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

SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

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

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 9F044-131060/A	**Amendment No. - N° modif.** 005
Client Reference No. - N° de référence du client 9F044-13-1060	**Date** 2014-09-30
GETS Reference No. - N° de référence de SEAG PW-$MTB-770-12863	
File No. - N° de dossier MTB-4-37113 (770)	**CCC No./N° CCC - FMS No./N° VME**
Solicitation Closes - L'invitation prend fin **at - à 02:00 PM** **on - le 2014-10-15**	**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: Mathurin , Martine	**Buyer Id - Id de l'acheteur** mtb770
Telephone No. - N° de téléphone (514) 496-3859 ( )	**FAX No. - N° de FAX** (514) 496-3822
Destination - of Goods, Services, and Construction: **Destination - des biens, services et construction:**	

Instructions: See Herein

Instructions: Voir aux présentes

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

PROJECT TITLE
RCM and Multi-mission Precision Transponder(s)

The above mentioned Request for Proposal (RFP) is hereby amended as follows:

1- Update the Standard Instructions, Clauses and Conditions and - General Conditions applicable for this requirement:

a) At PART 2 - BIDDER INSTRUCTIONS, section 2.1, Standard Instructions, Clauses and Conditions:

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

INSERT: The **2003 (2014-09-25)** Standard Instructions, Good or Services - Competitive Requirements are incorporated by reference into and form part of the bid solicitation.

b) At PART 7 - RESULTING CONTRACT CLAUSES, section 7.3.1 General Conditions:

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

INSERT: **2040 (2014-09-25)**, General Conditions - Research & Development, apply to and form part of the Contract.

2- Extend the resulting contract period:

a) At PART 1 - GENERAL INFORMATION, section 1.2 Summary, under “Period of contract”, of the RFP:

DELETE: From date of Contract award until July 31st 2017.

INSERT: The period of contract is from the date of contract award until **December 31st 2018**.

b) At PART 7 - RESULTING CONTRACT CLAUSES, section 7.5.1 “Period of Contract” :

DELETE: From date of Contract award until July 31st 2017.

INSERT: The period of contract is from the date of contract award until **December 31st 2018.**

3- Provide a summary as well as questions and answers resulting from the Bidder's conference and Site visit, held on September 17th 2014:

Please **ADD** to the RFP package, the document hereto attached, entitled ***Minutes / Questions and Answers following the Bidder's conference and Site visit, held on September 17th 2014***.

4- Provide supplementary instructions for the preparation of the financial bid:

At PART 3 - BIDDER PREPARATION INSTRUCTIONS, under section 3.3 SECTION II : FINANCIAL BID, of the RFP:

Please **ADD :**

3.3.3 : Schedule of Milestone Tables

Bidders are requested to prepare their financial bid in accordance with the document entitled ***Supplementary instructions for the preparation of the financial bid***, hereto attached. Bidders are requested to dully fill and submit all the tables presented in the aforementioned document and include them in their financial bid.

5- Provide a revised ANNEX A - Statement of Work (SOW) to answer questions and give clarifications following the Bidder's conference and Site visit, held on September 17th 2014 :

At PART 7 - RESULTING CONTRACT CLAUSES, "ANNEX A - STATEMENT OF WORK", of the RFP:

DELETE: In its entirety

INSERT: **ANNEX A - STATEMENT OF WORK (REVISED)**, document hereto attached

If you have already submitted your proposal but wish to reconsider it, please send your revised proposal in a sealed envelope to the address of the Bid Reception Unit (indicated in the RFP, PART 2 - BIDDER INSTRUCTIONS, section 2.3) before the deadline.

**** You must indicate the Solicitation Number and "REVISED BID" on the sealed envelope.**

ALL OTHER TERMS AND CONDITIONS OF THE RFP REMAIN UNCHANGED

Minutes / Questions and Answers following the Bidder's Conference and Site Visit held on September 17th, 2014

RCM and Multimission Precision Transponder Request for Proposal (RFP) number 9F044-13-1060/A

RFP Closing Date: October 15th, 2014

Prepared by:

Martine Mathurin
Procurement Specialist

Supply and Compensation Directorate
Acquisition Branch
Public Works and Government Services Canada

Place Bonaventure
800, de La Gauchetière West Street, 7th floor, Suite 7300
Montreal, Quebec, Canada
H5A 1L6

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

A- Background

As stated under Part 2, sections 2.7 and 2.8 of the subject *Request For Proposal* (RFP) document, all parties who intend to submit a proposal in response to the RFP were invited to attend a Bidder's Conference and Site Visit. This conference and visit were presented as a good opportunity for any interested bidder to seek clarifications with the Project team about the requirements and the project.

The conference and the site visit were held, as planned, on Wednesday September 17th 2014, in-person and through a teleconference/WebEx from the Canadian Space Agency's headquarters, room 4B-238, in St-Hubert, Quebec.

The speakers were Martine Mathurin, Stéphane Côté and Marie-Hélène Cyr.
The meeting (conference and site visit) began at 9:00 am (EDT) and ended at about 12:30 pm (EDT).

B- Attendees

Ten people attended the session. In the audience, we had one representative of a private company, three representatives of Public Works and Government Services Canada (PWGSC) and six representatives from the Canadian Space Agency (CSA).

C- Minutes of the meeting

Introduction

Ms. Martine Mathurin was the first speaker and led the introduction period with a short presentation. She first welcomed the participants and then followed by introducing herself as the PWGSC *Contracting Officer* in charge of managing this procurement activity for CSA.

She invited the other attendees to introduce themselves. Representatives from PWGSC and CSA all introduced themselves after which our guest was asked to do the same.

Once all the participants introduced themselves, Ms. Mathurin carried on by informing all participants on the proposed agenda and the objectives of the bidder's conference and the site visit. She also specified that there would be a question period at the end of CSA's presentation and that we would write down all the Questions and Answers (Q&As) that would arise from the conference and those Q&As would be posted on www.buyandsell.gc.ca, in both languages, a few days after the event. (Please refer to section D- of this document for the Q&As.)

This last precision closed the introduction period, which lasted about ten minutes. CSA then began their presentation. Copies of the presentations made by PWGSC and CSA are included in attachment to this document.

CSA Presentation

Ms. Marie-Hélène Cyr, CSA *Project Engineer* for the Precision Transponder RFP, first presented an overview of the RADARSAT Constellation Mission (RCM) including general information and objectives of the mission, as well as the different mandates and Government priorities associated with RCM. Mr. Stéphane Côté, CSA *Data Quality Manager for the Satellite Operations and Ground Infrastructure section*, provided more detailed information on the different applications that can be used with radar satellites, such as RADARSAT-2 and RCM.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Ms. Cyr carried on by presenting an overview of the RCM Ground Segment (GS) with the different components to be delivered as Government Furnished Equipement (GFE) and subsystems to be delivered by the RCM Prime Contractor. Mr. Côté then continued by providing more details on the Image Quality Subsystem (IQS) into which the precision transponder will be integrated. A short introduction to precision transponders, their application and typical measurements they provide and how they work in general was given by Mr. Côté as well. In summary, precision transponders are mainly used for geometric and radiometric precision measurements, for radar calibration purposes.

Mr. Côté then discussed the key system requirements of the precision transponder to be procured under the current RFP. He specified that the interface between the IQS and the precision transponder is already mostly defined in an *Interface Control Document* (ICD) written by the RCM Prime Contractor and that key interface considerations are reported into the precision transponder requirements specification document provided with the RFP document package. Ms. Cyr reminded the participants that Ms. Mathurin can provide the RCM Prime Contractor's ICD after signing a *Non-Disclosure Agreement* (NDA). Ms. Cyr specified that the ICD will be part of some key IQS-related reviews in the next few months, namely the IQS Preliminary Design Review (PDR) currently scheduled for December 2014 and the IQS Critical Design Review (CDR) currently scheduled for June 2015. Since about 80% of the contents of the ICD will be finalized at the IQS PDR and since some changes to the interface might occur during the IQS PDR, Ms. Cyr informed that changes to the ICD could be proposed up to the IQS CDR where the ICD contents will most likely be finalized. Mr. Réjean Fortier, CSA *RCM GFE Project Manager*, specified that there is some flexibility on the IQS CDR date in order to allow the selected contractor to provide inputs for the ICD prior to the IQS CDR since it would benefit CSA, the selected contractor and the RCM Prime Contractor to wait for the selected contractor's inputs.

At the request of our guest, Mr. Côté and Mr. Jérôme Colinas, CSA *SAR Engineer*, then provided a short introduction to the compact polarization mode that will be available on RCM. More details on that mode are available in the following online file: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/sarrso/pdf/compact_e.pdf.

Ms. Cyr followed by providing general information on the baseline work to be provided through the RFP and the schedule constraints driven by the RCM Prime Contractor master schedule that are imposed on the bidders to deliver the first transponder (baseline). Ms. Cyr carried on with the main contents of the Statement of Work (SOW), the contract options envisioned for the RFP, the physical facilities available in both Saint-Hubert and Ottawa installation sites and the different planned interactions between CSA, the selected contractor and the RCM Prime Contractor through the contract issued from the RFP process.

Mr. Côté provided some precisions on the dome located in Saint-Hubert, clarifying the constraints expressed in requirements TXPD-PHYS-0070 and TXPD-PHYS-0080 defined in the precision transponder requirements specification. Although not illustrated in the document, straps impose space constraints when the dome is closed, so Mr. Côté insisted on the fact that bidders need to be careful with the width of the transponder design proposed because of the additional lost space due to the straps. The following pictures show these straps when the dome is closed. The maximum distance between the dome and the straps, as shown with a red arrow in both pictures below, is 19 cm. It is also to be noted that when the dome is open, the straps are out of the way and do not pose any problem.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Figure 1: North Side Strap

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Figure 2: South Side Strap

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

The presentation ended with an overview of the RCM GS verification flow test events and dependencies so our guest would have a better understanding of where the contract for the procurement of the precision transponder fits into the overall RCM GS verification activities.

Question Period

The presentation ended at approximately 10:00 am after which a question period was entertained by Ms. Mathurin, Mr. Côté and Ms. Cyr. The following is a list of the Questions that were raised and answered. Please note that our guest was free to ask questions throughout the CSA presentation. For clarity purposes of these minutes, questions asked during the presentation are in Section D- only.

D- Questions and Answers (Q&As)

Question 1:
Regarding the requirement TXPD-RFAS-0070 on time delay adjustment, what is the rationale for the values 1.0 µs and 1000 µs for the adjustable/programmable time delay?

Answer 1:
The minimum value (1.0 µs) is required because of CSA's need to have simultaneous transmit and receive of the SAR signal by the precision transponder. The maximum value (1000 µs) is required to enable supporting other missions where transponder transmit and receive are not simultaneous.

Question 2:
Could you provide more details on the second transponder unit defined as an option to the contract, in particular its location, the physical facilities around it and if there are schedule constraints for its delivery?

Answer 2:
The approach that will be taken to calibrate the compact polarization mode is still unsure but it might be preferable to have two precision transponders sitting in the same beam footprint in an image instead of having both precision transponders located many kilometers away from each other as will be the case if one is installed in Saint-Hubert and the second one is installed in Ottawa. The preferred distance for co-located transponders would then be a few kilometers.

It is to be assumed that if the second transponder is not installed in Ottawa, physical facilities similar to the current Ottawa site will be furnished by the Government: concrete foundation on which the transponder outdoor unit will be and a shelter for the indoor unit that will be at most 50 meters away from the transponder itself (requirement TXPD-PHYS-0010). No dome is planned to be installed to protect the outdoor unit of the second transponder.

If the option to procure a second transponder is exercised, there will be no schedule constraints imposed on the contractor for the delivery of this transponder apart from the fact that the second transponder will have to be accepted and commissioned before the contract end date.

Question 3:
Is it accurate to assume that Work Phase 3 – Shipping, Installation and On-Site Test of the first precision transponder (culminating with its On-site Acceptance Test (OSAT)) must end prior to the GS Production OSAT which is currently scheduled to occur in spring 2017?

Answer 3:
Yes, the assumption is correct. Additionally, Work Phase 3 for the optional second precision transponder may be performed concurrently with Work Phases 4, 5 and 6 of the first precision transponder.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Question 4:
Could Work Phase 4 – Training be conducted later than 30 days after the OSAT1?

Answer 4:
Yes, CSA confirms that there are no time constraints to get the training on the precision transponder, as long as it is before RCM launch (preferably for the end of fall 2017) in order to be ready to operate the transponder. As stated in the SOW Section 3.3.6, the requirement to have the training within 30 days after the OSAT1 is a "should".

Question 5:
The current contract end date as mentioned in the RFP solicitation document is July 31, 2017. Portions of Work Phase 5 – Commissioning Operations and the Work Phase 6 – Operations and Technical Support will not be able to be completed before the RCM launch, at least, which is scheduled for July 2018. Please confirm the timeline for Work Phases 5 and 6.

Answer 5:
The task requirements of Work Phases 5 and 6 were reworded in the SOW as shown below. Revision B of the SOW, attached to this document, reflects these changes.

The new contract end date is December 31st 2018.

FROM:

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.

TO:

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 or any other compatible satellite; 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 GS FAR 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 Final Acceptance Review (FAR) and up to three (3) months after the RCM launch 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.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

The duration of Work Phase 6 is planned for the period between the GS FAR up to three (3) months after the RCM launch. The TA assumes that delivery, commissioning, acceptance and integration of the transponder system in SHUB into the IQS will be completed by the GS FAR.

Question 6:
In the precision transponder requirements specification, requirement TXPD-FUNC-0010 (p. 15) states that the transponder shall have an external calibration mode to be utilized to measure the RCS of the transponder instrument itself.

In the SOW Section 3.3.4 (p. 36), one of the task requirements for Work Phase 2 is to "calibrate the transponder system by a method approved by the RCM Transponder Technical Team". Nowhere in the SOW is it stated that external calibration must be carried out during Work Phase 2.

Could you please indicate if external calibration is required or not?

Answer 6:
In the precision transponder requirements specification, where external calibration is mentioned, the contractor might envision any calibration scheme that is compliant with calibration as defined in CEOS WGCV:

"Calibration: The process of quantitatively defining the system responses to known, controlled signal inputs."
(Source:
http://www.ceos.org/index.php?option=com_content&view=article&id=138:wgcvhome&catid=75&Itemid=113)

Calibration therefore entails a comparison between 2 measurements:
1- Known and controlled signal inputs;
2- System responses.

Measurement 1 is of known magnitude or correctness, and is made with one device designated as the *standard*, generating the controlled signal input for measurement 2. Measurement 2 is then made to characterize the device to be calibrated.

Question 7:
Are there planned dates for the Technical Interchange Meetings (TIMs) listed as official reviews in Table 3-2 of the SOW?

Answer 7:
There are currently no dates planned for the TIMs listed, but CSA, the RCM Prime Contractor and the selected contractor will discuss together the best time for all parties involved to hold the TIMs in order to all benefit from these meetings.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Question 8:
Could you please elaborate on the need to get a prototype of the transponder control software related to the dome control at the SHUB installation site prior to the delivery of the transponder? Refer to SOW, Section 3.3.4 (p.35) for more information.

Answer 8:
The timeframe described in the SOW for the delivery of the prototype is to avoid the time required to adjust the software once the transponder is delivered and installed on site. Refer to the document R2CSA-ML0007 provided in Annex A of the RFP solicitation document for more information on the useful commands and quirks to develop such a prototype.

In particular, it is worth mentioning that the software must prevent the transponder from moving if the transponder's physical dimensions do not allow free movement when the dome is closed. In addition, protection must be implemented for the opening/closing mechanism of the dome for some extreme weather conditions, such as significant snow fall, freezing rain, etc. that could potentially damage the dome.

Question 9:
There are accuracy or precision requirements in the precision transponder requirements specification that refer to 1σ numbers. In Section 1.3, it is stated that "accuracy or precision requirement values in this document are specified as 3σ numbers". Please clarify.

Answer 9:
The first bullet of Section 1.3 of the precision transponder requirements specification should read as follows: "*accuracy or precision requirement values in this document are specified as 3σ numbers unless otherwise specified in the document*".

Question 10:
In the SOW Section 3.1.3.3 Document Deliverables, it is stated that "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".

Can proposals include suggestions of combination of deliverables or will the combination of deliverables be negotiated once the contract is awarded?

Answer 10:
The proposals submitted through the RFP process must reflect the deliverables described in the SOW. However, during contract negotiations, prior to contract award, the selected contractor will have the opportunity to propose combinations of deliverables in order for them to follow their company's logical flow and improve their work efficiency. CSA will then make their decision based on the viability of the case presented by the selected contractor.

RCM AND MULTIMISSION PRECISION TRANSPONDER – Bidder's Conference and Site Visit Minutes

Question 11:
There are no time constraints to hold the OSAT2 (for the optional second precision transponder), but is it correct to assume that it will have to occur before the contract end date?

Answer 11:
The OSAT2 is not on the project schedule critical path. If option 1 (procurement of the second precision transponder) is exercised, the contract end date will be pushed according to the timeframe necessary to perform the work requirements prior and for the OSAT2.

Question 12:
If option 1 (procurement of the second precision transponder) is exercised, will there be 1 or 2 Factory Acceptance Test(s) (FATs)?

Answer 12:
There will be 2 FATs if option 1 is exercised. CSA suggests that manufacturing, assembly, testing of the second precision transponder, the FAT2 and the OSAT2 be done in the shortest delay possible to avoid having to retest components uselessly.

Table 3-2 was modified in the SOW as shown below. Other changes were necessary in other sections of the SOW to reflect these modifications. Revision B of the SOW, attached to this document, reflects these changes.

- "Factory Acceptance Test (FAT) Readiness Review" was renamed to "Factory Acceptance Test 1 (FAT1) Readiness Review (SHUB Transponder)";
- "Factory Acceptance Test (FAT)" was renamed to "Factory Acceptance Test 1 (FAT1) (SHUB Transponder)";
- "Factory Acceptance Test (FAT) Data Review" was renamed to "Factory Acceptance Test 1 (FAT1) Data Review";
- "(Option) Factory Acceptance Test 2 (FAT2) Readiness Review (Ottawa (TBC) Transponder)" was added and the same entry criteria, objectives and exit criteria as the FAT1 Readiness Review were defined;
- "(Option) Factory Acceptance Test 2 (FAT2) (Ottawa (TBC) Transponder)" was added and the same entry criteria, objectives and exit criteria as the FAT1 were defined;
- "(Option) Factory Acceptance Test 2 (FAT2) Data Review (Ottawa (TBC) Transponder)" was added and the same entry criteria, objectives and exit criteria as the FAT1 Data Review were defined.

It is to be noted that other minor changes were made in Revision B of the SOW, in which a complete description of these changes is provided.

E- Adjournment of the session

Following the Q&A period, Ms. Mathurin thanked all the participants to the conference for their interventions and invited our guest to send her, by e-mail, any other questions that he may have. She then adjourned the conference at about 11:45 am (EDT).

F- Site visit

Ms. Mathurin invited all participants to the conference to attend a site visit where the physical facilities of the precision transponder located in Saint-Hubert are located. Ms. Mathurin, Ms. Geneviève Matton, PWGSC *Supply Clerk*, the private company representative, Mr. Côté, Ms. Cyr and Ms. Stéphanie Muir, C*ontracted Engineer with expertise with RADARSAT-1/2 transponders*, who joined the group for the site visit to assist Mr. Côté, were the participants to the site visit.

Mr. Côté and Ms. Muir presented the first floor (shelter) and its components and then, our guest went with Mr. Côté on the second floor where the existing precision transponder is located. The private company representative took pictures and was able to see the facilities to get a better understanding of the physical constraints imposed by the shelter and the dome.

Ms. Mathurin then adjourned the site visit at about 12:30 pm (EDT).

---End of the Bidder's Conference and Site Visit Minutes---

Copies of our PowerPoint™ presentations are attached to this document.

9F044-131060/A

Bidder's conference

September 17th 2014

Agenda

1. Welcome and Introduction of Participants
2. Sign-in sheet
3. Conduct of the conference
4. Presentation on RCM and Precision Transponder
5. Question period
6. Site Visit

Conduct of the conference and Site Visit

- Duration

  Conference : 2 hours

  Site Visit: 1 hour
- Washroom location
- Please turn off all cell-phones and any recording devices

- Objective of the conference is to provide you with relevenat information, not to debate the content of the documents, the requirement or the answers provided.
- Objective of the Site visit is to give the potential bidder a chance to see the physical facilities of the existing transponder at CSA.

- There will be a question period at the end of the presentation.
- Responses to questions will be provided at the Bidders conference if possible and will be posted after on the web site of Buy and Sell (www.buyandsell.gc.ca)

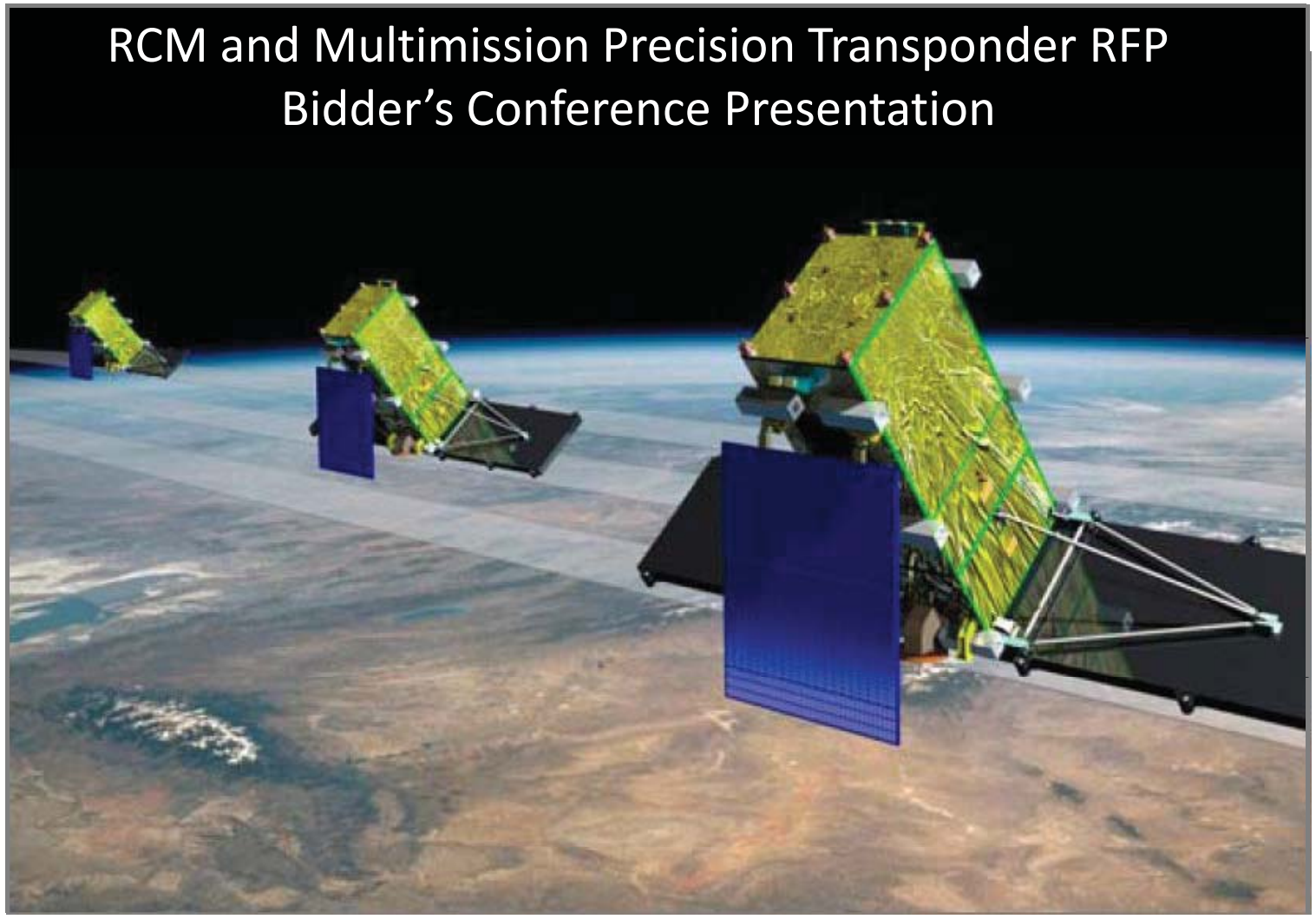
Presentation on RCM and Precision Transponder (by CSA team)

Questions

?

RADARSAT Constellation Mission

RCM and Multimission Precision Transponder RFP
Bidder's Conference Presentation



17 September 2014

Outline

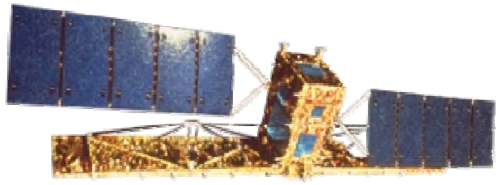
1. Introduction to RCM
2. RCM Ground Segment Overview
3. Precision Transponders

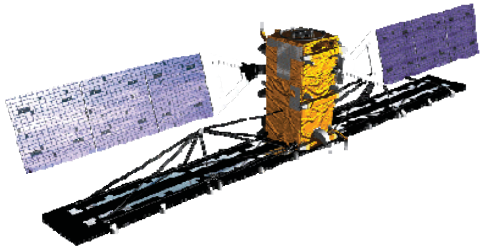
The RADARSAT Constellation Mission

Mission Overview

- Constellation of 3 small satellites.
- Government-owned and operated.
- Addresses the increasing requirement for radar imagery in support of operational government programs.
- **RCM addresses Federal departments mandates and Government priorities in the following areas:**
  - Enables **daily monitoring of maritime approaches** for detection of illegal vessel activity and pollution;
  - Supports **northern development** through surveillance of the North West passage, ice monitoring and mapping;
  - Supports response to **natural disasters**;
  - Enables monitoring and **management of natural resources** and sensitive ecosystems.
- Launch: July 2018.

RADARSAT Program Evolution





1995: RADARSAT-1

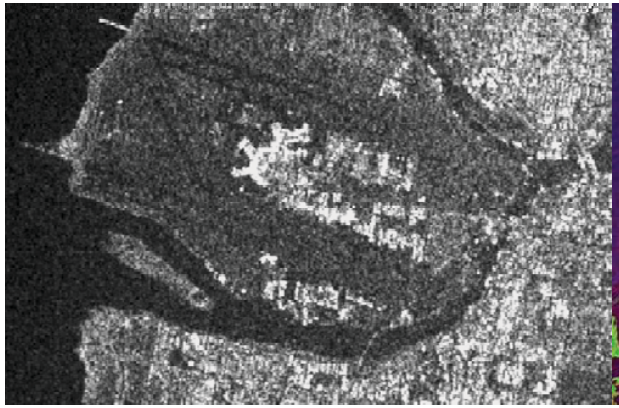
- First operational civilian SAR satellite in the world
- Clients mostly operational, with some involved in R&D
- GoC-owned
- Single-polarized: HH

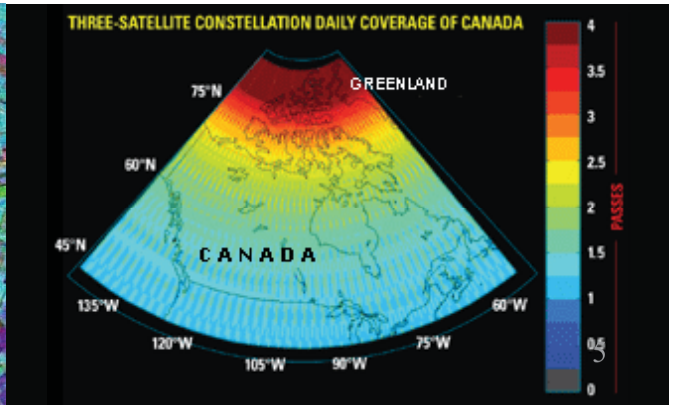
2007: RADARSAT-2

- Ops extended to DND (ship detection)
- Extended choice of imaging modes (resolution, coverage)
- Privately-owned (MDA Ltd)
- Single-, Dual-, and Quadri-polarized options

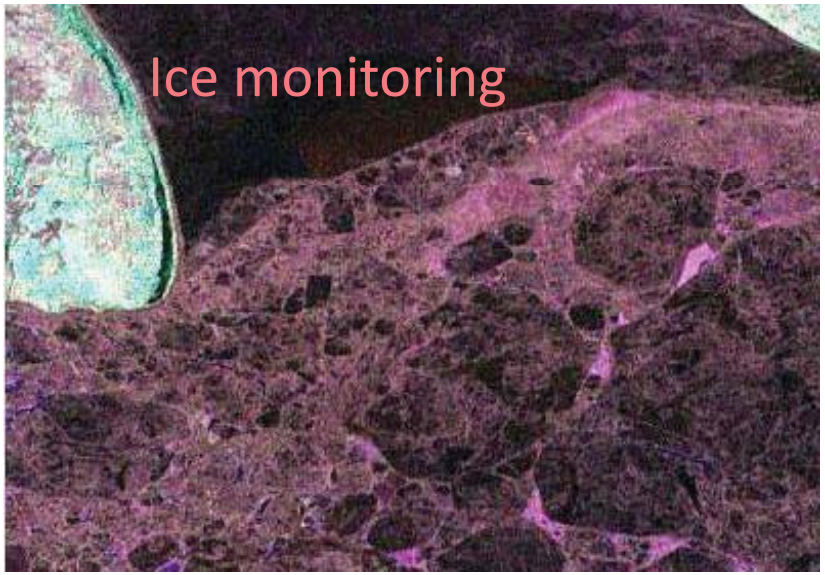
2018: RCM

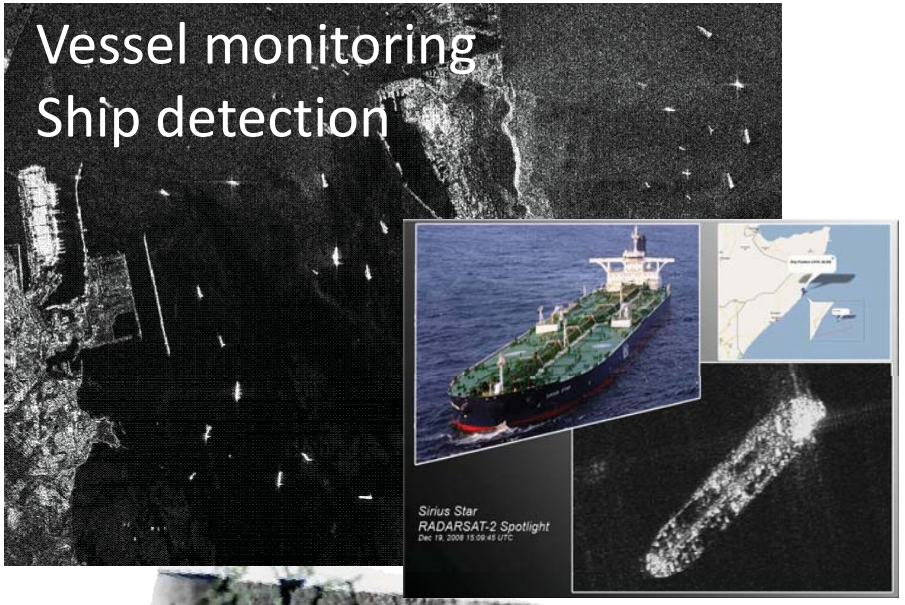
- Designed for operational clients
- Fast tasking, fast delivery
- Enhanced ship detection
- GoC-owned
- Single-, Dual-, Quadri-, and Compact-polarized options
- Common set of imaging modes across the satellites

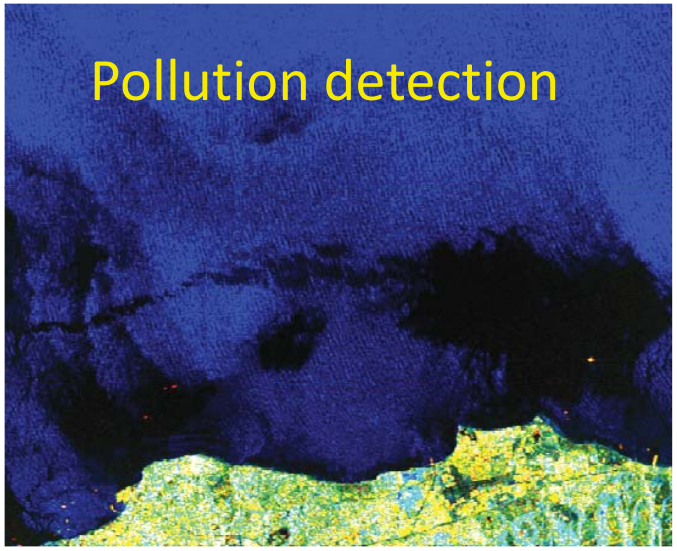


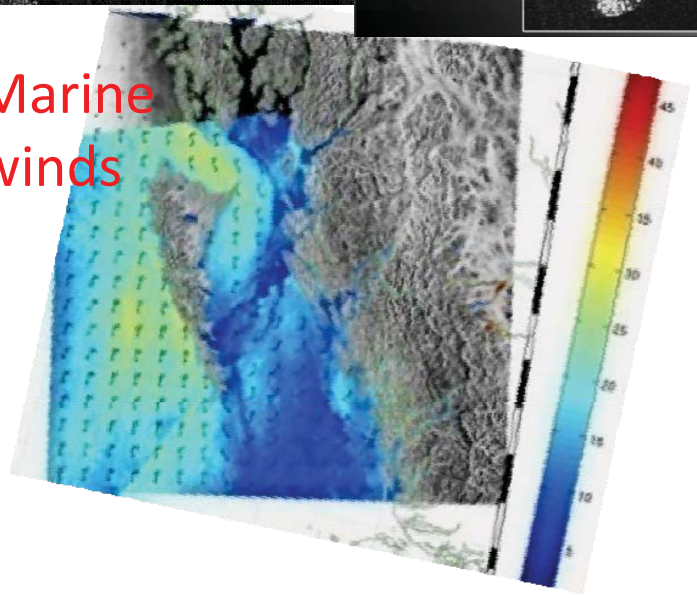


Maritime Surveillance



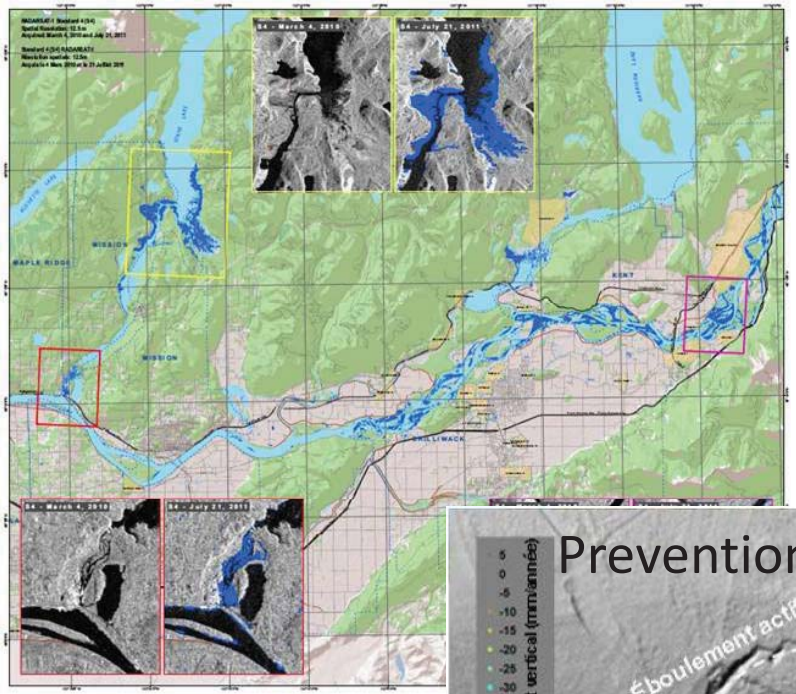




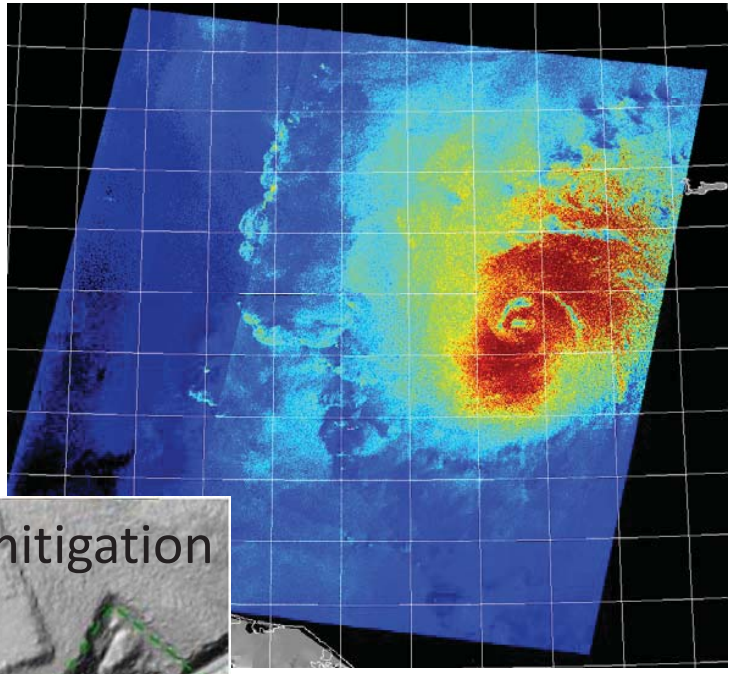


Disaster Management

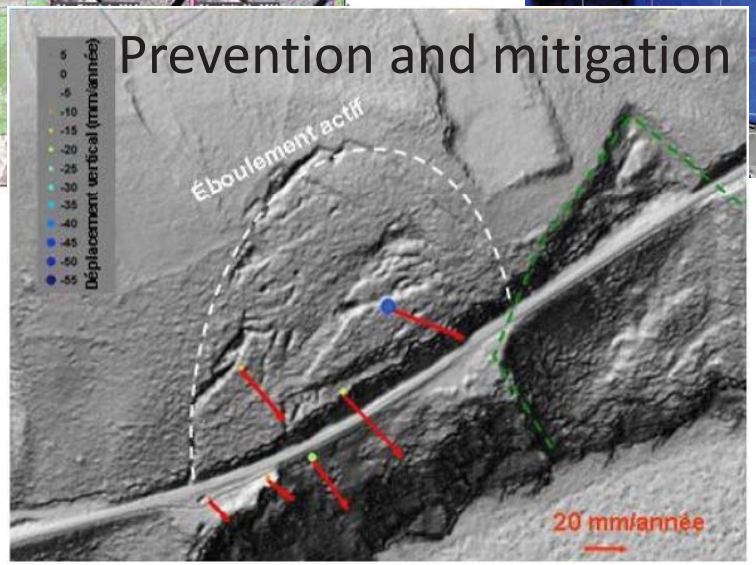
Preparedness and response



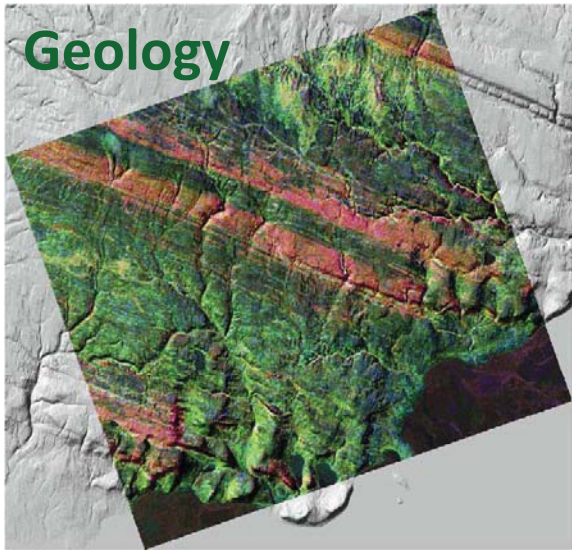
Disaster warning

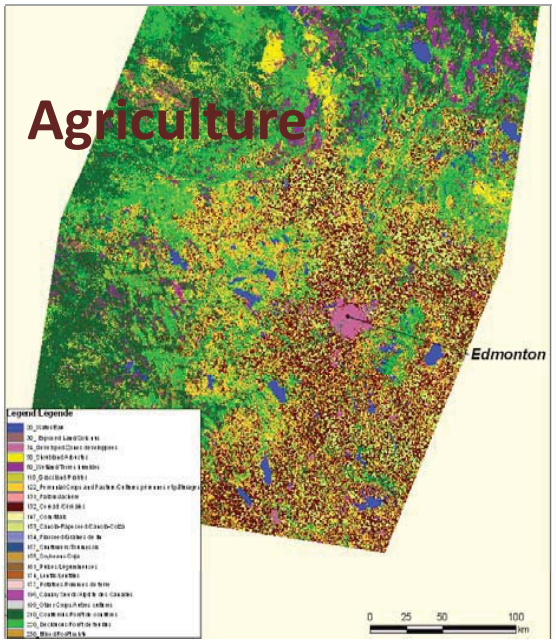


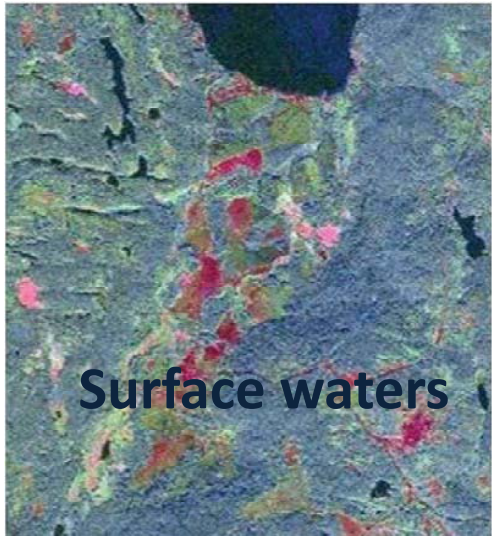
Prevention and mitigation

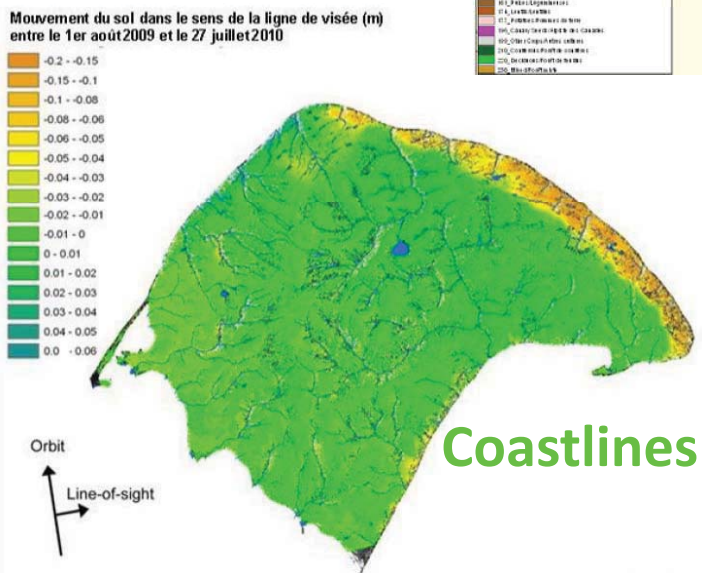


Natural Resources Management

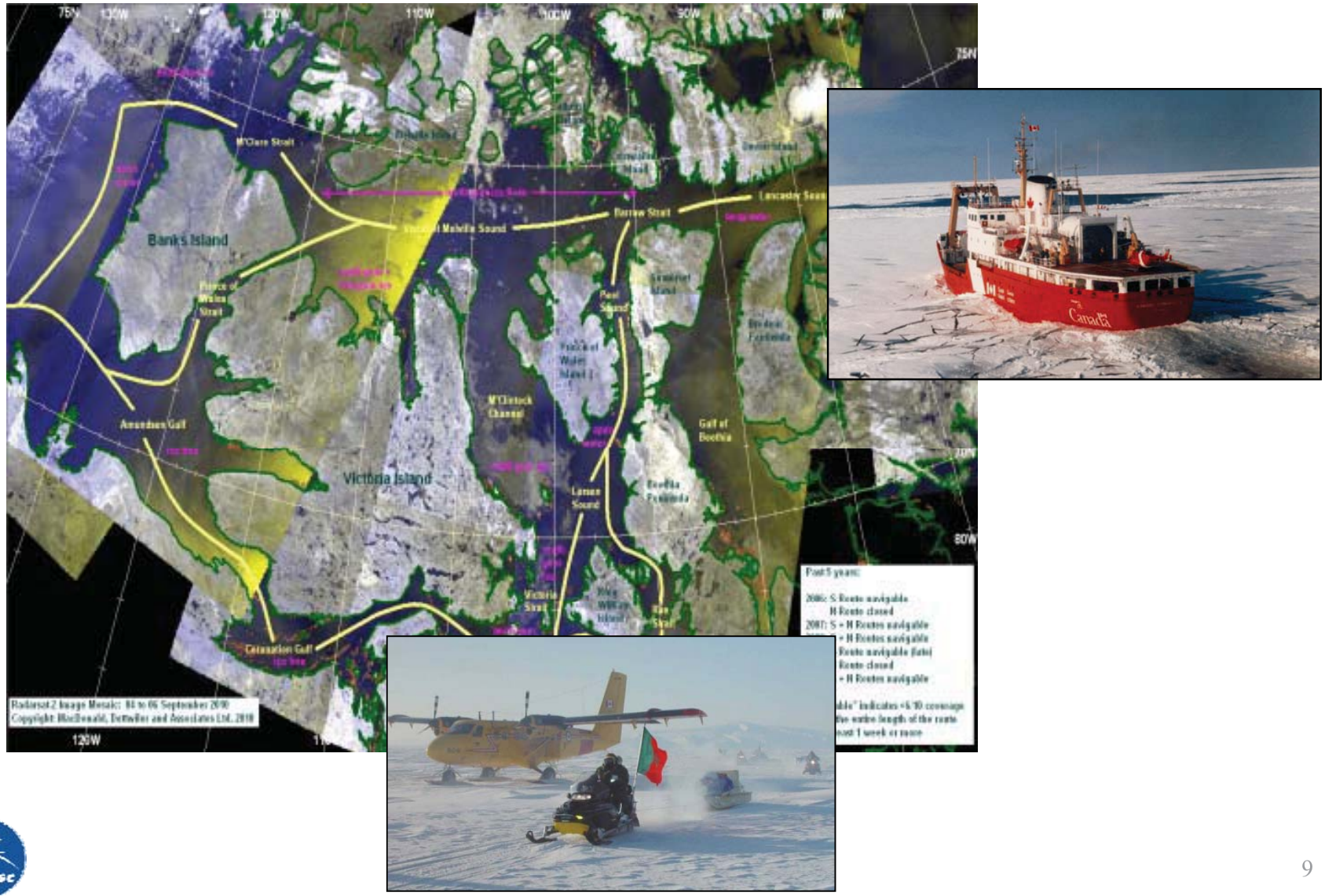




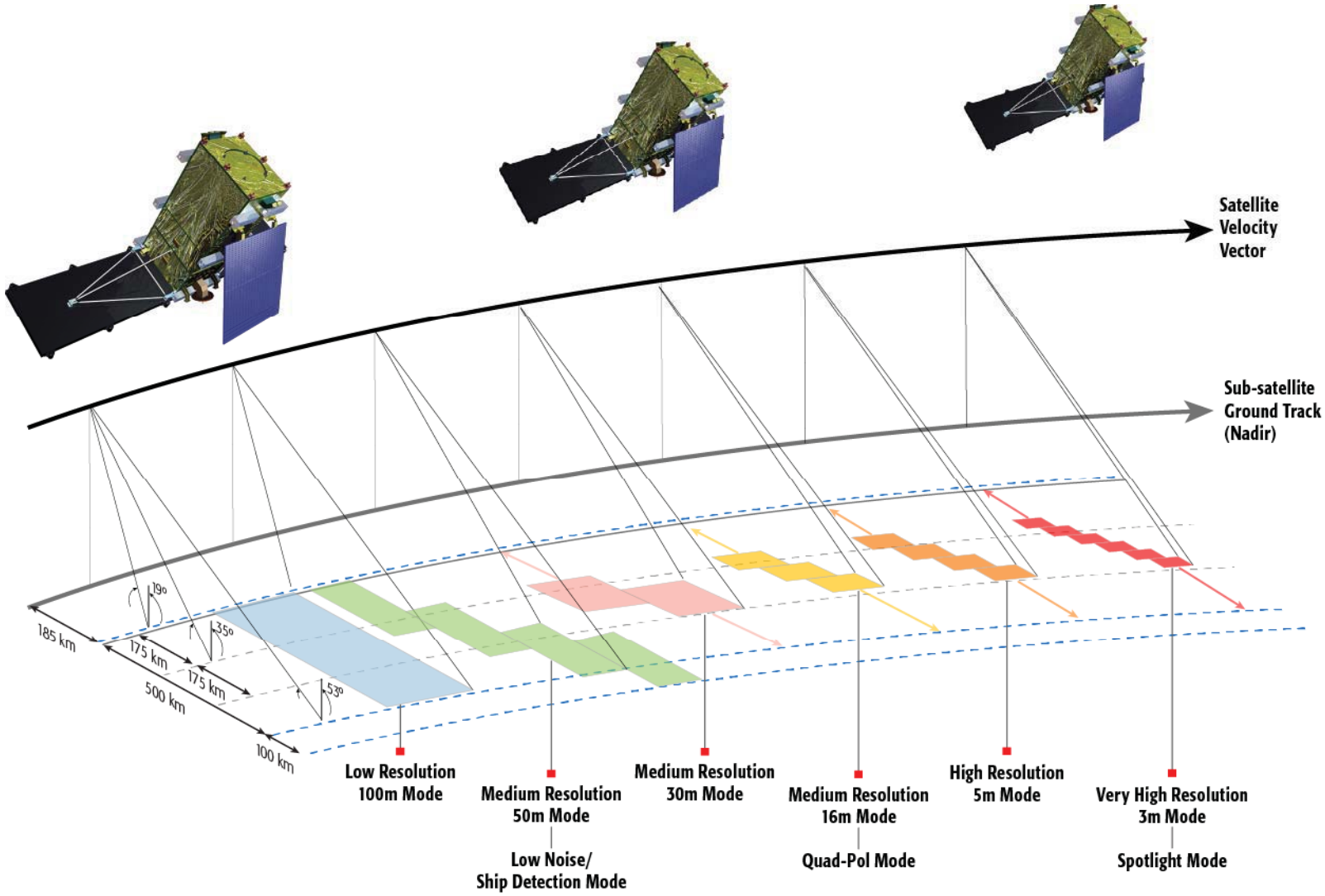




Northern Development

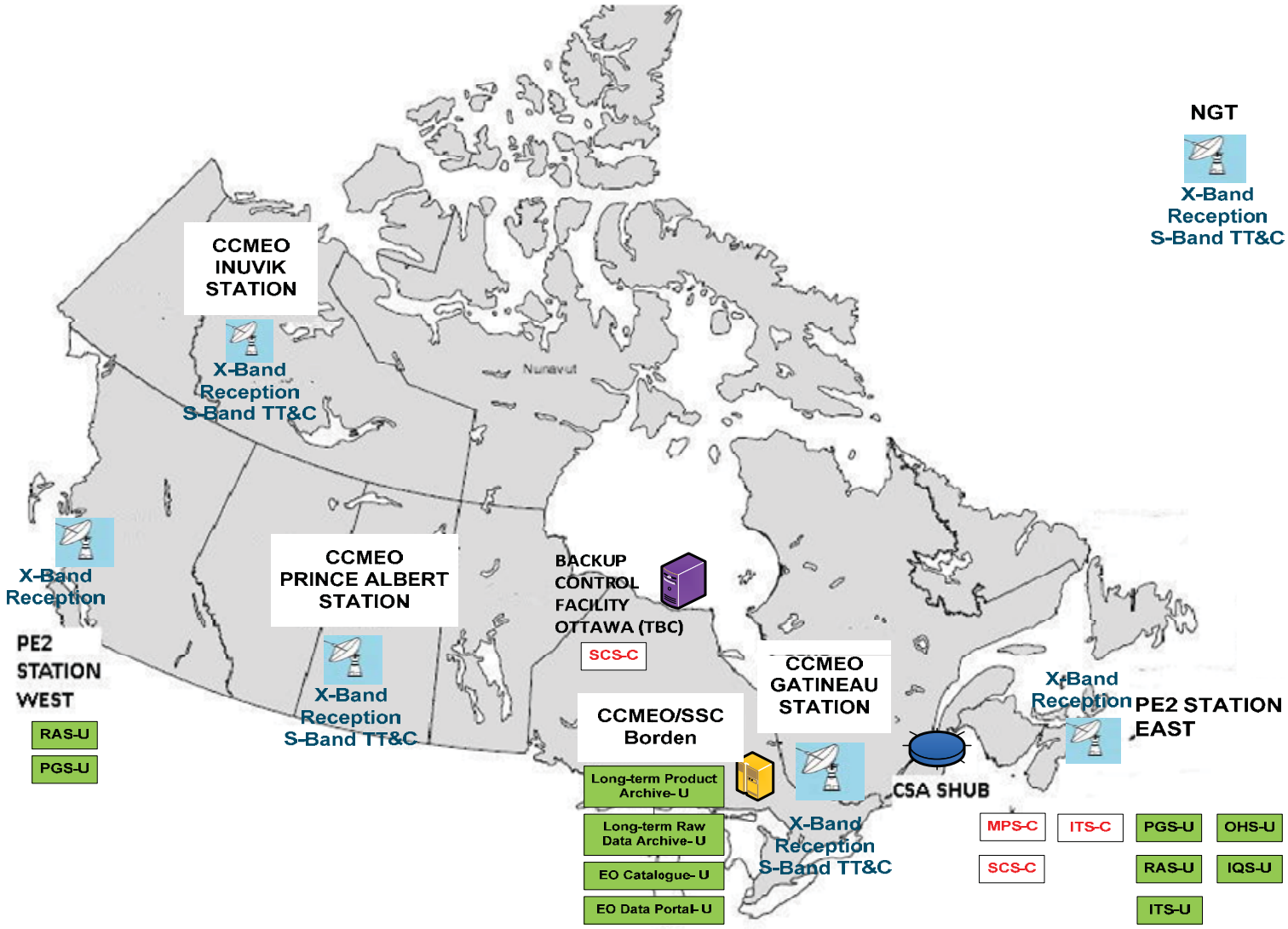


RCM Imaging Modes



RCM Ground Segment Overview

RCM Ground Segment Baseline



RCM GS Baseline: Contract

- MDA is the prime contractor for the RCM space and ground segments (GS).
- For the GS, the scope of the contract entails the design, development and implementation of the GS subsystems for RCM.
- The GS encompasses the set of equipment (including software) that is used to operate the spacecrafts as well as receive, process and disseminate RCM data. It consists of:
  - Order Handling Subsystem (OHS);
  - Mission Planning Subsystem (MPS);
  - Spacecraft Control Subsystem (SCS);
  - Restoration and Archiving Subsystem (RAS);
  - Product Generation Subsystem (PGS);
  - **Image Quality Subsystem (IQS);**
  - Spacecraft Simulator Subsystem (SIM); and
  - Information Technology Subsystem (ITS).

RCM GS Baseline: IQS

Image Quality Subsystem (IQS)

Provides capabilities for:

- Calibration of the end-to-end imaging system, from radar in space to image processing on the ground;
- Monitoring and adjusting image quality, ensure quality of RCM images delivered to ordering clients;
- Defining the imaging modes of the system.

IQS routinely orders products for image quality activities, testing, and calibration operations.

Calibration data are obtained using precision transponders.

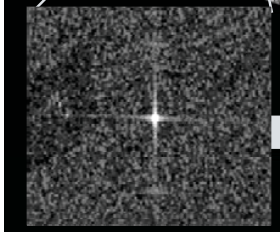
Precision Transponders

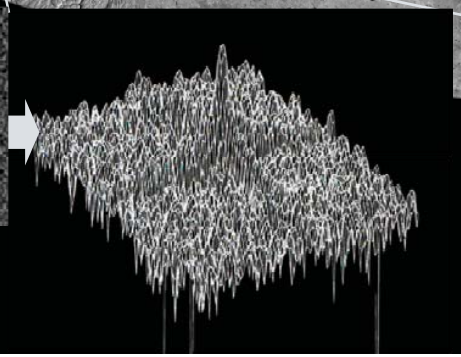
Automatic devices that, on schedule, receive the radar signal of a RADARSAT satellite, which is then amplified and retransmitted as a calibrated response to the satellite.

This response is visible on a RADARSAT image, and is used for evaluation of imaging performance, through image analysis.

A transponder basically is a controllable, calibrated target which can also locally store signal data for further analysis.

Precision transponder signal in a RADARSAT image





Precision Transponders

Typical measurements performed by precision transponders

- **Resolution of image**
  - Focusing quality of processed image.
- **Georeference in the image product**
  - Geographical location of an object as reported in an image product vs real location of the object.
- **Antenna pattern of the satellite radar**
- **Radar pulses from the satellite radar**
  - Actual pulses generated by the spacecraft's radar to produce an image.
- **Polarimetric measurements of the satellite radar**
  - Cross-talk (power ratios) and time delays between polarization orientations of a multi-polarized radar signal.

Precision Transponders

Key System requirements of proposed precision transponder(s)

- **Interface Requirements**
  - Imposed by RCM's IQS for scheduling activities and reporting measurements data, and requirements to interface with the dome hatch opening system (St-Hubert site) for open-close telecommanding.
- **Radiometric Requirements**
  - Stability (±0.1 dB, 3σ),
  - Absolute RCS accuracy (±0.2 dBm^2, 1σ),
    - More stringent than for RADARSAT-1 transponders (1995), but less stringent than for ESA's Sentinel-1A transponders.
- **Independent Receive and Transmit Polarization Orientations**
  - H or V or 45°
- **Time Delay Adjustment**
  - Adjustable/programmable time delay in the transponder, between reception of radar signal and re-transmission to the satellite, from 1.0 to 1000 μs.
- **RCS**
  - Maximum RCS 60 dBm^2 (goal RCS 62 dBm^2)
- **Polarization Cross-talk**
  - > 35 dB

Precision Transponders for RCM/Other Missions

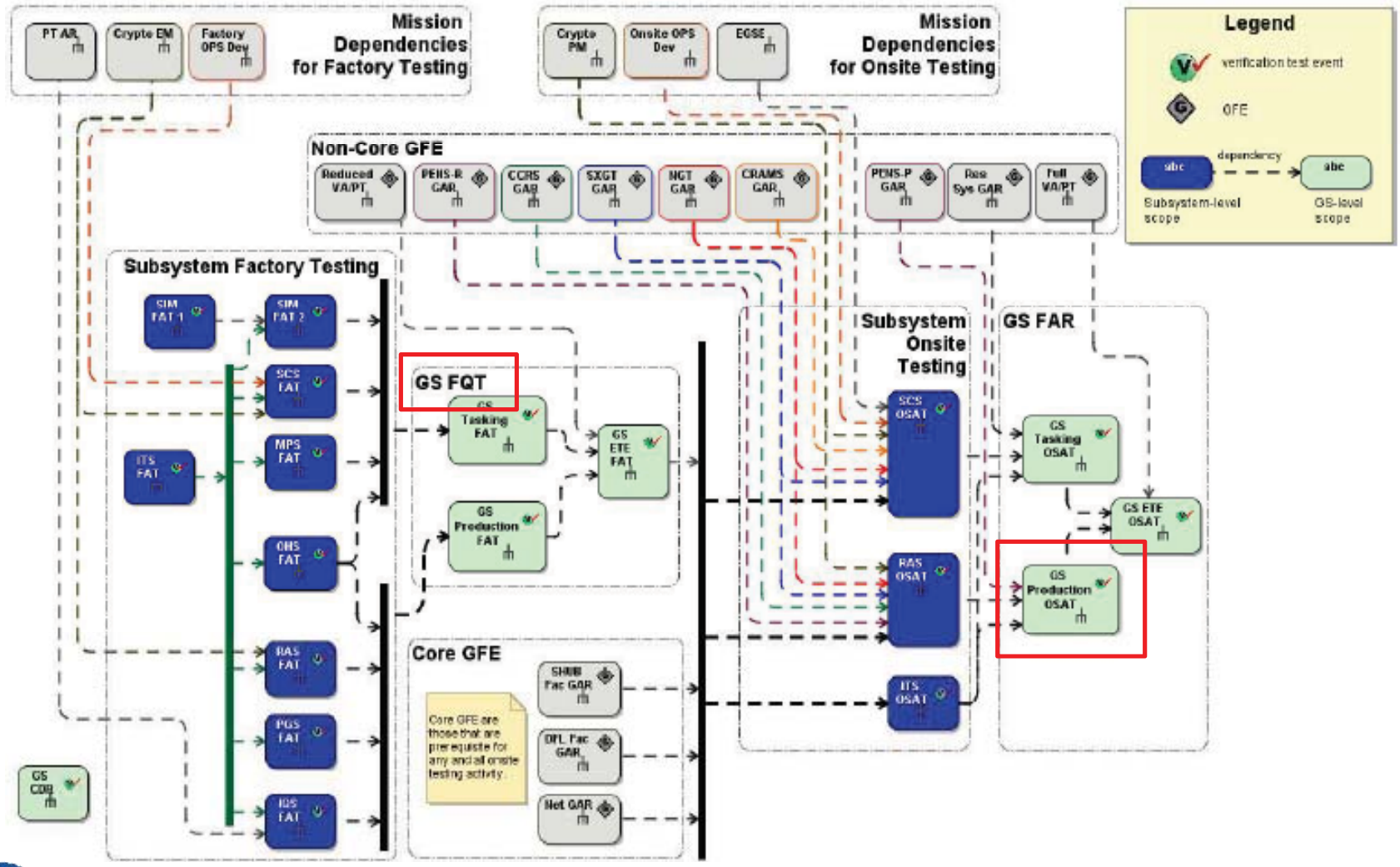
- Deployed on fixed, permanent locations in Canada.
- For this RFP, the baseline is one (1) new precision transponder installed at St-Hubert in replacement to a 20-year-old precision transponder, with an option for a second unit, location TBD (Ottawa or Montreal area).
  - Site preparation (decommissioning of existing transponder, foundation, power, communication, shelter) to be performed by GoC before delivery of baseline and second (optional) unit.
- Precision transponder is to be delivered as a Government Furnished Equipement (GFE) to MDA in December 2016.
  - December 2016: GS Factory Qualification Test (FQT); all GS subsystems and GFE items need to be ready (tested and accepted) by this date.
  - Spring 2017: MDA GS On-Site Acceptance Tests (OSATs); important milestone for precision transponder is GS Production OSAT.
  - July 2017: GS Final Acceptance Review (FAR).

Precision Transponders

Additional Clarifications

- **Statement of Work (SOW) Contents**
  - Work phases and task requirements for each phase;
  - List of deliverables;
  - List of suggested milestones, reviews, meetings;
  - List of Government Furnished Equipment (GFE) / Government Furnished Information (GFI);
  - Contract options: Option 1 (second transponder system), Option 2 (dual-channel design), Option 3 (remote control of antenna polarizations), Option 4 (procurement of spares), Option 5 (extended warranty), Option 6 (maintenance contract), Option 7 (translation of documentation).
- **Contract Options**
  - Only baseline (1 transponder) and Option 1 will be included in evaluation of price during bid evaluation.
  - Delivery of Option 1 (if exercised) is less time-critical for RCM.
  - If Option 2 is exercised, Option 3 will not be exercised.
- **Interface with Physical Facilities**
  - Refer to CSA-RC-RD-0010 – Requirements Specification for more details.
- **Interactions with RCM Prime Contractor**
  - Transponder development closely linked to IQS development, integration, tests and acceptance.
  - Technical Interchange Meeting (TIM) planned during transponder contract (see SOW for more details) to ensure good understanding of interface requirements between IQS and transponder.

Ground Segment Verification Flow
Test Events & Dependencies



QUESTIONS ?

Acronyms

Acronyms

- AR – Acceptance Review
- CRAMS – Conjunction Risk Assessment Management System
- CSA – Canadian Space Agency
- CCMEO – Canada Centre for Mapping and Earth Observation (formerly CCRS)
- CCRS – Canada Centre for Remote Sensing (now CCMEO)
- CDR – Critical Design Review
- dB – Decibel
- dBm – Decibel referenced to milliwatts
- DFL – David Florida Laboratory
- DND – Department of National Defence
- EGSE – Electrical Ground Support Equipment
- EO – Earth Observation
- ESA – European Space Agency
- ETE – End-to-End
- FAR – Final Acceptance Review

Acronyms

- FAT – Factory Acceptance Test
- FQT – Factory Qualification Test
- FTP – File Transfer Protocol
- GAR – GFE Acceptance Review
- GFE – Government Furnished Equipment
- GFI – Government Furnished Information
- GoC – Government of Canada
- GS – Ground Segment
- HH – Horizontally transmitted, Horizontally received polarizations
- IQS – Image Quality Subsystem
- ITS – Information Technology Subsystem
- MDA – MacDonald Dettwiler and Associates Ltd.
- MPS – Mission Planning Subsystem
- NGT - Northern Ground Terminal
- OHS – Order Handling Subsystem

Acronyms

- OPS – Operations
- OSAT – On Site Acceptance Test
- PE2 – Polar Epsilon 2
- PENS – Polar Epsilon Network Station
- PGS – Product Generation Subsystem
- PM – Protoflight Model
- R&D – Research and Development
- RAS – Restoration and Archiving Subsystem
- RCM – RADARSAT Constellation Mission
- RCS – Radar Cross Section
- RFP – Request For Proposal
- SAR – Synthetic Aperture Radar
- SCS – Spacecraft Control Subsystem
- SHUB – St-Hubert
- SIM – Spacecraft Simulator Subsystem

Acronyms

- SOW – Statement of Work
- SSC – Shared Services Canada
- SXGT – S and X band Ground Terminal
- TBC – To Be Confirmed
- TBD – To Be Determined
- TIM – Technical Interchange Meeting
- TT&C – Telemetry, Tracking and Command
- µs – Microsecond
- VA/PT – Vulnerability Assessment and Penetration Testing

Back up Slides

RCM Concept of Operations

- Primary Control Facility at CSA;
- Back up Control Facility at DFL, Ottawa (TBC);
- EO Data Management System at CCMEO: Entry point for EO data users;
- Long term Archiving by CCMEO (physical location of Archive in Borden Ontario (TBC));
- Antenna for satellite commanding: Prince-Albert, Inuvik, Gatineau;
- Antenna for data reception: Prince-Albert, Inuvik and Gatineau, Masstown and Aldergrove;
- RCM will have access to a Northern Ground Terminal (location TBC) for fast-tasking, off nominal emergency situation, near real time downlink of EO data;
- Orbit period is 96.4 minutes, number of orbits per day per satellite is 14.9 for a total of 44 orbits for 3 satellites, per day;
- Estimated data volume per day is 946 Gbs;
- Delay between each satellite contact depends on position of ground stations. The worst case is when all 3 satellites will go over the same station with a delay of only 20 minutes between each satellite;
- Data transfer to customer will be done through FTP;
- RCM data network availability requirement is at 99.95%, which means that the allowable downtime is about 0.5 day/year.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS FOR THE PREPARATION OF THE FINANCIAL BID

Bidders should fill and include the following tables with their submission in response to the Request for Proposal 9F044-131060/A

1. Milestone Payments

The following tables contain the Precision Transponder Project milestones for both the contracted baseline and irrevocable options, sorted by Month After Contract Award (MACA). The milestone will be paid only if all the Exit Criteria of the milestone have been fully met by the Contractor and if approved for payment by the Technical Authority (TA) and the Contracting Authority (CA). Submission of a milestone certificate is mandatory to request a milestone payment.

Table 1: Precision transponder to be installed in St-Hubert, Qc, Canada (Baseline to be contracted)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Baseline Cost	Cost
1.	KOM		5%	
2.	PDR		10%	
3.	CDR		20%	
4.	FAT1		25%	
5.	OSAT1		30%	
6.	End of Training		5%	
7.	Project Closeout Meeting		5%	

Total firm price (precision transponder to be installed in St-Hubert): $CAD _____

(Applicable taxes extra)

Table 2: Optional precision transponder to be installed in TBD, Canada (Option #1)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Option Cost	Cost
1.	PDR		25%	
2.	FAT2		50%	
3.	OSAT2		25%	

Total firm price (optional precision transponder to be installed in TBD): $CAD _____

(Applicable taxes extra)

The bidder should take note of the following assumptions from Canada in regards to option #1:

- *This option will be exercised on or following the completion of the SRR.*
- *It is assumed that the Contractor will use the same design for the second transponder as the baseline and that the second transponder will be built using the same types of hardware and software components.*

Table 3: Dual Channel Design (Option #2)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Option Cost	Cost
1.	SRR		5%	
2.	PDR		35%	
3.	CDR		50%	
4.	FAT1		10%	

Total firm price (optional dual channel design): $CAD _____

(Applicable taxes extra)

The bidder should take note of the following assumptions from Canada in regards to option #2:

- *It is expected that this option will be exercised on or following the completion of the SRR.*
- *If Option #3 is exercised, this option will not be exercised (mutually exclusive).*

Table 4: Remote Control of Antenna Polarizations (Option #3)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Option Cost	Cost
1.	SRR		5%	
2.	PDR		35%	
3.	CDR		50%	
4.	FAT1		10%	

Total firm price (optional remote control of antenna polarizations): $CAD _____

(Applicable taxes extra)

The bidder should take note of the following assumptions from Canada in regards to option #3:

- *It is expected that this option will be exercised on or following the completion of the SRR.*
- *If Option #2 is exercised, this option will not be exercised (mutually exclusive).*

Table 5: Procurement of spares (Option #4)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Option Cost	Cost
1.	PDR		30%	
2.	Delivery and acceptance of the complete spares list		70%	

Total firm price (optional procurement of spares): $CAD _____

(Applicable taxes extra)

The bidder should take note of the following assumptions from Canada in regards to option #4:

- *This option will be exercised on or following the completion of the PDR.*
- *It is assumed that the Contractor will procure the spare parts at the same time as for the parts of the baseline.*
- *Delivery location of the spares is expected to be St-Hubert, Qc, Canada.*

Table 6: Extended Warranty (Option #5)

Item #	Milestone Description	Months After Contract Award (MACA)	Percentage of Overall Option Cost	Cost
1.	PDR		5%	
2.	End of standard 12-month warranty (during transponder routine operations phase)		95%	

Total firm price (optional extended warranty): $CAD _____

(Applicable taxes extra)

The bidder should take note of the following assumptions from Canada in regards to option #5:

- *This option will be exercised on or following the completion of the PDR.*
- *If Option 4 (procurement of spares) is exercised, this option will not be exercised (mutually exclusive).*

Table 7: Maintenance Contract (Option #6)

Item #	Milestone Description	Cost Model	Cost
1.	Annual cost to be paid at beginning of 12-month period of maintenance	Annual rates (several rates for several types of services as described in SOW)	

Total firm price (optional procurement of spares): $CAD _____

(Applicable taxes extra)

Table 8: Translation of Documentation (Option #7)

Item #	Milestone Description	Cost Model	Cost
1.	OSAT1	Cost per page (Applicable taxes extra)	

The bidder should take note of the following assumption from Canada in regards to option #7:

- *This option will be exercised on or following the completion of the OSAT1.*

RFP #9F044-131060

CSA-RC-SOW-0005

ANNEX A - STATEMENT OF WORK (REVISED)

Canadian Space Agency

RADARSAT CONSTELLATION MISSION (RCM)

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

Revision B

September 26, 2014

Canadian Space Agency | Agence Spatiale Canadienne

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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	2014-09-24 Date
Reviewed by:	/s/ Stéphane Côté Stéphane Côté RCM Data Quality Manager Space Utilization	2014-09-24 Date
Reviewed by:	/s/ Patrice Côté Patrice Côté RCM GS GFE Systems Engineer Space Science and Technology	2014-09-25 Date
Reviewed by:	/s/ Victor Chang Victor Chang Safety and Mission Assurance Manager Space Science and Technology	2014-09-26 Date
Approved by:	/s/ Réjean Fortier Réjean Fortier RCM GS GFE Project Manager Space Utilization	2014-09-26 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
B	Revision B Release per the approval of CSACR1373 that includes: • **Table 3-2: Technical Reviews**: 3 reviews were added for the FAT of the (option) transponder system in Ottawa (TBC) and names of reviews related to the FAT were slightly modified as well. The addition of FAT-related reviews for the (option) transponder system in Ottawa (TBC) were also reflected in Section 3.3.4, Section 3.3.4.5, Table 5-1, Appendix A.2 and Appendix A.3. The proposed timeframe for the project closeout meeting was modified as well. • **Table 3-3: GS Technical Reviews Led by RCM Prime Contractor**: 1 review was added for the RCM launch, the IQS PDR date was modified and minor changes to the transponder system GAR and the GS FAR additional notes were also made. The word "Industry" was replaced by "RCM Prime Contractor" in that table as well to avoid confusion with the Contractor. • **Section 3.3.4 Work Phase 2 –**	MHC	September 26, 2014

Rev.	Description	Initials	Date
	Manufacturing, Assembly, Integration and Test (MAIT): A note was added to the effect that the Contractor may request access to in-orbit satellites during Work Phase 2. The conditions for the end of Work Phase 2 were slightly adjusted to avoid confusion between the transponder system in SHUB and (option) the transponder system in Ottawa (TBC). • **Section 3.3.5 Work Phase 3 – Shipping, Installation and On-Site Test**: The conditions for the end of Work Phase 3 were slightly adjusted to avoid confusion between the transponder system in SHUB and (option) the transponder system in Ottawa (TBC). • **Section 3.3.7 Work Phase 5 – Commissioning Operations**: The milestone associated with the completion of Work Phase 5 was modified for the transponder system in SHUB and (option) added for the transponder system in Ottawa (TBC). An assumption was also added for the timeframe planned for the transponder system in SHUB to be integrated into the GS. • **Section 3.3.8 Work Phase 6 – Operations and Technical Support**: The last paragraph was deleted since the information is already covered in Section 4.6. An additional task was defined during Work Phase 6 and the milestones associated with the duration of Work Phase 6 were modified.		

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

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 1 (FAT1) Readiness Review (SHUB Transponder)	Contractor's facility (teleconference for those from the RCM Transponder Team who will not travel)	FAT1 – 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 FAT1.	See Section 3.3.1.1.2. Requirement verifications planned to be performed at FAT1 are accepted.

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
				are reconciled.		
8.	Factory Acceptance Test 1 (FAT1) (SHUB Transponder)	Contractor's facility	TBD by Contractor's master project schedule (CDRL PM-2)	MAIT of transponder system for SHUB is completed and ready for formal verification. SHUB site is 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 is ready for shipping from Contractor's facility to installation site, 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 are preventing shipment. Transport is ready and site preparations (by the RCM Transponder Team) are completed.
9.	Factory Acceptance Test 1 (FAT1) Data Review (SHUB Transponder)	Teleconference	FAT1 + 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 FAT1.	See Section 3.3.1.1.2.
10.	(Option) Factory Acceptance Test 2 (FAT2) Readiness Review (Ottawa (TBC) Transponder)	Contractor's facility (teleconference for those from the RCM Transponder Team who will not travel)	FAT2 – 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 are reconciled.	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 FAT2.	See Section 3.3.1.1.2. Requirement verifications planned to be performed at FAT2 are accepted.
11.	(Option) Factory Acceptance Test 2 (FAT2) (Ottawa (TBC) Transponder)	Contractor's facility	TBD by Contractor's master project schedule (CDRL PM-2)	MAIT of transponder system for Ottawa (TBC) is completed and ready for formal verification. Ottawa (TBC) site is ready to start on-site installation. Team and logistics	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 Ottawa (TBC) is ready for shipping from Contractor's facility to installation site, on-site	No outstanding issues with the transponder system for Ottawa (TBC) are preventing shipment. Transport is ready and site preparations (by the RCM Transponder Team) are

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
				preparation activities are completed.	installation and on-site testing activities phase (Work Phase 3 (see Section 3.3.5)).	completed.
12.	(Option) Factory Acceptance Test 2 (FAT2) Data Review (Ottawa (TBC) Transponder)	Teleconference	FAT2 + 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 FAT2.	See Section 3.3.1.1.2.
13.	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.
14.	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 integrated into the transponder system.	Prove that the transponder system produced and installed in SHUB functions as specified under the operational environment. 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.	Transponder system in SHUB is ready to be accepted by the RCM Transponder team and the RCM Prime Contractor*.
15.	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.
16.	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.

#	Review Name	Proposed Location	Proposed Timeframe	Entry Criteria	Purpose / Objectives	Exit Criteria
17.	(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.
18.	(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.
19.	(Option) On-Site Acceptance Test 1 (OSAT2) Data Review (SHUB Transponder)	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 tests conducted at the OSAT2.	See Section 3.3.1.1.2.
20.	Project Closeout Meeting	Teleconference	RCM launch + 3 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	December 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.	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. Commissioning operations (Work Phase 5) of the transponder system installed in SHUB using in-orbit earth observation satellites, such as RADARSAT-2 or any other compatible satellite, shall be successfully completed at this review.
6.	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 the RCM Prime Contractor are ready to be shipped to SHUB for integration (same purpose as the transponder system FAT1).
7.	GS FAR	July 2017	Review to be held in SHUB to verify that the GS is operational with GS subsystems delivered by the RCM Prime Contractor and GFE items (same purpose as the transponder system OSAT1). The transponder system installed in SHUB will be integrated into the IQS by this review.
8.	RCM Launch	July 2018	Launch of the RCM satellites. A delta-commissioning of the transponder system installed in SHUB with the RCM satellites is expected to occur during the commissioning of the RCM satellites (up to a few months after the RCM launch).

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 FAT1 data package (CDRL PM-10) and hold the FAT1 readiness review meeting (see Section 3.3.4.4), the FAT1 (see Section 3.3.4.5) and the FAT1 data review meeting (see Section 3.3.4.6);
- (Option) Prepare the FAT2 data package (CDRL PM-10) and hold the FAT2 readiness review meeting (see Section 3.3.4.4), the FAT2 (see Section 3.3.4.5) and the FAT2 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 FAT1 readiness review meeting, the FAT1 or the FAT1 data review meeting in Appendix A.3;
- (Option) Develop/update and deliver the documents as identified to be delivered at tests on subsystems, the FAT2 readiness review meeting, the FAT2 or the FAT2 data review meeting in Appendix A.3;
- Provide to the RCM Transponder Team prior to the FAT1 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.

If the Contractor deems necessary to test the transponder system with in-orbit earth observation satellites, such as RADARSAT-2 or any other compatible satellite, as part of its factory testing activities, the RCM Transponder Team will make arrangements to access such satellites.

Work Phase 2 for the transponder system in SHUB shall be completed upon successful completion of the FAT1 and after the FAT1 data review meeting is held. (Option) Work Phase 2 for the transponder system in Ottawa (TBC) shall be completed upon successful completion of the FAT2 and after the FAT2 data review meeting is held. Results of Work Phase 2 shall be presented in the FAT Report (CDRL EN-17) for the FAT1 and (option) for the FAT2.

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), FAT1, (option) FAT2, 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 is ready to be shipped to the 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 for the transponder system in SHUB shall be completed upon successful completion of the OSAT1 and after the OSAT1 data review meeting is held. (Option) Work Phase 3 for the transponder system in Ottawa (TBC) shall be completed upon 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 or any other compatible satellite; and
- Develop and deliver the End Item Data Package (EIDP) (CDRL PA-8) associated with the transponder system.

The TA assumes that integration of the transponder system in SHUB into the IQS will be completed by the GS FAR.

Work Phase 5 shall be completed upon successful completion of the GS FAR for the transponder system in SHUB and (option) no later than the RCM launch for the transponder system in Ottawa (TBC).

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.

Assuming that the RCM launch occurred, the Contractor shall complete the validation of the transponder system in SHUB with a RCM data acquisition, which will then be considered by the TA as the final test on the transponder system in SHUB. The RCM Transponder Team will make arrangement to access one RCM satellite for this task to be performed.

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 Final Acceptance Review (FAR) and up to three (3) months after the RCM launch 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 FAR up to three (3) months after the RCM launch. Work Phase 6 will culminate with the project closeout meeting.

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	FAT1
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	FAT2
6.	Dome to house components of the transponder system outdoor unit at the SHUB installation site. See RCM and Multimission Precision	1 (SHUB)	CSA	FAT1

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	FAT1
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	FAT2
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	FAT1
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	FAT2
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	FAT1

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	FAT1
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	FAT2
17.	Test passes from other earth observation satellites operating at the same frequency.	As Required	CSA	Work Phase 2 FAT1 (Option) FAT2 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	FAT1
20.	Necessary operating license for the SHUB installation site.	1 (SHUB)	CSA	FAT1
21.	(Option) Necessary operating license for the Ottawa (TBC) installation site.	1 (Ottawa) (TBC)	CSA	FAT2

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)	FAT1 (Option) FAT2

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	2 lots (SHUB)	OSAT1	Electronic, source code files and binaries, including build and

	the transponder system for diagnostic 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.	(Option) 1 lot (Ottawa) (TBC)	(Option) OSAT2	configure instructions.

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	0002

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.5.2 3.3.5.3 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	0008

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.5	
PM-11	Crown Assets List	SRR PDR CDR FAR / Project Closeout Meeting	Initial Release Update Update Final Release	A A A A	3.2.6 3.3.3	0110
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 FAT1	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	Initial Release Initial Release	A A	3.3.7 3.4.3	0010

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
		GAR	Final Release	A		
Engineering						
EN-1	System Requirements Specification	SRR PDR	Initial Release Final Release	A A	3.3.1.6 3.3.3 3.3.4.3	0220
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	0204

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
					3.3.4.3 3.3.4.5 3.3.5 3.3.5.3	
EN-9	Installation Plan and Installation Procedure (on-site assembly instructions)	SRR CDR FAT1 – 3 months	Draft Initial Release Final Release	R R R	3.3.3 3.3.5 3.3.5.1.1 3.3.5.1.3	0264
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(x) OSAT(x) FAR / Project Closeout Meeting	Initial Release 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(x) – 3 months	Initial Release Final Release	A A	Table 3-2 3.3.3 3.3.4 3.3.4.3	0280

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
EN-17	Factory Acceptance Test (FAT) Report	FAT(x) + 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 3.3.5	0280
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	FAT1	Initial Release	A	3.3.4	0320

CDRL #	Title	Milestone	Version	Approval Category	SOW Para.	DID #
		OSAT1	Update	A	3.3.5	
		FAR / Project Closeout Meeting	Final Release	A	3.3.6	
OPS-7	Transponder Maintenance Manual	FAT1	Initial Release	A	3.3.4	0321
		OSAT1	Update	A	3.3.5	
		FAR / Project Closeout Meeting	Final Release	A	3.3.6	

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.