inside the dome of the facility when closed.

*Note: for TXPD-PHYS-0060, TXPD-PHYS-0070 and TXPD-PHYS-0080**,** the dome dimensions are provided in Figure 8.*

[TXPD-PHYS-0090] Cable Conduits: All cables connecting the Outdoor Unit with the Indoor Unit of the Transponder System shall fit inside a conduit of 150 mm diameter.

[TXPD-PHYS-0100] Cable Conduit Position: The Pedestal shall allow cables (electrical, data transfer) coming from the Outdoor Unit to run in the conduit situated at the centre of the bolt pattern (illustrated in Figure 6), directly underneath the Pedestal, whether the pedestal extender (shown in Figure 5) is utilized or not.

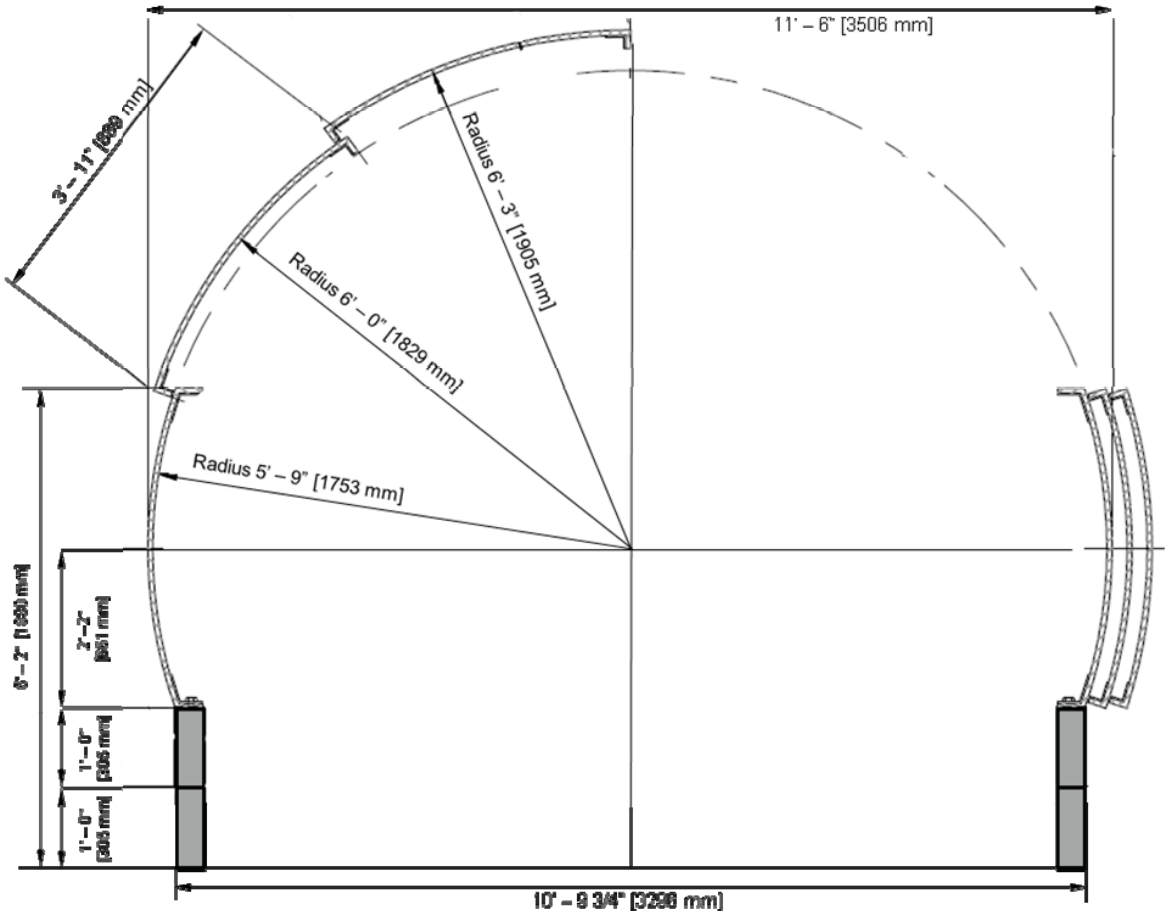


Figure 8 Dimensions of the Dome at the JHC Space Centre site

4.6 ENVIRONMENTAL REQUIREMENTS

[TXPD-ENVR-0010] Outdoor Operating Temperature: The Transponder Instrument and Pedestal Assembly shall operate between -30°C and +30°C in compliance with the requirements of the General, RF and Antenna Subsystems and Positionner Subsystem sections.

[TXPD-ENVR-0020] Outdoor Relative Humidity: The Transponder Instrument and Pedestal Assembly shall operate between 10% and 100% relative humidity. .

[TXPD-ENVR-0030] Indoor Operating Temperature: The Indoor Unit shall operate between +10°C and +30°C..

[TXPD-ENVR-0040] Indoor Relative Humidity: The Indoor Unit shall operate between 30% to 70% relative humidity.

[TXPD-ENVR-0050] Circuit Protection: The Transponder Instrument shall provide input circuit protection against potential system-damaging high input signal levels. The Contractor shall determine the level of protection reasonably required, subject to approval by the Crown.

[TXPD-ENVR-0060] DELETED.

[TXPD-ENVR-0070] DELETED.

[TXPD-ENVR-0080] DELETED.

[TXPD-ENVR-0090] Overheat Protection: The RF Subsystem of the Transponder Instrument shall include overheat protection circuitry to prevent against potential damage to the transponder instrument.

[TXPD-ENVR-0100] Temperature Monitoring: The temperature(s) shall be monitored within the RF Subsystem by a sufficient number of independent sensors, strategically distributed, and relayed as system status indicators, regularly updated to the Control Computer and Software.

[TXPD-ENVR-0110] Withstanding Windload: The Outdoor Unit shall withstand wind gusts of up to 100 km/h.

[TXPD-ENVR-0120] Operational Windload: The Outdoor Unit shall be operational when wind is up to 60 km/h steady state.

4.7 RELIABILITY, MAINTAINABILITY AND AVAILABILITY REQUIREMENTS

[TXPD-RMAR-0010] Field Replaceable Units: The Transponder Instrument (mainly, the RF Subsystem and related electronics) should, as much as possible, be built out of Field Replaceable Units (FRUs).

[TXPD-RMAR-0020] Field Replaceable Unit Status: The status of the FRUs shall be reported when the Transponder System is in Test Mode.

[TXPD-RMAR-0030] Signal Monitoring: The Transponder Instrument shall provide means for signal monitoring, parameter setting and/or test signal injection, sufficient to confirm the transponder instrument operations within specification, and facilitate RCS characterization measurements.

Note TXPD-RMAR-0030: A transponder achieving these monitoring functionalities without physical external ports and signal injection is acceptable if these functionalities are demonstrated.

[TXPD-RMAR-0040] RCS Calibration Measurement: The Transponder System shall include the following capabilities for external RCS characterization:

1. To power the Transponder System and control its operation, on a (outdoor or indoor) designated temporary test site;

2. To utilize the Transponder System, and to control the system reset capabilities as required for RCS measurement.

[TXPD-RMAR-0050] Mean Time Between Failures: The mean time between failures should be six (6) months or more

[TXPD-RMAR-0060] Mean Time to Repair: The mean time to repair should be no more than one (1) week.

Note TXPD-RMAR-0060.1: this is equivalent the average time to repair any part within the system.

[TXPD-RMAR-0070] Maintenance Down Time: The maintenance down time per year should be no more than two (2) weeks (excluding RCS calibration).

[TXPD-RMAR-0080] Software Platform: The Transponder System software shall be developed using COTS, upgradable operating system, and COTS, upgradable software development environment.

[TXPD-RMAR-0090] Control Computer & Software - Spare: The Transponder System shall be equipped with a spare Control Computer & Software, as a backup to the prime unit (see Figure 2), operational when powered on and connected to the rest of the system.

4.8 STORAGE AND TRANSPORTABILITY REQUIREMENTS

[TXPD-SATR-0010] Storage Life: All Transponder System elements shall be designed to allow for storage for a minimum of two (2) years, either before or after OSAT, without any degradation in performance.

[TXPD-SATR-0020] Storage Temperature – Outdoor Unit: The Transponder Instrument and Pedestal Assembly shall be designed to be stored at a temperature between -40°C and +45°C.

[TXPD-SATR-0030] Storage Temperature – Indoor Unit: The Transponder Control Subsystem shall be designed to be stored at a temperature between +10°C and +40°C.

[TXPD-SATR-0040] Shipping: The components of the Transponder System shall be transportable using commercial air carriers, able to withstand the expected shipping and handling environments.

[TXPD-SATR-0050] Shipping Containers: The Transponder System shall be delivered with shipping containers that are sufficiently rugged to withstand the expected shipping and handling environments, in accordance with best commercial practices.

[TXPD-SATR-0060] DELETED.

[TXPD-SATR-0070] Equipment Rack Transport: The equipment rack should be sufficiently rugged for transport in a van.

[TXPD-SATR-0090] RCS Calibration - Frequency: Repeat Transponder System RCS calibration measurements should be performed at a frequency no more than once a year per Transponder System.

[TXPD-SATR-0100] DELETED.

[TXPD-SATR-0110] RCS Calibration – Shipping Containers: The ruggedized shipping containers shall be reusable for transport of the Transponder System components identified for the repeat Transponder System RCS calibration measurements.

4.9 PRODUCT ASSURANCE REQUIREMENTS

This section defines the PA requirements for the Transponder System applicable to the Contractor and subcontractors. Unless otherwise stated, the scope encompasses the design, development, procurement, manufacture, integration, test, delivery and Statement of Work of the Transponder System [AD-8]. The information below is based, in part, on MIL-HDBK-454 [RD-6].

COTS hardware and software proven in an operational environment similar to, or more stringent than, the Transponder System's environment is preferred to new product development.

4.9.1 Design and Construction

[TXPD-PAR-0010] Parts and Material Selection: Parts and materials shall be selected such that their characteristics meet or exceed the Project's Reliability, Maintainability and Availability (RMA) and environmental (operating and storage) requirements.

[TXPD-PAR-0020] EEE Parts Protection: Electrical, Electronic, and Electromechanical (EEE) parts susceptible to environmental elements shall be protected against the applicable vulnerabilities.

Note TXPD-PAR-0020: This includes protecting connectors exposed to the environment by ensuring that the connectors are pressurized and/or waterproof and applies during storage, transport, installation/removal, operations and maintenance activities.

[TXPD-PAR-0030] Derating: EEE parts shall be derated in order to ensure the RMA requirements will be met within the expected operating conditions.

Note TXPD-PAR-0030: Derating process/standard will be specified in the Quality Assurance Plan.

[TXPD-PAR-0040] Flammability: Materials shall be selected and rated as fire retardant in the end-item configuration and the most hazardous expected condition in accordance with UL-94 [AD-7].

[TXPD-PAR-0050] Fungus Inert: Materials which are not hermetically sealed or in a controlled environment shall be fungus resistant in accordance with MIL-T-152 [AD-9].

[TXPD-PAR-0060] Surface Treatment: All exposed inorganic materials shall have a specified surface treatment such that degradation of exposed metal surface is controlled.

[TXPD-PAR-0070] Corrosion: Metallic materials selected shall be corrosion resistant or protected from corrosive environments in the end-item configuration and the most hazardous expected condition in accordance with MIL-STD-889 [AD-10].

[TXPD-PAR-0080] Galvanic Corrosion: When use of dissimilar metals, as defined by MIL-STD-889 [AD-10], in contact is unavoidable, metals shall be protected against galvanic corrosion by a suitable method listed in MIL-STD-889 [AD-10].

[TXPD-PAR-0090] Heat Treatment: Heat treatment of machined metallic parts shall be in accordance with the following reference specifications, as applicable:

- Aluminum alloys: SAE AMS 2770 [RD-7], AMS 2771 [RD-8], AMS 2772 [RD-9];
- Be-Cu alloys: SAE AMS H 7199 [RD-10];
- Nickel alloys and steels: SAE AMS H 6875 [RD-11];
- Titanium alloys: SAE AMS H 81200 [RD-12].

Note TXPD-PAR-0090: Heat treatments not included in these specifications may be used provided sufficient test data is available to substantiate that the heat treatment process improves the properties of the specific alloy without increasing any susceptibility to degradation and is approved by the Technical Authority.

[TXPD-PAR-0100] Prohibited Materials: Materials that constitute a safety hazard (examples provided below) shall be prohibited from use.

Asbestos;	Lithium (except if used in batteries);
Beryllium oxide (except if it is contained in a sealed part and identified);	Magnesium and magnesium alloys;
Beryllium;	Mercury and mercury compounds;
Cadmium;	Polyvinyl chloride;
Chlorinated fluorocarbons;	Radioactive material; and
Corrosive solder fluxes and corrosive generating silicone sealants;	Zinc.
Glass;	

[TXPD-PAR-0110] PWB Manufacturing Standards: Printed Wiring Boards (PWB) shall be manufactured in accordance with, as a minimum, IPC-6011 [AD-11] Class 2 and IPC-6012 Class 2 [AD-12].

[TXPD-PAR-0120] Soldering and Electronic Assemblies: Soldering and electronic assembly shall be performed in accordance with, as a minimum, IPC-A-610 [AD-13] Class 2, J-STD-001 [AD-14] Class 2 and ANSI/ESD S20.20 [AD-15].

Note TXPD-PAR-0120: If any conflicts between ANSI J-STD-001 [AD-14] and IPC-A-610 [AD-13] are encountered, the requirements in ANSI J-STD-001 [AD-14] take precedence.

[TXPD-PAR-0130] Conformal Coating: Printed Wiring Assemblies shall be conformal coated in accordance with IPC-CC-830 [AD-16].

[TXPD-PAR-0140] Wiring: Wiring shall be in accordance with IPC-WHMA-A-620 [AD-17].

[TXPD-PAR-0150] Marking: The Transponder System, including FRUs, life limited items and shipping containers shall be marked, permanently and legibly, with a) vendor's identification and logo, b) model, part and serial numbers, c) warning signs (French and English), d) date of manufacture, and, as applicable, e) safety certifications, f) date of calibration and g) handling points.

Note TXPD-PAR-0150: MIL-STD-1285 [RD-13] and/or MIL-STD-130 [RD-14] may be used as a guide.

[TXPD-PAR-0160] Accessibility: The design shall provide for maintenance and FRU servicing access in accordance with the Project's RMA requirements without damaging or causing instability to other equipment.

Note TXPD-PAR-0160: Maintenance activities will not require unsoldering of components to perform the requisite activity.

[TXPD-PAR-0170] Interchangeability: Units, sub-assemblies, components, and parts with the same part number shall be interchangeable in form, fit and function and still meet the performance specification of the next higher level assembly with minimum tuning and recalibration.

[TXPD-PAR-0180] Burn-In: The Transponder System shall survive a 168 hours burn-in and remain within the specified performance specifications.

4.9.2 Personnel Safety and Equipment Hazards

[TXPD-PAR-0190] Certification: The Transponder System shall be certified by a nationally recognized test laboratory for use in Canada.

[TXPD-PAR-0200] Fail Safe: The Transponder System shall be designed with fail-safe features to ensure personnel safety and to limit failure propagation during transport, installation/removal, operations and maintenance activities.

[TXPD-PAR-0210] Mitigating Features: The design shall incorporate mitigating features identified in the Safety Assessment Report to ensure personnel and equipment safety and to limit

the failures/hazard propagation during transport, installation/removal, operations and maintenance activities.

Note TXPD-PAR-0210: This includes human exposure to radio frequency electromagnetic fields in accordance with IEEE C95.1 [AD-18].

[TXPD-PAR-0220] Electrical Overload Protection: The design shall incorporate current overload protection for primary circuits.

[TXPD-PAR-0230] Maintenance Safety: The design shall provide a means to remove power from the Transponder System in order to support installation/removal and maintenance activities.

[TXPD-PAR-0240] Grounding: The design shall be such that the end-item (i.e. electrically conductive parts and surfaces) is grounded, or provides a grounding means, via a secure and permanent connection to ground during transport, installation/removal, operations and maintenance activities.

[TXPD-PAR-0250] Human Engineering: The design should consider human engineering factors where feasible and cost-effective; MIL-STD-1472 [RD-15] may be used as a guide.

Appendix A List of Acronyms and Abbreviations

A	Amperes
AD	Applicable Document
CEOS	Committee on Earth Observation Satellites
cm	Centimeter
COTS	Commercial-off-the-Shelf
CSA	Canadian Space Agency
dB	Decibel
EEE	Electrical, Electronic, and Electromechanical
EO	Earth Observation
ESA	European Space Agency
FRU	Field Replaceable Unit
GFE	Government Furnished Equipment
GHz	GigaHertz
GoC	Government of Canada
GPS	Global Positioning system
GS	Ground Segment
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
JHC	John H. Chapman
kg	Kilogram
kHz	KiloHertz
km	Kilometer
kVA	Kilo Volt-Ampere
lb	Pound
m	Metre
mm	Millimeter
MHz	MegaHertz
OSAT	On Site Acceptance Test
PA	Product Assurance
PRF	Pulse Repetition Frequency

PWB	Printed Wiring Board
RCM	RADARSAT Constellation Mission
RCS	Radar Cross Section
RD	Reference Document
RF	Radio-Frequency
RMA	Reliability, Maintainability and Availability
RMS	Root-Mean-Square
SAR	Synthetic Aperture Radar
UPS	Uninterruptible Power Source
μs	Microsecond
US	United States
VAC	Volt, Alternative Current
WGCV	Working Group on Calibration Validation

Appendix B Maximum Received Power Density at the Transponder.

The estimated maximum received power density at the transponder is -39 dbW/m^2 as per the following table:

Average Earth radius	m	R	6 371 000
Speed of light	m/s	c	299 792 458
Frequency	Hz	f	5.45E+09
Wavelength	m	$\lambda=c/f$	0.055
Antenna Aperture	m^2	A	9.45
Antenna Directivity		$D=4\pi A^2/\lambda^2$	370 873
Minimum Altitude	m	h	586 000
Antenna Efficiency		ρ	0.76
Antenna Gain	dB	$G=10\log(D\rho)$	54.49
Minimum Elevation Angle	deg	ε	15.763
Minimum Incidence Angle	deg	$\alpha=\arcsin\{((R+h)/R)*\sin\varepsilon\}$	17.26
SAR Output Power	W	$P_{out,\ linear}$	1920
SAR Output Power	dBW	P_{out}	32.83
Minimum Slant Range	m	$S=\lvert R\cos\alpha-\sqrt{\{4R^2\cos^2\alpha+4(2hR+h^2)\}}\rvert$	611 000
Spatial Loss	linear	$L_{linear}=4\pi S^2$	4.69E+12
Spatial Loss	dB	$L=10\log L_{linear}$	126.72
Power Density at Ground	dBW/m^2	$G+P_{out}-L$	**-39.39**

This document is the user manual of the Dome scheduler application who should be installed on the PC located under the CSA transponder's dome. The Dome scheduler application is required to safely operate the Radarsat-2 transponder situated in St-Hubert.

Satellite Operations

Dome Scheduler User Manual

RS2CSA-ML0007

Approved by	Signature	Name (Print)	Date
Author		S. Muir	14/04/09
Contractor Concurrence		S. Desjardins	14/04/010
Reviewed By		S. Côté	14/04/09
Approved By		B. Banik for S. Srivastava	14/04/010
Product Assurance		M. Bennett	14/04/10

Released by CADM:

Revision	IR					
Release Date	14/04/10					
CADM	MB					

Revision History

Revision	Change Notice Number	Release Date	Number of Pages *
IR	---	14/04/10	18

* Total number of pages, including Title Page, Revision History Page, text pages, appendices, etc.

TABLE OF CONTENTS

TABLE OF FIGURES

APPENDICES

1 INTRODUCTION

The document was originally created by Mr. Patrick Pomerleau who was a coop-student with the image quality group of the Satellite Operations, Infrastructures and Applications, during the Winter 2012 semester.

1.1 Purpose

The Dome Scheduler was created for scheduled and manual control of the dome facility protecting the RADARSAT precision transponder. This facility was constructed in the front of the Canadian Space Agency headquarters building in 2011. The transponder control software was not initially designed to manage Dome operations, and due to obsolescence and aging of the transponder control systems still deployed at that time, a dome scheduler application could not be integrated within the original control software. A dome control solution was therefore developed as an independent application which:

- Exchanges commands and status to/from the dome controller on a serial link;
- Controls the execution of the transponder control software itself, mainly for security (see below).

1.2 Requirement

The following software and/or hardware have to be present in order to run the Dome Scheduler application:

- A Windows XP or later environment and Microsoft Access 2003 or later have to be installed;
- The transponder control software, which controls the transponder and acquires acquisition data, is a Windows 3.1 software and must run on a virtual machine, provided by Oracle (freeware);
- A minimum of 3 serials ports must be available on the computer that runs both the Dome Scheduler and the virtual machine supporting the transponder control software:
    - One for the Dome controller;
    - One for the Transponder positioner controller;
    - And one for the SPA (Signal Processing Assembly) on board the transponder instrument.

As serial ports are rare on modern computers, the use of a USB or an Ethernet serial extension box is recommended.

1.3 Notes

1.3.1 Security

Due to the dimensions of the RADARSAT transponder used at time for the Dome Scheduler creation, the dome must be opened prior to an event. If, for any reason, the transponder moves inside a closed dome, it could permanently damage itself and/or the dome structure. To avoid

this situation, security features were added to the Dome Scheduler application. Those security features are:

- The transponder is controlled by the transponder control software. Therefore, it does not run all the time, which prevents inadvertent commands to move the instrument. The dome scheduler will open the dome 90 minutes prior to an event. Then, it will verify that the dome has been completely opened before starting the transponder control software. If the dome is not able to open, the TCU software will not start and an error message will be added in the event table included in the scheduler application;
- The Dome Scheduler records the transponder park position just before opening the dome and verifies that it was at the same position before reclosing the dome. Doing this will prevent closing the dome if the transponder is not is a known safe position;
- When set to “automatic mode”, the Dome Scheduler uses the transponder alarm 2 seconds before initiating dome opening;
- An Emergency button that will stop all operations being performed by the Dome Scheduler is available on the main screen. If pressed, all serials ports are deactivated and the transponder control software will be shut down. However if that button is used, the Dome Scheduler application must be restarted to operate properly.

1.3.2 General

The Dome Scheduler is mostly coded with VBA imbedded in MS ACCESS. The module created to control the dome is placed in Appendix A of this document.

2 MAIN FORM

When launching the application, the main form will be shown. The following figure represents the entry screen of the application when all serial ports are correctly connected.

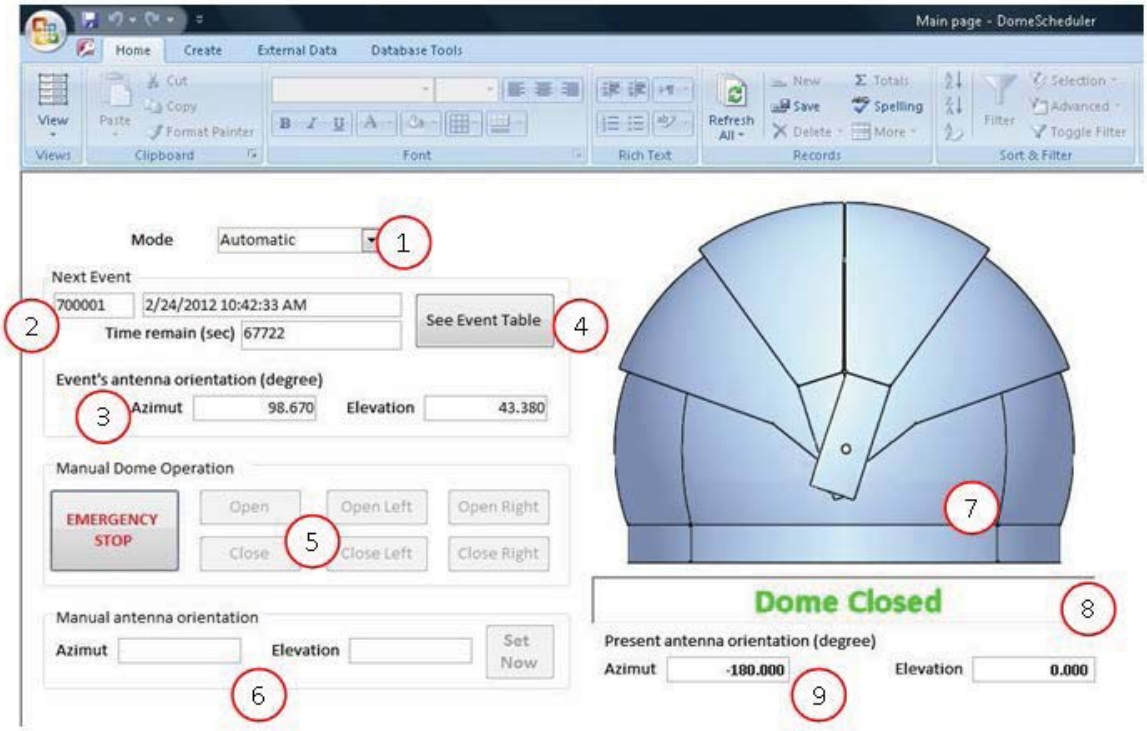


Figure 1: Screenshot of the main form

The numbered features are explained below:

1. Operating mode: Automatic or Manual.
2. Next event detail: Event ID, date and seconds remaining before opening the dome.
3. Azimuth and Elevation of the transponder during the next event.
4. This button opens the scheduled events table.
5. Manual dome operation button, enabled when in Manual operating mode. The Emergency button is always enabled.
6. Manually change the transponder position. For the RADARSAT-1/-2 transponders, Elevation must be between -5° and 97° and Azimuth between 0° and 360°.
7. Dome status in picture, that shows if the dome is open, closed, left hatch opened, right hatch opened, or in an intermediate state.
8. Textual status of the dome state: Green text means no error, Red text means moving timeout or no respond from the dome controller.
9. Position of the transponder when the program started. If no communication was established with the transponder positioner controller, the "**NA**" text is displayed for both Azimuth and Elevation.

3 EVENT TABLE

The Event Table is accessible by the “See Event Table” button on the main form. This table is updated by the **schevent.dat** file located on the **c:\TCUShare** folder, a file that is used by the transponder control software. This folder is shared between the local computer and the virtual machine where the transponder control software is located. This shared folder is the only link between the virtual environment and the real one. Every time the virtual machine is restarted, the schevent.dat file is copied into the shared directory. The Dome Scheduler application verifies the event file every second to see a change in the modification date. If it does find a difference, the event table will automatically be updated with the new information. The columns in this event table are detailed below:

ID: The Event ID, a unique number;
EventTime: The date and time of the beginning of the acquisition event. The dome should open sometime earlier and close sometime after. These times are settable (see Configuration Table next);
Azimuth/Elevation: Transponder pointing position during the event;
Duration: Total duration in minutes that the dome will stay opened, covering the event duration;
Comment: Gives details about the successful or unsuccessful events handled by the Dome Scheduler.

EventTable

ID	EventTime	Azimuth	Elevation	Duration	Comment
700001	2/24/2012 10:42:33 PM	98.670	43.380	180	
900011	2/16/2012 3:00:00 PM	150.000	25.000	180	
900010	2/15/2012 4:45:00 PM	150.000	75.000	180	
2908	4/26/2010 10:11:47 AM	93.500	35.140	180	
2907	4/22/2010 10:28:31 AM	96.890	48.970	180	
2896	3/15/2010 10:36:52 AM	98.520	58.070	180	
2890	2/26/2010 10:32:37 AM	97.710	53.280	180	
2881	1/29/2010 10:09:56 PM	261.380	59.330	180	
2872	12/26/2009 10:41:00 AM	99.300	63.240	180	
2870	12/22/2009 10:18:16 PM	262.840	50.020	180	
2866	12/6/2009 10:24:08 AM	96.070	45.050	180	
2864	11/29/2009 10:28:21 AM	96.900	48.980	180	
2860	11/11/2009 10:14:11 PM	262.130	54.480	180	
2857	11/4/2009 10:18:07 PM	262.840	50.030	180	
2851	10/19/2009 10:24:14 AM	96.060	45.010	180	
2850	10/11/2009 10:18:17 PM	262.840	50.030	180	
2848	10/5/2009 10:32:38 AM	97.720	53.330	180	
2845	9/24/2009 10:14:04 PM	262.130	54.480	180	
2838	8/21/2009 10:05:43 PM	260.590	64.570	180	
2837	8/21/2009 10:45:05 AM	100.050	68.770	180	
2832	7/28/2009 10:05:40 PM	260.580	64.590	180	
2826	7/7/2009 10:18:13 PM	262.850	50.000	180	
2823	6/25/2009 10:07:31 AM	92.670	32.510	180	
2817	6/6/2009 10:22:30 PM	263.550	45.840	180	
2813	5/24/2009 10:01:38 PM	259.750	70.020	180	
2809	5/10/2009 10:09:53 PM	261.400	59.240	180	
2799	4/12/2009 10:26:28 PM	264.190	42.280	180	

Record: 1 of 48 No Filter Search

Figure 2: Screen shot of the Event Table

4 CONFIGURATION TABLE

The Configuration Table is only accessible though the navigation pane. To show the navigation pane, press F11.

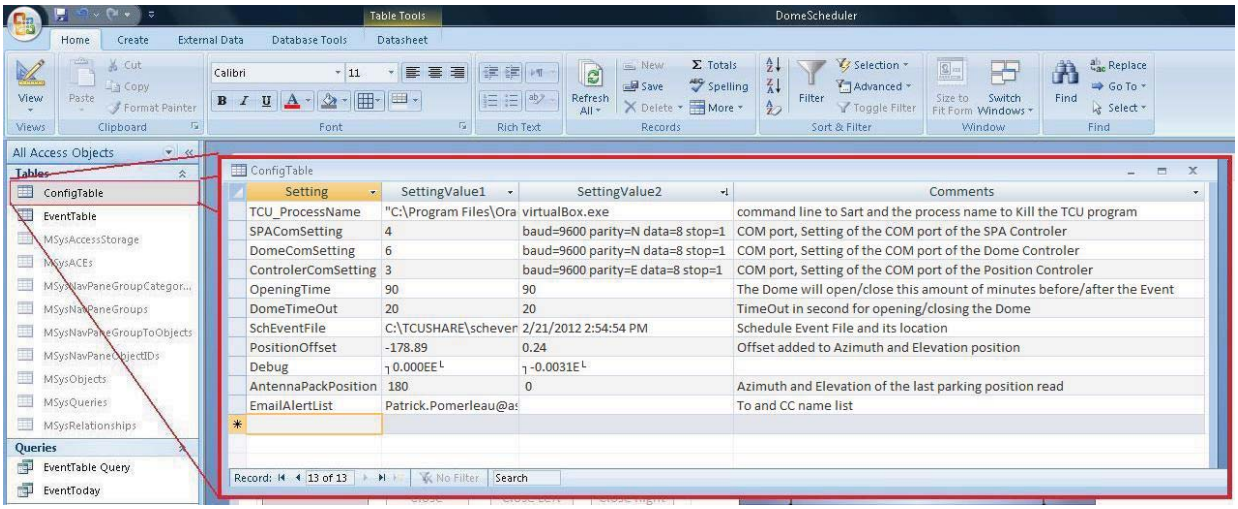


Figure 3: Screen shot of the configuration table

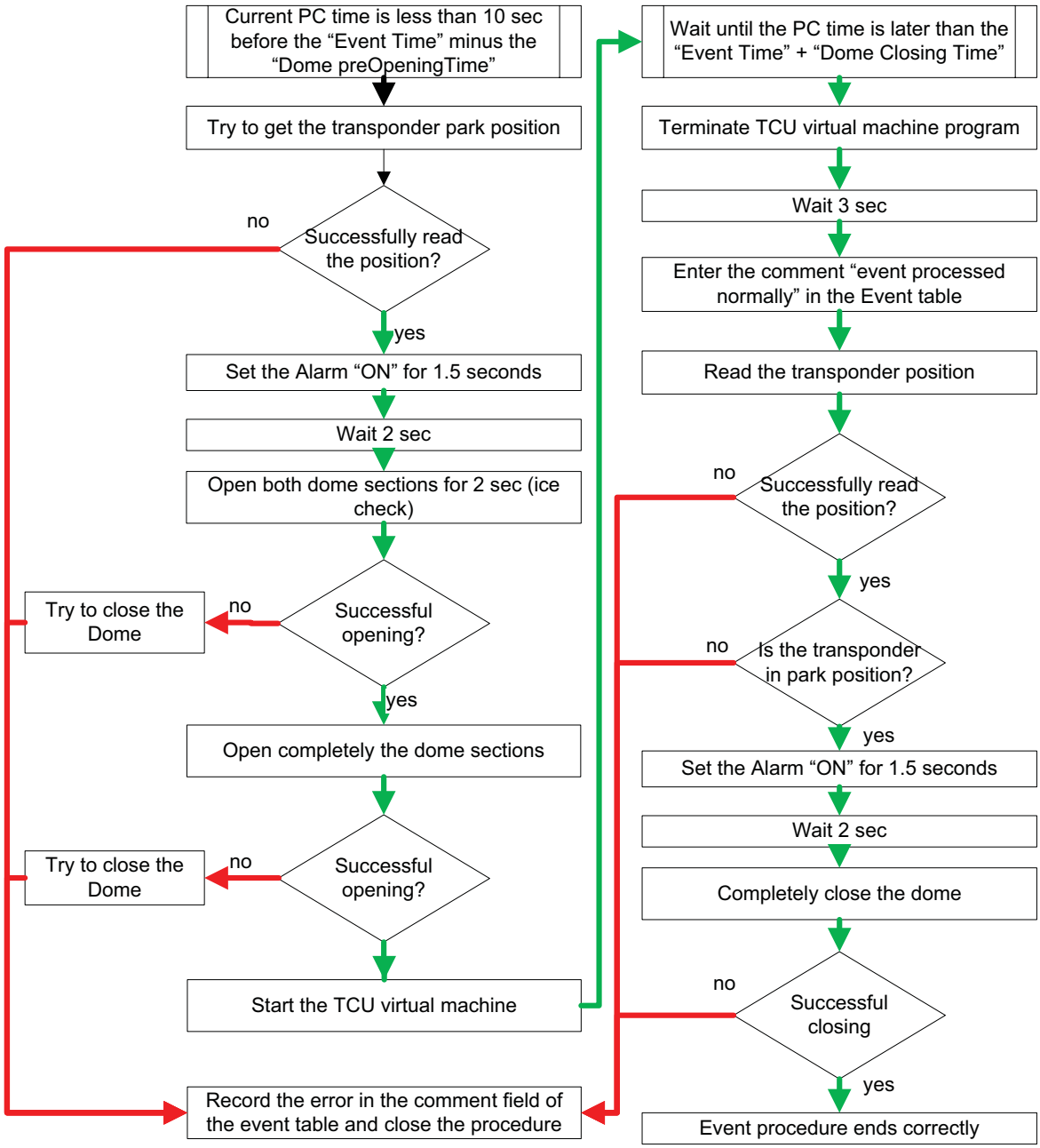
Each setting (left column) contains two values, SettingValue1 and SettingValue2.

- TCU_ProcessName:
  - Value1: The command line required to start the virtual machine installed on the computer host along with the transponder control software;
  - Value2: The process name (shown in the task manager) that is required to be killed in order to close the virtual machine.
- SPAComSetting, DomeComSetting, ControleurComSetting:
  - Value1: The serial com port number;
  - Value2: The serial com port setting.
- OpeningTime:
  - Value1: Number of minutes for which the dome will open **before** the event;
  - Value2: Number of minutes for which the dome will close **after** the event.
- DomeTimeOut:
  - Value1: Timeout (seconds) before detecting an opening problem (i.e.: incomplete open);
  - Value2: Timeout (seconds) before detecting a closing problem (i.e.: incomplete close).
- schEventFile:
  - Value1: File name and path of the binary event schedule file (generated by the transponder control software);
  - Value2: Last modification date of the schedule file.
- PositionOffset: The values placed here must match the one present in the transponder control software setup window. They are only used for manual (az,el) positioning of the transponder.
  - Value1: Azimuth offset of the position switch;
  - Value2: Elevation offset of the position switch.
- AntennaPackPosition:

- Value1: Azimuth position of the transponder just before the dome opening;
- Value2: Elevation position of the transponder just before the dome opening.

- Debug, EmailAlertList: Not used.

5 EVENT OPERATION SEQUENCE



Appendix A - Code Extract: Dome Function Module

C:\TEMP\dome function module.vb — Wednesday, March 12, 2014 1:26 PM

```
'--------------------------------------------------------------------------------
' Liste des fonctions qui servent à contrôler l'ouverture et la fermeture du Dôme
' Auteur : Patrick Pomerleau
' Date : Février 2012
'--------------------------------------------------------------------------------


Option Compare Database
Option Explicit

Const DOME_SOUTH_OPEN_COMMAND = "a"
Const DOME_SOUTH_CLOSE_COMMAND = "A"
Const DOME_SOUTH_BOT_DETECTED = "x"
Const DOME_SOUTH_TOP_DETECTED = "X"

Const DOME_NORTH_OPEN_COMMAND = "b"
Const DOME_NORTH_CLOSE_COMMAND = "B"
Const DOME_NORTH_BOT_DETECTED = "y"
Const DOME_NORTH_TOP_DETECTED = "Y"

'--------------------------------------------------------------------------------
' DomeOpen - Open the Dome by sending 'a' and 'b' caracter to the Dome Controler
'            Start by a 2s Pre opening to test stuck by ice. Wait up to 20s to read
'            "3" string from controler to be sure that cover is not stuck.
'            If not stuck, continue to full open.
'
' Parameters:
'
' Returns:
'   Error Code  - 0 = No Error, 1 = South side TimeOUT, 2 = North Side TimeOut,
'                 3 = Both Side TimeOut, 4 = No Controler respond,
'                 10 = pre opening problem (stuck)
'                 20 = Comm Error
'
'--------------------------------------------------------------------------------
Public Function DomeOpen() As Long
    Dim ErrorMsg As String
    Dim strRespSouth As String          'Contient la réponse du controleur pour la partie Sud
    Dim strRespNorth As String          'Contient la réponse du controleur pour la partie Nord
    Dim Debut As Date

    On Error GoTo Routine_Error

'****** Ouvre le port série du Dome **********
    If CommOpen(DomeComNumber, "COM" & CStr(DomeComNumber), DomeComSetting) <> 0 Then
        GoTo Error_Comm                                 'S'il y a eu une erreur de port série
    End If


    Debut = Now                         'Note l'heure de départ pour calculer le timeOut de 2 sec

'***** Commence par faire descendre les panneaux un peu (2 secondes)
    Do
        SendDomeCommand (DOME_SOUTH_OPEN_COMMAND)       'Envoie la commande au controleur
```

```
        SendDomeCommand (DOME_NORTH_OPEN_COMMAND)        'Envoie la commande au controleur

    Loop Until DateDiff("s", Debut, Now) >= 2            'Boucle jusqu'a la réponse attendu, ou
    apres un TimeOut

' **** Vérifie s'ils sont bien descendu, sinon, attend 20s pour voir s'il ne decollerai pas
tout seul
    Do
        strRespSouth = SendDomeCommand("")               'Lit les messages venant du controleur
                                                         'Boucle jusqu'a la réponse attendu, ou
                                                         apres un TimeOut
    Loop Until strRespSouth = "3" Or DateDiff("s", Debut, Now) >= OpenTimeOut


    If strRespSouth = "3" Then                           'Si les 2 paneaux sont bien descendu
'**** Continue la descente normalement **********

        Debut = Now                                      'Note l'heure de départ pour calculer
        le timeOut

        Do

            If strRespSouth <> DOME_SOUTH_BOT_DETECTED Then                'Tant qu'on a pas
            le signal de fin pour le cote Sud
                strRespSouth = SendDomeCommand(DOME_SOUTH_OPEN_COMMAND)    'Envoie la commande
                au controleur
            End If


            If strRespNorth <> DOME_NORTH_BOT_DETECTED Then                'Tant qu'on a pas
            le signal de fin pour le cote Nord
                strRespNorth = SendDomeCommand(DOME_NORTH_OPEN_COMMAND)    'Envoie la commande
                au controleur
            End If

                                                                           'Boucle jusqu'a la
                                                                           réponse attendu, ou
                                                                           apres un TimeOut
        Loop Until (strRespSouth = DOME_SOUTH_BOT_DETECTED And strRespNorth =
        DOME_NORTH_BOT_DETECTED) Or DateDiff("s", Debut, Now) > OpenTimeOut

    '** vérifie si tout s'est bien passée
        If strRespSouth = DOME_SOUTH_BOT_DETECTED And strRespNorth = DOME_NORTH_BOT_DETECTED Then
            DomeOpen = 0                                                   'Valeur par defaut a
            retourner
        Else
            If strRespSouth = "" And strRespNorth = "" Then
                DomeOpen = 4                                               'S'il y a pas de
                réponse venant du controler
            ElseIf strRespSouth <> DOME_SOUTH_BOT_DETECTED And strRespNorth <>
            DOME_NORTH_BOT_DETECTED Then
                DomeOpen = 3                                               'TimeOut pour les deux
                paneaux
            ElseIf strRespSouth = DOME_SOUTH_BOT_DETECTED Then             'Si le paneau Sud a
```

```
            reussi
                DomeOpen = DOME_NORTH_SIDE                          'TimeOut sur le paneau
                Nord
            ElseIf strRespNorth = DOME_NORTH_BOT_DETECTED Then      'Si le paneau Nord a
            reussi
                DomeOpen = DOME_SOUTH_SIDE                          'TimeOut sur le paneau
                Sud
            Else
                DomeOpen = 4                                        'Si la reponse est
                inconnu
            End If
        End If
'**** Si un des paneau est resté collé
    Else
        DomeOpen = 10
    End If

    CommClose DomeComNumber                                 'Ferme le port du Dome
    Exit Function

Routine_Error:
    CommClose DomeComNumber                                 'Ferme le port du Dome
    DomeOpen = CommGetError(ErrorMsg)
    Exit Function

Error_Comm:
    DomeOpen = 20                                           'Comm Erreur
    CommGetError (ErrorMsg)
    ErrorLog "DomeOpen comm error : " & ErrorMsg

End Function
'--------------------------------------------------------------------------------
' DomeClose - Close the Dome by sending 'A' and 'B' caracter to the Dome Controler
'
' Parameters:
'
' Returns:
'   Error Code  - 0 = No Error, 1 = South side TimeOUT, 2 = North Side TimeOut,
'                 3 = Both Side TimeOut, 4 = No Controler respond
'                 20 = Comm Error
'
'--------------------------------------------------------------------------------
Public Function DomeClose() As Long
    Dim ErrorMsg As String
    Dim strRespSouth As String                      'Contient la réponse du controleur pour
    la partie Sud
    Dim strRespNorth As String                      'Contient la réponse du controleur pour
    la partie Nord
    Dim Debut As Date

    On Error GoTo Routine_Error

'****** Ouvre le port série du Dome **********
    If CommOpen(DomeComNumber, "COM" & CStr(DomeComNumber), DomeComSetting) <> 0 Then
```

```
        GoTo Error_Comm                                    'S'il y a eu une erreur de port série
    End If


    Debut = Now                                            'Note l'heure de départ pour calculer
    le timeOut

'**** Effectue la montée normalement **********
    Do
        If strRespSouth <> DOME_SOUTH_TOP_DETECTED Then                'Tant qu'on a pas le
        signal de fin pour le cote Sud
            strRespSouth = SendDomeCommand(DOME_SOUTH_CLOSE_COMMAND)   'Envoie la commande au
            controleur
        End If

        If strRespNorth <> DOME_NORTH_TOP_DETECTED Then                'Tant qu'on a pas le
        signal de fin pour le cote Nord
            strRespNorth = SendDomeCommand(DOME_NORTH_CLOSE_COMMAND)   'Envoie la commande au
            controleur
        End If
                                                                       'Boucle jusqu'a la
                                                                       réponse attendu, ou
                                                                       apres un TimeOut
    Loop Until (strRespSouth = DOME_SOUTH_TOP_DETECTED And strRespNorth =
    DOME_NORTH_TOP_DETECTED) Or DateDiff("s", Debut, Now) > CloseTimeOut

'** vérifie si tout s'est bien passée
    If strRespSouth = DOME_SOUTH_TOP_DETECTED And strRespNorth = DOME_NORTH_TOP_DETECTED Then
        DomeClose = 0                                          'Valeur OK a retourner
    Else
        If strRespSouth = "" And strRespNorth = "" Then
            DomeClose = 4                                      'S'il y a pas de réponse
            venant du controler
        ElseIf strRespSouth <> DOME_SOUTH_TOP_DETECTED And strRespNorth <>
        DOME_NORTH_TOP_DETECTED Then
            DomeClose = 3                                      'TimeOut sur les deux paneaux
        ElseIf strRespSouth = DOME_SOUTH_TOP_DETECTED Then     'Si le paneau Sud a reussi
            DomeClose = DOME_NORTH_SIDE                        'TimeOut sur le paneau Nord
        ElseIf strRespNorth = DOME_NORTH_TOP_DETECTED Then     'Si le paneau Nord a reussi
            DomeClose = DOME_SOUTH_SIDE                        'TimeOut sur le paneau Sud
        Else
            DomeClose = 4                                      'S'il y a une reponse inconnu
        End If
    End If

    CommClose DomeComNumber                                'Ferme le port du Dome
    Exit Function

Routine_Error:
    CommClose DomeComNumber                                'Ferme le port du Dome
    DomeClose = CommGetError(ErrorMsg)
    Exit Function

Error_Comm:
```

```
    DomeClose = 20                                          'Comm Erreur
    CommGetError (ErrorMsg)
    ErrorLog "DomeClose comm error : " & ErrorMsg

End Function


'--------------------------------------------------------------------------------
' DomeOpenSide - Open only one side of the Dome by sending 'a' or 'b' caracter
'                to the Dome Controler. Each Caractere send is returned until limit reach.
'                Start by a 2s Pre opening to test stuck by ice. Wait up to 20s to read
'                string "3", "1" or "2" from controler to be sure that cover is not stuck.
'                If not stuck, continue to full open.
'
' Parameters:
'   intSide     - 1 = South side, 2 = North Side
'
' Returns:
'   Error Code  - 0 = No Error, , 1 = South side TimeOUT, 2 = North Side TimeOut
'                 4 = No Controler respond
'                 10 = pre opening problem,
'                 20 = Comm Error
'
'--------------------------------------------------------------------------------
Public Function DomeOpenSide(intSide As Integer) As Long
    Dim ErrorMsg As String
    Dim strData As String
    Dim Debut As Date
    Dim Command As String
    Dim LimRespond As String

    On Error GoTo Routine_Error

'****** Ouvre le port série du Dome **********
    If CommOpen(DomeComNumber, "COM" & CStr(DomeComNumber), DomeComSetting) <> 0 Then
        GoTo Error_Comm                                     'S'il y a eu une erreur de port
        série
    End If

'****** Determine la commande a envoyer et la réponse finale attendu selon le coté choisi
**********
    If intSide = DOME_SOUTH_SIDE Then
        Command = DOME_SOUTH_OPEN_COMMAND
        LimRespond = DOME_SOUTH_BOT_DETECTED
    ElseIf intSide = DOME_NORTH_SIDE Then
        Command = DOME_NORTH_OPEN_COMMAND
        LimRespond = DOME_NORTH_BOT_DETECTED
    End If


    Debut = Now                                             'Note l'heure de départ pour
    calculer le timeOut de 2 sec

'**** Commence par faire descendre le paneau un peu (2 secondes)
```

```
    Do
        SendDomeCommand (Command)                                   'Envoie la commande au controleur
    Loop Until DateDiff("s", Debut, Now) >= 2

'*** Vérifie s'ils sont bien descendu
    Do
        strData = SendDomeCommand("")                               'Lit les messages venant du
        controleur
                                                                    'Boucle jusqu'a la réponse
                                                                    attendu, ou apres un TimeOut
    Loop Until DateDiff("s", Debut, Now) >= OpenTimeOut Or strData = "3" Or _
    (strData = "2" And intSide = DOME_SOUTH_SIDE) Or (strData = "1" And intSide =
    DOME_NORTH_SIDE)

                                                                    'Si le paneau est bien descendu
    If strData = "3" Or (strData = "2" And intSide = DOME_SOUTH_SIDE) Or (strData = "1" And
    intSide = DOME_NORTH_SIDE) Then

'**** Continue la descente normalement **********
        Debut = Now                                                 'Note l'heure de départ pour
        calculer le timeOut

        Do
            strData = SendDomeCommand(Command)                      'Envoie la commande au controleur
                                                                    'Boucle jusqu'a la réponse
                                                                    attendu, ou apres un TimeOut
        Loop Until strData = LimRespond Or DateDiff("s", Debut, Now) > OpenTimeOut

    '** vérifie si tout s'est bien passée
        If strData = LimRespond Then                                'Si tout est OK
            DomeOpenSide = 0
        ElseIf strData = Command Then                               'Si le paneau est encore levé
            DomeOpenSide = intSide
        Else
            DomeOpenSide = 4                                        'S'il y a pas de réponse venant
            du controler
        End If
'**** Si un des paneau est resté collé
    Else
        DomeOpenSide = 10
    End If

    CommClose DomeComNumber                                         'Ferme le port du Dome
    Exit Function

Routine_Error:
    CommClose DomeComNumber                                         'Ferme le port du Dome
    DomeOpenSide = CommGetError(ErrorMsg)
    Exit Function

Error_Comm:
    DomeOpenSide = 20                                               'Comm Erreur
    CommGetError (ErrorMsg)
    ErrorLog "DomeOpenSide comm error : " & ErrorMsg
```

```
End Function

'--------------------------------------------------------------------------------
' DomeCloseSide - Close only one side of the Dome by sending 'A' or 'B' caracter
'                 to the Dome Controler. Each Caractere send is returned until limit reach.
'
' Parameters:
'   intSide     - 1 = South side, 2 = North Side
'
' Returns:
'   Error Code  - 0 = No Error, , 1 = South side TimeOUT, 2 = North Side TimeOut
'                 4 = No Controler respond
'                 20 = Comm Error
'
'--------------------------------------------------------------------------------
Public Function DomeCloseSide(intSide As Integer) As Long
    Dim ErrorMsg As String
    Dim strData As String
    Dim Debut As Date
    Dim Command As String
    Dim LimRespond As String

    On Error GoTo Routine_Error

'****** Ouvre le port série du Dome **********
    If CommOpen(DomeComNumber, "COM" & CStr(DomeComNumber), DomeComSetting) <> 0 Then
        GoTo Error_Comm                                     'S'il y a eu une erreur de port
        série
    End If


    Debut = Now                                             'Note l'heure de départ pour
    calculer le timeOut

'****** Determine la commande a envoyer et la réponse finale attendu selon le coté choisi
**********
    If intSide = DOME_SOUTH_SIDE Then
        Command = DOME_SOUTH_CLOSE_COMMAND
        LimRespond = DOME_SOUTH_TOP_DETECTED
    ElseIf intSide = DOME_NORTH_SIDE Then
        Command = DOME_NORTH_CLOSE_COMMAND
        LimRespond = DOME_NORTH_TOP_DETECTED
    End If

'**** Effectu la montée normalement **********
    Do
        strData = SendDomeCommand(Command)                  'Envoie la commande au controleur
                                                            'Boucle jusqu'a la réponse
                                                            attendu, ou apres un TimeOut
    Loop Until strData = LimRespond Or DateDiff("s", Debut, Now) > CloseTimeOut

'** vérifie si tout s'est bien passée
```

```
    If strData = LimRespond Then                                    'Si tout est OK
        DomeCloseSide = 0
    ElseIf strData = Command Then                                   'Si le paneau est encore baissé
        DomeCloseSide = intSide
    Else                                                            'S'il y a pas de réponse venant
    du controler
        DomeCloseSide = 4
    End If

    CommClose DomeComNumber                                         'Ferme le port du Dome
    Exit Function

Routine_Error:
    CommClose DomeComNumber                                         'Ferme le port du Dome
    DomeCloseSide = CommGetError(ErrorMsg)
    Exit Function

Error_Comm:
    DomeCloseSide = 20                                              'Comm Erreur
    CommGetError (ErrorMsg)
    ErrorLog "DomeCloseSide comm error : " & ErrorMsg

End Function

'--------------------------------------------------------------------------------
' SendDomeCommand - Send string, wait DomeSpeed related delay, read dome
'                   controler response
'
' Parameters:
'   Command : commande string to send to controler
'
' Return:   Response string from crontroler
'--------------------------------------------------------------------------------
Private Function SendDomeCommand(Command As String) As String
    Dim strData As String

    CommWrite DomeComNumber, Command                'Envoie la commande au controleur
    Call AppSleep(1000 / DomeSpeed)                 'Delais entre les transmissions
    CommRead DomeComNumber, strData, 10             'Lit la réponse du controleur

    SendDomeCommand = strData
End Function


'--------------------------------------------------------------------------------
' DomeErrorMsg - Return a textual error message to display
'
' Parameters:
'   intDomeErrorID   - ID of Error (0, 1 ,2 , ..)
'
'--------------------------------------------------------------------------------
Public Function DomeErrorMsg(intDomeErrorID As Integer) As String
    If intDomeErrorID = 0 Then
        DomeErrorMsg = "No Error"
```

```
    ElseIf intDomeErrorID = 1 Then
        DomeErrorMsg = "South side TimeOUT"
    ElseIf intDomeErrorID = 2 Then
        DomeErrorMsg = "North Side TimeOut"
    ElseIf intDomeErrorID = 3 Then
        DomeErrorMsg = "Both Side TimeOut"
    ElseIf intDomeErrorID = 4 Then
        DomeErrorMsg = "No Controler response"
    ElseIf intDomeErrorID = 10 Then
        DomeErrorMsg = "Dome panel stuck"
    ElseIf intDomeErrorID = 20 Then
        DomeErrorMsg = "Dome comm error"
    Else
        Dim strMessage As String
        CommGetError strMessage
        DomeErrorMsg = strMessage
    End If
End Function
```

ANNEX C
SECURITY REQUIREMENTS CHECK LIST

Government of Canada / Gouvernement du Canada

RECEIVED
MAR 2 4 2014

Contract Number / Numéro du contrat
20131060
Security Classification / Classification de sécurité

SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine: Agence spatiale canadienne

2. Branch or Directorate / Direction générale ou Direction: Utilisation de l'espace / Projects d'utilisation de l'espace

3. a) Subcontract Number / Numéro du contrat de sous-traitance

3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant

4. Brief Description of Work / Brève description du travail

L'équipe du Ground Segment de RCM désire émettre un contrat pour l'analyse des requis, la conception préliminaire et détaillée, la fabrication, l'intégration, les tests, la livraison, l'installation et les tests globaux d'un (1) nouveau transpondeur de précision et un 2e (option au contrat) pour remplacer les anciens aux sites de St-Hubert et Ottawa (option). Ces nouveaux transpondeurs de précision serviront à faire la calibration des satellites de la constellation RADARSAT une fois en orbite, ainsi que les satellites d'autres missions.

5. a) Will the supplier require access to Controlled Goods? Le fournisseur aura-t-il accès à des marchandises contrôlées?	☑ No Non	☐ Yes Oui
5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?	☑ No Non	☐ Yes Oui
6. Indicate the type of access required / Indiquer le type d'accès requis		
6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)	☐ No Non	☑ Yes Oui
6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.	☑ No Non	☐ Yes Oui
6. c) Is this a commercial courier or delivery requirement with **no** overnight storage? S'agit-il d'un contrat de messagerie ou de livraison commerciale **sans** entreposage de nuit?	☑ No Non	☐ Yes Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada	NATO / OTAN	Foreign / Étranger
☑	☐	☐

7. b) Release restrictions / Restrictions relatives à la diffusion

Canada	NATO / OTAN	Foreign / Étranger
No release restrictions / Aucune restriction relative à la diffusion ☑	All NATO countries / Tous les pays de l'OTAN ☐	No release restrictions / Aucune restriction relative à la diffusion ☐
Not releasable / À ne pas diffuser ☐		
Restricted to: / Limité à : ☐	Restricted to: / Limité à : ☐	Restricted to: / Limité à : ☐
Specify country(ies): / Préciser le(s) pays :	Specify country(ies): / Préciser le(s) pays :	Specify country(ies): / Préciser le(s) pays :

7. c) Level of information / Niveau d'information

Canada	NATO	Foreign / Étranger
PROTECTED A / PROTÉGÉ A ☑	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ ☐	PROTECTED A / PROTÉGÉ A ☐
PROTECTED B / PROTÉGÉ B ☐	NATO RESTRICTED / NATO DIFFUSION RESTREINTE ☐	PROTECTED B / PROTÉGÉ B ☐
PROTECTED C / PROTÉGÉ C ☐	NATO CONFIDENTIAL / NATO CONFIDENTIEL ☐	PROTECTED C / PROTÉGÉ C ☐
CONFIDENTIAL / CONFIDENTIEL ☐	NATO SECRET / NATO SECRET ☐	CONFIDENTIAL / CONFIDENTIEL ☐
SECRET / SECRET ☐	COSMIC TOP SECRET / COSMIC TRÈS SECRET ☐	SECRET / SECRET ☐
TOP SECRET / TRÈS SECRET ☐		TOP SECRET / TRÈS SECRET ☐
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

PART A *(continued)* / PARTIE A *(suite)*

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets? — No / Non ☑ Yes / Oui ☐
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?
If Yes, indicate the level of sensitivity:
Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets? — No / Non ☑ Yes / Oui ☐
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?

Short Title(s) of material / Titre(s) abrégé(s) du matériel :
Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

☑ RELIABILITY STATUS / COTE DE FIABILITÉ	☐ CONFIDENTIAL / CONFIDENTIEL	☐ SECRET / SECRET	☐ TOP SECRET / TRÈS SECRET
☐ TOP SECRET– SIGINT / TRÈS SECRET – SIGINT	☐ NATO CONFIDENTIAL / NATO CONFIDENTIEL	☐ NATO SECRET / NATO SECRET	☐ COSMIC TOP SECRET / COSMIC TRÈS SECRET
☐ SITE ACCESS / ACCÈS AUX EMPLACEMENTS			

Special comments:
Commentaires spéciaux : _____

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.
REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work? — No / Non ☐ Yes / Oui ☑
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?

If Yes, will unscreened personnel be escorted? — No / Non ☐ Yes / Oui ☑
Dans l'affirmative, le personnel en question sera-t-il escorté?

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises? — No / Non ☐ Yes / Oui ☑
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?

11. b) Will the supplier be required to safeguard COMSEC information or assets? — No / Non ☑ Yes / Oui ☐
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises? — No / Non ☑ Yes / Oui ☐
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data? — No / Non ☐ Yes / Oui ☑
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS?

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency? — No / Non ☑ Yes / Oui ☐
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

PART C - *(continued)* / PARTIE C - *(suite)*

For users completing the form **manually** use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.
Les utilisateurs qui remplissent le formulaire **manuellement** doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form **online** (via the Internet), the summary chart is automatically populated by your responses to previous questions.
Dans le cas des utilisateurs qui remplissent le formulaire **en ligne** (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ A	PROTECTED / PROTÉGÉ B	PROTECTED / PROTÉGÉ C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRES SECRET
Information / Assets / Renseignements / Biens	✓															
Production																
IT Media / Support TI	✓															
IT Link / Lien électronique																

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?
La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

☑ No / Non ☐ Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".
Dans l'affirmative, classifier le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?
La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

☑ No / Non ☐ Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).
Dans l'affirmative, classifier le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquer qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat	
Security Classification / Classification de sécurité	

PART D - AUTHORIZATION / PARTIE D - AUTORISATION

13. Organization Project Authority / Chargé de projet de l'organisme

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Marie-Hélène Cyr	RCM GFE Project Engineer	Marie-Hélène Cyr

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
450-926-4395	450-926-6620	marie-helene.cyr@asc-csa.gc.ca	2014-03-03

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Annie Desrochers	intérimaire Gestionnaire Service de sécurité	Annie Des

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
450-926-4884	450-926-4885	annie.desrochers@asc-csa.gc.ca	2014/03/04

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

☑ No / Non ☐ Yes / Oui

16. Procurement Officer / Agent d'approvisionnement

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Isabelle Doray	Agent des Contrats	Isabelle Doray

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
450-926-4873		isabelle.doray@asc-csc.gc.ca	5 mars 2014

17. Contracting Security Authority / Autorité contractante en matière de sécurité

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Chrisoula Langis	Contract Security officer	C Langis

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
613-941-5152	613-954-4171	Chrisoula.langis@pwgsc.gc.ca	April 9/14

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

ANNEX E

File No. **Sample**

Bidder/Contractor

Date

CONTRACT PLAN AND REPORT FORM

INSTRUCTIONS TO BIDDER/CONTRACTOR

This form serves 2 functions: Planning and estimating the cost of work; and, Reporting actual progress and cost against the plan during contract performance.

Plan
Your work and cost plan may be prepared on the attached "Contract Plan and Report Form" PWGSC-TPSGC 9143 and must be submitted as part of your proposal. The plan shall demonstrate how you propose to perform the contractual work by subdividing the work into tasks and providing an estimate of the cost for each task and a schedule for its completion.

This is an example of a completed form as of August 31, (shown with a heavy line).
Legend : ▭ = Original Estimate, ▬ = Completed Work, – – – = Revised Estimate.

Reporting Progress
Following contract award, monthly progress reports which record actual start dates and projected completion dates by task, actual cost by task, actual cost by time period and Estimated to Complete (E.T.C.) by task are to be prepared and submitted in accordance with this sample. Progress reports must be completed to the satisfaction of the Contracting Authority before progress claims be be processed for payments.

Task Description	Task Duration												Task Cost		
	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Planned	Actual	E.T.C.
Design													5000	3000	1000
Material													3000	1200	1800
Fabrication													2000	-	2000
Assembly													3000	-	3000
Test													2000	-	2000
Planned Cost ($)	1000	1600	1600	2100	2100	1100	1500	1000	1000	1000	1000	1000	15000		
Actual Cost ($)	0	1000	1600	1600										4200	9800

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

N° du dossier

Échantillon

Entrepreneur

Date

FORMULAIRE DE PROJET DE CONTRAT ET DE RAPPORT

INSTRUCTIONS AUX SOUMISSIONNAIRES ENTREPRENEURS

Ce formulaire a un double but : elle sont premièrement à planifier et à évaluer le coût des travaux et, deuxièmement, à vérifier, tout au long de l'exécution du contrat, si les travaux et les coûts respectent le plan.

Plan
Les plans concernant les travaux et les coûts prévus peuvent être établis sur le « Formulaire de projet de contrat et de rapport PWGSC-TPSGC 9143-1 ci-joints et doivent être présentés comme faisant partie de votre proposition. Le plan doit faire état de al façon dont vous prévoyez mettre le contrat à exécution en divisant le travail en tâches et en donnant, pour chaque tâche, une estimation du coût et un calendrier d'exécution.

La présente est un exemple d'un formulaire rempli au 31 août (indiqué par une ligne épaisse).
Légende : = estimation original, = travaux terminés, = estimation révisée.

Rapport de situation
Lorsqu'un contrat est adjugé, il faut remplir un rapport de situation mensuel indiquant, par tâche, la date à laquelle celle-ci a été entreprise, la date prévue d'achèvement, le coût actuel, le coût actuel mensuel et l'estimation à venir et présenter ce rapport de la façon indiquée dans le présent échantillon. Le rapport de situation doit être jugé satisfaisant par l'autorité contractuelle avant les demandes d'acompte ne soient traitées.

Description de la tâche	Durée de la tâche												Coût de la tâche		
	Mai	Juin	Juillet	Août	Sept.	Oct.	Nov.	Dec.	Janv.	Fév..	Mars.	Avr.	Prévu à l'origine	Actuel-lement	À venir
Conception													5000	3000	1000
Matériel													3000	1200	1800
Fabrication													2000	-	2000
Assemblage													3000	-	3000
Vérification													2000	-	2000
Coût prévu ($)	1000	1600	1600	2100	2100	1100	1500	1000	1000	1000	1000	1000	15000		
Coût actuel ($)	0	1000	1600	1600										4200	9800

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

CONTRACT PLAN AND REPORT FORM
FORMULAIRE DE PROJET DE CONTRAT ET DE RAPPORT

File No. - N° du dossier
Bidder/Contractor - Entrepreneur
Date

INSTRUCTIONS TO BIDDER/CONTRACTOR - INSTRUCTIONS AUX SOUMISSIONNAIRES ENTREPRENEURS

This form serves 2 functions: Planning and estimating the cost of work; and, Reporting actual progress and cost against the plan during contract performance.

Ce formulaire a un double but : elle sont premièrement à planifier et à évaluer le coût des travaux et, deuxièmement, à vérifier, tout au long de l'exécution du contrat, si les travaux et les coûts respectent le plan.

Task Description **Description de la tâche**	**Task Duration - Durée de la tâche**												**Task Cost - Coût de la tâche**		
	May Mai	June Juin	July Juillet	Aug Août	Sept.	Oct.	Nov.	Dec. Déc.	Jan.	Feb. Fev.	Mar.	Apr. Avril	Planned Prévu à l'origine	Actual Actuel-lement	E.T.C. À venir
Planned Cost ($) - Coût prévu ($)															
Actual Cost ($) - Coût actuel ($)															

Canada